

News Release

Title

Delayed bedtime is associated with ADHD symptoms especially in children at low genetic risk for ADHD

Key Points

- In children aged 8 to 9 years, ADHD symptoms become more severe when they fall asleep late.
- The effect of sleep onset time on ADHD symptoms depends on genetic susceptibility to ADHD.
- When assessing ADHD symptoms in children, it is necessary to carefully assess their sleep habits.

Summary

A group led by Nagahide Takahashi, Associate Professor of Department of Child and Adolescent Psychiatry at Nagoya University Hospital, Tokai National University Organization (Director: Professor Norio Ozaki), in collaboration with Specially Appointed Assistant Professor Akemi Okumura and Specially Appointed Professor Kenji Tsuchiya of the Research Center for Child Mental Development, Hamamatsu University School of Medicine, conducted a study as part of the Hamamatsu Birth Cohort Study of Mothers and Children (HBC Study). They found that the severity of inattention and hyperactivity/impulsivity symptoms is affected by daily sleep habits, and that the magnitude of the effect is related to the degree of change in genes associated with the development of ADHD*¹. The results indicate that it is important to consider sleep habits in the assessment and diagnosis of ADHD symptoms.

The results of this study indicate that when assessing ADHD symptoms in children, it is important to carefully examine their sleep habits, to see if they might affect the severity of ADHD symptoms, and that even in children who are currently diagnosed with ADHD, it is important to properly assess their sleep habits and determine whether they are being over-diagnosed with ADHD due to their falling asleep extremely late.

The results of the study will be published on January 5 (Japan time) in JAMA Network Open, a sister journal of JAMA, an internationally prestigious English-language journal of the American Medical Association.

Research Background

- Social background: Wider understanding of attention deficit hyperactivity disorder, need for correct diagnosis.

Attention deficit hyperactivity disorder (ADHD) is one of the neurodevelopmental disorders, characterized by hyperactivity/impulsivity, that makes it difficult to sit still, and inattention, that makes it difficult to maintain concentration. It is reported to occur in about 5% of people under 18 years old and about 2.5% of adults. However, in clinical practice, it has been found that impulsivity and inattention associated with sleepiness may affect the

assessment of ADHD symptoms and, in turn, undermine the correctness of the diagnosis.

- Scientific background: Sleep habits may influence daytime ADHD symptoms, and these effects may be influenced by genes.

Both environmental and genetic factors are important in the development of ADHD, but the combination of common genetic changes found in many people has been considered to be more important. Further, it is known that 20-50% of people diagnosed with ADHD have problems with sleep habits, including sleepiness, but the relationship between the severity of ADHD symptoms, sleep habits and a genetic component has not been scientifically understood.

In this study, we focused on the genetic changes associated with the risk of ADHD ("genetic risk of ADHD" = susceptibility to ADHD based on genetic changes), and investigated (1) whether sleep habits are associated with daytime ADHD symptoms, and (2) whether the strength of the association differs depending on the genetic risk of developing ADHD.

Research Results

We conducted a whole genome genetic analysis to determine the association between changes in genes associated with the development of ADHD and sleep habits in children 8-9 years old.

Of the children who were entered into the Hamamatsu Birth Cohort Study (HBC Study) conducted at Hamamatsu University School of Medicine at birth, 835 continuously participated until the age of 8 to 9 years and consented to the genetic analysis. Their DNA was analyzed for changes in approximately 6.5 million genes, and a genetic risk index for ADHD, the Polygenic Risk Score,^{*2} was calculated to take into account the number of genetic changes associated with ADHD and the size of the effect, while referring to the results of large-scale genetic studies overseas. To assess the symptoms of ADHD, the ADHD-RS questionnaire, which is widely used worldwide, was used to score the two major symptoms of ADHD: hyperactivity/impulsivity symptoms and inattention symptoms. To evaluate sleep habits, the total sleep time, the time it takes to fall asleep, and the time of falling asleep (before or after 10 p.m.) was measured.

Results

(1) The later the time of sleep onset, the stronger the ADHD symptoms.

An analysis of the relationship between sleep habits and hyperactivity/impulsivity and inattention symptoms showed that the later the time of sleep onset, the higher the scores of hyperactivity/impulsivity and inattention symptoms. This association was not found for total sleep time or time taken to fall asleep.

(2) The effect of time taken to fall asleep on ADHD symptoms differed depending on genetic susceptibility to ADHD.

The children were divided into three groups according to their genetic risk for ADHD: high genetic risk group, medium genetic risk group, and low genetic risk group. The results

showed that in the high genetic group and the medium genetic risk group, although there was a tendency for the ADHD symptom scores to be higher due to a later bedtime, the effect was not statistically significant. However, in the low genetic risk group, we found that the scores of ADHD symptoms (hyperactivity/impulsivity and inattention) increased by about 20% due to late sleep onset.

Research Summary and Future Perspective

To summarize the results of this study, it can be said that in children aged 8 to 9 years, late sleep onset enhances ADHD-like symptoms, and this effect is especially strong in children who do not have many genetic changes that predispose them to ADHD (and may not have true ADHD).

The clinical implications of this study are twofold.

(1) When assessing ADHD symptoms in children, it is important to ask about their sleep habits, because children who fall asleep late may be assessed as having higher ADHD symptoms. Such a potential diagnosis is particularly high in groups with low genetic susceptibility to ADHD.

(2) Even in children who have been diagnosed with ADHD, their sleep habits should be properly assessed to determine whether they are being over-diagnosed because they are falling asleep extremely late.

It is hoped to replicate these results in other age groups of children and adults in the future.

Publication

Exploration of sleep parameters, daytime hyperactivity/inattention and an attention deficit hyperactivity disorder polygenic risk score in children in a birth cohort in Japan. *JAMA Network Open* 2022;5(1)-e2141768

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Japanese ver.

https://www.med.nagoya-u.ac.jp/medical_J/research/pdf/JA_Net_20220106.pdf