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# The relationship between attention deficit hyperactivity disorder emotion regulation difficulties and sleep quality in adults: a cross sectional study

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## Abstract

**Objective** Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder that begins in childhood and often persists into adulthood, characterized by difficulties with attention, impulsivity, and hyperactivity. This study aims to explore the relationship between ADHD, emotion regulation difficulties, and sleep quality in adults.

**Methods** Thirty-nine adults with ADHD were compared to thirty-seven healthy controls. Participants completed the Wender Utah Rating Scale (WURS), Pittsburgh Sleep Quality Index (PSQI), and the Difficulties in Emotion Regulation Scale (DERS).

**Results** Participants were categorized based on their WURS scores those with a score of 36 or higher (ADHD group) and those with a score below 36 (non ADHD group). Comparisons of the PSQI and DERS scores between groups revealed that the group with ADHD had significantly higher total and subscale DERS scores compared to the group without ADHD. However, no significant differences were observed between the groups in terms of PSQI total and subscale scores. When the relationship between emotion regulation difficulties and sleep quality of participants diagnosed with attention deficit and hyperactivity disorder (ADHD) was examined, a correlation was found between DERS total and subscale scores and PSQI total and subscale scores.

**Conclusion** The findings suggest that adults with ADHD have more difficulties in emotion regulation than those without ADHD. Although no difference in sleep quality was found in our study between adults with ADHD and those without ADHD, the correlation between PSQI and DERS suggests that developing emotion regulation strategies with a transdiagnostic approach may help improve sleep quality.

**Keywords** Attention deficit hyperactivity disorder, Emotion regulation difficulties, Sleep disorders

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## Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is characterized by impairments in attention, hyperactivity, and/or impulsivity, which are typically diagnosed in childhood but often persist into adulthood [1]. The prevalence of adult ADHD is estimated to range between 1.4% and 3.6% [2], indicating the continued impact of the disorder beyond childhood.

ADHD is often accompanied by comorbidities, and sleep disorders are among the most common [3]. Studies suggest that 25–50% of individuals with ADHD experience sleep disturbances. Additionally, adults who do not receive sufficient sleep are more likely to report ADHD symptoms [4]. A variety of sleep-related issues are prevalent in individuals with ADHD, including bedtime resistance, delayed sleep onset, shorter sleep duration, nocturnal awakenings, difficulty waking in the morning, restless leg syndrome, narcolepsy, and general sleep quality impairments [5]. The relationship between ADHD and sleep disturbances remains unclear, but evidence suggests a reciprocal nature, where ADHD symptoms may exacerbate sleep problems, and poor sleep can worsen ADHD symptoms [6]. This bidirectional relationship is thought to be rooted in neuroanatomical and functional overlaps between brain regions involved in both attention and sleep regulation [5].

In addition to sleep disturbances, emotion regulation difficulties are another common challenge for adults with ADHD. Emotional dysregulation refers to the impaired ability to modulate emotional responses, resulting in irritability, mood lability, and disproportionate reactions [7]. Approximately two-thirds of adults with ADHD experience emotional dysregulation, a symptom closely associated with functional impairments and the presence of other psychiatric conditions [8]. Approximately 34–70% of adults with ADHD have been shown to experience some form of emotional dysregulation [9]. Emotional dysregulation is considered a core feature of ADHD and can occur in the absence of other comorbid conditions [10]. Moreover, emotional dysregulation has been associated with sleep disturbances, and research shows that emotional dysregulation is a predictor of insomnia [11].

The interplay between ADHD, emotional dysregulation, and sleep quality represents a complex and interrelated challenge. Sleep deprivation may impair emotional regulation, heightening the frequency of emotional outbursts, while emotional stress can exacerbate the onset of sleep difficulties. This cyclical relationship suggests that the interactions between emotional dysregulation and sleep disturbances may exacerbate each other in individuals with ADHD. Therefore, the aim of this study was to investigate the relationships between ADHD, sleep disturbances, and emotional dysregulation in a sample of adults who were diagnosed with ADHD for the first time in adulthood and had not yet received any treatment.

## Methods

### Participants and procedure

This cross-sectional study was conducted at the Department of Psychiatry, Bandırma Onyedi Eylül University. The study was approved by the Bandırma Onyedi Eylül University Health Sciences Non-Interventional Research Ethics Committee (Approval No. 2023-46) in accordance with the Declaration of Helsinki. A statement of human ethics and participation consent was received, all participants provided their written informed consent before participating in the study. The researchers also informed the participants that the data collected would be anonymized. No funds, grants, or other support were received during the preparation of this manuscript.

Patients adults aged 18 to 65 years presenting to the psychiatry outpatient clinic with complaints of attention deficit hyperactivity were administered the WURS. Patients with WURS ≥ 36 were evaluated by an experienced psychiatrist, and the structured clinical interview for DSM-5-disorders-clinician version (SCID-5/CV) was applied. Those who met the diagnostic criteria for ADHD according to SCID-5/CV constituted the ADHD patient group of the study. Two patients who had WURS ≥ 36 but did not meet the diagnosis of ADHD according to DSM-V [1] were excluded from the study.

The control group was comprised of age- and gender-matched individuals who were recruited from outpatient clinics at the same hospital. These participants had minor physical complaints (e.g., common cold), no chronic medical conditions, and no lifetime history of psychiatric disorders. Participants were given the WURS, and all participants had a WURS result of less than 36, which was confirmed by a clinical interview using SCID-5/CV, and these patients formed the control group of the study.

Exclusion criteria included individuals younger than 18 or older than 65 years, those with a comorbid psychiatric disorder, chronic medical conditions, mental retardation, specific developmental defects, past or current epilepsy, brain injury, cerebral palsy, or substance/alcohol abuse or dependence.

Ethics approval was obtained from the Bandırma Onyedi Eylül University Health Sciences Non-Interventional Research Ethics Committee. All participants provided both verbal and written informed consent prior to participation. The study adhered to the ethical principles outlined in the Declaration of Helsinki.

### Measures

#### *Socio-demographic data form*

A form designed by the researchers was used to collect socio-demographic information, including age, gender,

socioeconomic status, education, marital status, and vocational details.

#### *Structured clinical interview for DSM-5-disorders - clinician version (SCID-5/CV)*

The SCID-5, developed by First et al. (2016), is a structured clinical interview used to assess DSM-V mental disorders [12]. It is designed to enhance diagnostic reliability and validity by ensuring appropriate application of diagnostic criteria and facilitating symptom screening. The adaptation and reliability of the SCID-5 have been established in Turkish by Elbir et al. (2019) [13].

#### *Wender Utah rating scale (WURS-25)*

The WURS is a self-report scale consisting of 61 items that retrospectively assess childhood ADHD symptoms in adults. A 25-item short form of the WURS has been shown to effectively distinguish ADHD patients from healthy controls [14]. The Turkish adaptation of the WURS has established a cut-off score of 36, with sensitivity of 82.5% and specificity of 90.8% [15].

#### *Pittsburgh sleep quality index (PSQI)*

The PSQI is a self-reported tool used to assess sleep quality and disturbances over the past month. The 24-item questionnaire consists of 11 main questions and provides scores for 7 subscales: subjective sleep duration, sleep disturbance, sleep latency, habitual sleep efficiency, subjective sleep quality, sleep medication use, and daytime dysfunction [16]. An increase in the subscale scores and total score indicates deterioration in sleep quality. The Turkish validity and reliability of the PSQI was performed by Agargün et al. [17].

**Table 1** Sociodemographic data of participants

| *n*:76 | Mean ± SD/ *n*(%) |
|---|---|
| **Age** | |
| 18–21 | 53 (69,7) |
| 22–25 | 20 (26,3) |
| 26–29 | 0 (0) |
| 30 | 3 (3,9) |
| **Gender** | |
| Female | 59 (77,6) |
| Male | 17 (22,4) |
| **Marital Status** | |
| Married | 5 (6,6) |
| Single | 71(93,4) |
| **Employment Status** | |
| Employed | 18 (23,7) |
| Unemployed | 58 (76,3 |
| **Socioeconomic Level** | |
| Low | 14 (18,4) |
| Medium | 60 (78,9) |
| High | 2 (2,6) |
| **Physical Activity** | |
| Yes | 32 (42,1) |
| No | 44 (57,9) |
| **Physical Illness** | |
| Yes | 22 (28,9) |
| No | 54 (71,1) |

n = number of participants, mean = average, SD = standard deviation

#### *Difficulties in emotion regulation scale (DERS)*

The DERS is a 36-item self-report questionnaire that measures difficulties in emotion regulation across six domains: non-acceptance of emotional responses, goal-directed behavior difficulties, impulsivity, emotional awareness, limited access to emotional regulation strategies, and emotional identification. It uses a 5-point Likert scale (1 = "almost never" to 5 = "almost always"). Higher total scores indicate greater difficulties in emotion regulation [18]. The Turkish version of the DERS was validated by Rugancı et al. [19].

### Statistical analysis

The research data was evaluated using SPSS (Statistical Package for Social Sciences for Windows v.22.0, SPSS Inc., Chicago, IL). Descriptive statistics were presented as mean (±) standard deviation, frequency distribution, and percentage. The normality of the distribution of the data was evaluated using the Kolmogorov-Smirnov test and histogram graphics. In the data set obtained from the research, comparisons between groups were evaluated with an Independent Sample T-Test when parametric test prerequisites were met for continuous variables. If parametric test prerequisites were not met, the Mann-Whitney-U test was used in the analysis of continuous variables. In order to examine the relationship between variables, the Pearson correlation test was applied when parametric test prerequisites were met, and the Spearman correlation test was applied when parametric test prerequisites were not met. Statistical significance level was accepted as $p < 0.05$.

## Results

This study was conducted with 76 participants. 53 (69.7%) of the participants were between the ages of 18–21, 20 (26.3%) were between the ages of 22–25, and 3 (3.9%) were 30 years old. 59 (77.6%) of the participants were female and 17 (22.4) were male. 71 (93.4%) of the participants were single, and 5 (6.6%) were married. Various sociodemographic data of the participants are shown in Table 1.

Pittsburgh Sleep Quality Index (PSQI) total and subscale scores and Difficulties in Emotion Regulation Scale (DERS) total and subscale scores were compared between the groups. In the group with ADHD, the total score of DERS and all subscale scores were significantly higher than in the group without ADHD. When the

groups were compared in terms of PSQI scores, no difference was found between the groups in terms of total score and subscale scores. The results of the comparison of Pittsburgh Sleep Quality Index (PSQI) and Difficulties in Emotion Regulation Scale (DERS) scores between the groups are shown in Table 2.

In order to examine the relationship between emotion regulation difficulties and sleep quality of participants with ADHD, correlation analysis was performed between DERS total and subscale scores and PSQI total and subscale scores. There was a significant positive relationship between DERS-total score and PSQI-total and PSQI-latency, PSQI-duration, and PSQI-disorder subscale scores of the participants. As emotion regulation difficulties increased, sleep quality also deteriorated.

There was a significant positive relationship between the DERS-openness subscale and PSQI-total score and PSQI-latency and PSQI-efficiency subscale scores. There was a significant positive relationship between the DERS-unacceptance subscale and the PSQI-total score and PSQI-latency, PSQI-disorder, and PSQI-daytime functioning subscale scores. There was a positive significant relationship between DERS-impulse subscale score and PSQI-duration subscale and a negative significant relationship between PSQI-medication subscale. The results of the correlation analysis between the DERS and PSQI scores of participants with ADHD are shown in Table 3.

**Table 2** Comparison of Pittsburgh sleep quality index (PSQI) and difficulties in emotion regulation scale (DERS) scores between groups

| ***n*:76** | **ADHD (*n* = 39) Mean ± SD** | **Non-ADHD (*n* = 37) Mean ± SD** | ***P*** |
|---|---|---|---|
| **DERS Total** | 114,8 ± 18,8 | 89,3 ± 20,2 | < 0,001[a] |
| **DERS - Awareness** | 16,3 ± 4,2 | 13,5 ± 3,8 | 0,004[a] |
| **DERS - Clarity** | 14,9 ± 4,0 | 12,9 ± 4,1 | 0,035[b] |
| **DERS - Nonacceptance** | 18,7 ± 4,2 | 15,2 ± 5,9 | 0,003[b] |
| **DERS - Impulse** | 21,2 ± 4,9 | 12,7 ± 4,4 | < 0,001[a] |
| **DERS - Goal-directed Behavior** | 20,4 ± 5,1 | 16,0 ± 3,8 | < 0,001[b] |
| **DERS - Strategy** | 23,1 ± 6,5 | 18,9 ± 5,7 | 0,002[b] |
| **PSQI Total** | 7,18 ± 3,4 | 6,54 ± 2,9 | 0,387[a] |
| **PSQI - Subjective** | 1,51 ± 0,8 | 1,59 ± 0,6 | 0,552[b] |
| **PSQI - Latency** | 1,51 ± 0,9 | 1,24 ± 0,7 | 0,177[b] |
| **PSQI - Duration** | 0,85 ± 1,0 | 0,92 ± 1,1 | 0,852[b] |
| **PSQI - Efficiency** | 0,49 ± 0,8 | 0,22 ± 0,5 | 0,079[b] |
| **PSQI - Disturbance** | 0,90 ± 0,5 | 0,86 ± 0,4 | 0,831[b] |
| **PSQI - Medication** | 0,15 ± 0,4 | 0,16 ± 0,5 | 0,796[b] |
| **PSQI - Daytime Functioning** | 1,77 ± 0,8 | 1,54 ± 0,9 | 0,295[b] |

n = number of participants, mean = average, SD = standard deviation, DERS: Difficulties in Emotion Regulation Scale, PSQI: Pittsburgh Sleep Quality Index, a = Independent Samples t-test, b = Mann-Whitney U test

## Discussion

We conducted a study on the relationship between ADHD, emotion regulation difficulties and sleep quality in adults. We used a sample of patients diagnosed with ADHD by experienced psychiatrist and a control group matched for similar sociodemographic characteristics. Our main findings were as follows. First, no significant difference was observed between patients with ADHD and the control group in terms of PSQI total and subscale scores. Second, when comparing DERS scores across groups, we found that the group with ADHD showed significantly higher total and subscale DERS scores compared to the group without ADHD. Finally, in order to examine the relationship between emotion regulation difficulties and sleep quality in participants with ADHD, correlation analysis was performed between the total and subscale scores of the DERS and the total and subscale scores of the PSQI. There was a significant positive correlation between the participants' DERS-total score and PSQI-total and PSQI-delay, PSQI-duration and PSQI-disorder subscale scores. We found that sleep quality deteriorated as emotion regulation difficulties increased.

Almost all studies on subjective sleep parameters in adult ADHD have reported impaired sleep maintenance and difficulty waking up in the morning. However, some studies have shown inconsistent results for subjectively measured sleep onset latency and total sleep duration [20]. While no difference was found in patients who retrospectively reported sleep onset latency compared to controls [21], Bijlenga et al. found longer latencies [22]. Contrasting results were also found when latency was measured prospectively. Sobanski et al. found longer sleep latency in ADHD patients [21], while Philipsen et al. found no difference [23]. Although one study reported more frequent nighttime awakenings in ADHD patients compared with controls [22], in another study the time spent awake at night was the same in ADHD patients and controls [24]. At home, ADHD patients reported shorter total sleep duration compared to controls [22]. However, no difference was found when ADHD patients' sleep duration was measured over two nights in a laboratory [23].

In our study, no significant difference was observed between patients with ADHD and the control group in terms of PSQI total and subscale scores. The inconsistent results in some studies investigating the relationship between ADHD and sleep may be due to incomplete or inaccurate reporting of sleep-related information by participants due to subjective evaluation of sleep, difficulties in estimating total sleep time, or lack of time awareness in ADHD patients. In addition, total sleep duration may have differed depending on the environment in which it was measured, and the presence or absence of stimulant

**Table 3** Correlation analysis between DERS and PSQI scores in participants with ADHD

| *n* = 39 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *r* | *r* | *r* | *r* | *r* | *r* | *r* | *r* | *r* | *r* | *r* | *r* | *r* | *r* | *r* |
| **1-DERS Total** | 1 | | | | | | | | | | | | | | |
| **2-DERS Awareness** | 0,302 | 1 | | | | | | | | | | | | | |
| **3-DERS Clarity** | 0,686** | 0,116 | 1 | | | | | | | | | | | | |
| **4-DERS Nonacceptance** | 0,356* | -0,036 | 0,180 | 1 | | | | | | | | | | | |
| **5-DERS Impulse** | 0,496** | -0,001 | 0,254 | -0,171 | 1 | | | | | | | | | | |
| **6-DERS Goal-directed Behavior** | 0,716** | 0,092 | 0,532** | 0,122 | 0,250 | 1 | | | | | | | | | |
| **7-DERS Strategy** | 0,886** | 0,274 | 0,613** | 0,197 | 0,435** | 0,603** | 1 | | | | | | | | |
| **8- PSQI Total** | 0,487** | 0,044 | 0,345* | 0,403* | 0,151 | 0,081 | 0,264 | 1 | | | | | | | |
| **9-PSQI Subjective** | 0,095 | 0,138 | 0,228 | -0,064 | 0,059 | -0,079 | 0,119 | 0,690** | 1 | | | | | | |
| **10-PSQI Latency** | 0,366* | 0,053 | 0,399* | 0,592** | 0,005 | 0,166 | 0,172 | 0,777** | 0,386* | 1 | | | | | |
| **11-PSQI Duration** | 0,382* | 0,078 | -0,006 | 0,148 | 0,477** | 0,139 | 0,176 | 0,579** | 0,326* | 0,221 | 1 | | | | |
| **12-PSQI Efficiency** | 0,250 | -0,248 | 0,526** | 0,237 | 0,073 | 0,080 | 0,228 | 0,631** | 0,469** | 0,497** | 0,240 | 1 | | | |
| **13-PSQI Disturbance** | 0,457** | 0,091 | 0,167 | 0,499** | 0,202 | 0,063 | 0,379* | 0,662** | 0,324* | 0,421** | 0,370* | 0,315 | 1 | | |
| **14-PSQI Medication** | -0,054 | -0,014 | 0,136 | 0,095 | -0,526** | 0,080 | -0,038 | 0,068 | 0,239 | -0,034 | -0,311 | 0,065 | 0,074 | 1 | |
| **15-PSQI Daytime Functioning** | 0,182 | -0,037 | -0,004 | 0,425** | 0,191 | -0,098 | 0,141 | 0,510** | 0,094 | 0,462** | 0,233 | -0,034 | 0,474** | -0,171 | 1 |

n: number of patients r: correlation coefficient, *: $p < 0.05$, **: $p < 0.001$

drug use in ADHD patients during the study or the effect of drug types may have caused differences in the studies.

Our study did not reveal a significant relationship between ADHD and sleep quality. This may stem from factors such as the subjective nature of sleep quality measurements, variations in environmental conditions, and potential inaccuracies in estimating total sleep time, as previously discussed. Additionally, the fact that our ADHD patient sample did not exhibit any additional comorbidities and was not on any medications may have contributed to the lack of a correlation in our results. Existing research demonstrating sleep disturbances in ADHD often includes participants with co-occurring conditions and/or medication use [25]. Given the known sleep-disrupting effects of comorbidities like depression and anxiety, as well as medications such as psychostimulants, the fact that our sample consisted of unmedicated patients without additional diagnoses may be a crucial factor in explaining the lack of association between ADHD and sleep quality in our study [26, 27].

Dimensionality in ADHD is a topic that has received more attention in recent years. Subthreshold ADHD is seen at rates ranging from 0.8 to 23.1% and significantly affects functionality in adulthood and childhood [28]. Although individuals with subthreshold ADHD symptoms are classified as controls in clinical studies, they actually have symptoms of relatively similar severity to those diagnosed with ADHD [29, 30]. This may affect the study results. One of the reasons why there was no difference in sleep quality in our study may be the existence of individuals with subthreshold ADHD symptoms but who were not diagnosed. New studies examining the relationship between ADHD and sleep may provide new data regarding ADHD, taking into account the dimensionality of ADHD.

When the existing data on emotion regulation in adults with ADHD are evaluated, the results suggest that not only inattention, hyperactivity, and impulsivity, but also emotional dysregulation, is a core component of ADHD [31]. It has been reported that approximately 34–70% of adult ADHD patients experience emotional dysregulation symptoms [9]. It has been observed that as the severity of ADHD symptoms increases, emotional dysregulation also increases [32]. In a study conducted to evaluate emotional dysregulation symptoms in ADHD patients, anger, irritability, stress tolerance, and mood variability were evaluated, and an increase in impulsive behaviors, faster and more frequent changes in mood, and easy anger were found as ADHD symptom severity increased [33].

According to the findings obtained from our study, the mean DERS total and DERS subscale scores of the ADHD group were found to be statistically significantly higher than the control group. This finding shows that individuals with ADHD have significantly more difficulty in emotion regulation than healthy individuals. This finding is consistent with the literature. When the findings of our study are examined in more detail, the high level of the "goals" subscale, which reports the degree of difficulty in achieving goals while experiencing negative emotions in the DERS scale in the ADHD group, can be explained by the distractibility, difficulty in concentration, and difficulty in completing tasks, which are inherent in ADHD.

Finally when the relationship between emotion regulation difficulties and sleep is examined in the literature, little information is known about the interaction between sleep and emotional regulation. Moreau et al. suggested that sleep problems in children with ADHD may be associated with comorbid symptomatology [34]. A study by Sanabra et al. found a linear relationship between sleep disturbances and emotional dysregulation, suggesting that children with ADHD who have emotional dysregulation have more sleep disturbances or that sleep disturbances may be the cause of emotional dysregulation [35]. These relationships between sleep and emotional dysregulation are likely to be bidirectional, with sleep problems or insufficient sleep exacerbating emotional, and behavioral difficulties and emotional dysregulation may compromise sleep patterns [36].

In our study, we confirmed the literature findings that ADHD is associated with higher DESR rates and that there is a bidirectional relationship between DESR and sleep disorders.

Our study has several strengths. This study is one of the limited number of studies examining the relationship between emotion regulation difficulties and sleep in adult ADHD patients. The patient group in our study was newly diagnosed with ADHD and not receiving medication; the SCID was used to assess ADHD diagnosis, and comorbid diseases were ruled out. However, our study has some limitations. The main limitation is that our sample was relatively small. The assessment tools used in our study were retrospective assessment scales and may be confusing in terms of recall bias. The fact that our study was cross-sectional rather than longitudinal may be considered a limitation in this respect.

## Conclusions

The results of this study might suggest that teaching individuals with ADHD how to regulate their emotions can improve their emotional reactions. Furthermore, regardless of a person's diagnosis, developing emotion regulation skills may help them sleep better. It would be interesting to see more research that looks more closely at the connection between sleep disorders and DESR and identifies the main factor causing this association. In addition, in future studies, using measurements such as polysomnography in addition to questionnaires to investigate sleep disorders may provide more objective data.

**Abbreviations**

| | |
|---|---|
| ADHD | Attention deficit and hyperactivity disorder |
| WURS | Wender Utah Rating Scale |
| PSQI | Pittsburgh Sleep Quality Index |
| DERS | Difficulties in Emotion Regulation Scale |
| SCID-5/CV | Structured clinical interview for DSM-5-disorders-clinician version |
| DSM-5 | Diagnostic and Statistical Manual of Mental Disorders-5 |

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**Author contributions**
N.D. and T.S.K. conceptualized the study and performed the methodology. R.G.T. conducted the formal analysis. T.S.K. and N.D. provided resources and data curation. N.D. and R.G.T. drafted the manuscript. All authors reviewed the manuscript.

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**Data availability**
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Declarations

**Ethical approval and informed consent**
The study was approved by the Bandırma Onyedi Eylül University Health Sciences Non-Interventional Research Ethics Committee (Approval No. 2023-46) ) in accordance with the Declaration of Helsinki

**Human ethics and consent to participate**
All participants provided their written informed consent before participating in the study.

**Consent for publication**
Not applicable.

**Competing interests**
The authors declare no competing interests.

**Clinical trial number**
Not applicable.

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