

# 学位論文

Prevalence of attention deficit  
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# Prevalence of attention deficit hyperactivity disorder and/or autism spectrum disorder and its relation to lifestyle in female college students

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## Abstract

### *Objective*

The aim of this study was to explore the prevalence of attention deficit hyperactivity disorder (ADHD) and/or autism spectrum disorder (ASD) and its relation to lifestyle in female college students.

### *Subjects and methods*

A total of 375 female college students ( $19.2 \pm 1.3$  years) among 439 students were enrolled in this cross-sectional study. Using a self-reported questionnaire, we measured the prevalence of ADHD using the ADHD Self-Report Scale-v1.1 (ASRS) and the prevalence of ASD using the Autism-Spectrum Quotient (AQ). In addition, lifestyle choices such as medications, physical activity, cigarette smoking, alcohol drinking and sleeping habits were also evaluated.

### *Results*

The suspected prevalence of ADHD was 102 students (27.2 %) and the suspected prevalence of ASD was 4 students (1.1 %). Only one student (0.3 %) was thought to have both ADHD and ASD. Subjects with suspected ADHD had higher AQ scores compared with those without suspected ADHD. There were no unhealthy lifestyle choices in subjects with suspected ADHD and/or ASD.

### *Conclusion*

The prevalence of suspected ADHD and/or ASD may be relatively high even among female college students in Japan.

### **Keywords**

Attention deficit hyperactivity disorder (ADHD) • Autism spectrum disorder (ASD) • Lifestyle Self-reported questionnaire • Female college students

## Introduction

Attention deficit hyperactivity disorder (ADHD), characterized by hyperactivity, inattention and impulsivity, has become a health problem in adults as well as children in Japan [1]. For example, the worldwide-pooled prevalence of patients with ADHD was estimated at 5.29 % by metaanalysis [2]; furthermore, unhealthy lifestyles were characteristic in patients with ADHD [3–5]. In Japan, Nakamura reported a prevalence of adult ADHD at 1.7 % [6].

Autism spectrum disorder (ASD) is a common psychiatric disorder in Japan. Poor communication skills and narrow interests are fundamental features of ASD, with 1.1 % of children reported as having ASD in the USA [7]. Therefore, proper prevention and management of ADHD and/or ASD are urgently required. Although these two disorders (ADHD and ASD) are relevantly different from each other, Russell reported that 0.3 % of children have both ADHD and ASD in the UK [8]. Iwasaka investigated ADHD in adults in Japan, and found that symptoms continue in 30–70 % of children with ADHD when they become adults. In adults with ADHD, 63 % were diagnosed when they were over 18 years old [9]. However, the prevalence of ADHD and/or ASD still remains to be thoroughly investigated in Japan, and the evaluation of the suspected prevalence of these disorders, in apparently healthy subjects, would provide us useful information for prevention and management of ADHD and/or ASD in clinical practice.

Therefore, in this cross-sectional study, we evaluated the suspected prevalence of ADHD and ASD using self-reported questionnaires and their relation to lifestyle, i.e., exercise, cigarette smoking, alcohol drinking and sleeping in female college students.

## **Subjects and methods**

### **Subjects**

A total of 375 female college students among 439 students, aged  $19.2 \pm 1.3$  years, were enrolled in this cross-sectional study, and met the following criteria: (1) they voluntarily undertook the self-reported questionnaires at the women's college, Matsuyama, Japan, from April to May 2015, (2) they provided written, informed consent (Table 1). Ethical approval was obtained from the Ethical Committee of Shinonome Women's College (14-001).

### **Clinical measurements**

Age and lifestyle such as exercise, cigarette smoking, alcohol drinking and sleeping habits were investigated by self-reported questionnaires. Lifestyles were classified according to the National Health Nutritional Survey [10]. The subjects were asked if they currently exercise (over 30 min per session, 2 times per week, continually for more than 1 year). When the answer was "yes", they were classified as subjects with exercise habits. When the answer was "no", they were classified as subjects without exercise habits [10]. The subjects were asked if they currently smoked cigarettes. When the answer was "yes", they were classified as current smokers. When the answer was "no", they were classified as non-smokers [11]. Subjects with an alcohol level of over 1 go (180 ml of Japanese rice wine) per day, on 3 days or more per week, were defined as having drinking habits [12]. The subjects were asked if they had the following sleeping habits more than three times per week in the past month: difficulty in falling asleep, nocturnal awakening, early morning awakening, shortage of sleep, good sleep quality and daytime sleepiness. When the answer was "yes", they were classified as fitting the items. When the answer was "no", they were classified as not fitting the items.

**Table 1** Clinical characteristics of enrolled female students in this study

|                               |            | Minimum | Maximum |
|-------------------------------|------------|---------|---------|
| Number of subjects            | 375        |         |         |
| Age                           | 19.2 ± 1.3 | 18      | 22      |
| ADHD Self-Report Scale Part A | 2.6 ± 1.5  | 0       | 6       |
| Autism-spectrum Quotient      | 19.7 ± 5.6 | 4       | 38      |
| Medications                   | 14 (3.7)   |         |         |
| Exercise habits               | 177 (47.2) |         |         |
| Cigarette smoking habits      | 8 (2.1)    |         |         |
| Alcohol drinking habits       | 57 (15.2)  |         |         |
| Not Easy to fall asleep       | 110 (29.3) |         |         |
| Nocturnal awakening           | 80 (21.3)  |         |         |
| Early morning awakening       | 53 (14.1)  |         |         |
| Shortage of sleep             | 206 (54.9) |         |         |
| Bad sleep quality             | 134 (35.7) |         |         |
| Daytime sleepiness            | 244 (65.1) |         |         |

ADHD: Attention deficit hyperactivity disorder

Mean ±SD

Lifestyles were subjects who answered "Yes ( ):%"

### Evaluation of suspected ADHD and ASD

Suspected ADHD was determined using the ADHD Self-Report Scale (ASRS)-v1.1 Part A, as previously described [13, 14]. Scoring a level of 4 items or more, of 6, was defined as suspected ADHD. Sensitivity and specificity of this questionnaire were 84 and 66 %, respectively [15]. Takeda reported that the correlation coefficient rate in retest was 0.87, and correlation coefficient

rates between ASRS and Conners' Adult ADHD Rating Scales (CAARS) were from 0.61 to 0.80 [16]. Suspected ASD was also defined using the Autism Spectrum Quotient (AQ) [17, 18]. Scoring over a level of 33 of 50 items was defined as suspected ASD. Kurita showed that it had 79.3 % sensitivity and 97.7 % specificity [19].

### Statistical analysis

Data were expressed as mean  $\pm$  SD. Comparison of AQ scores between subjects with and without suspected ADHD was made by unpaired t tests. Comparison of lifestyle between subjects with and without suspected ADHD and/or ASD was performed by  $\chi^2$  tests, where  $p < 0.05$  was statistically significant.

### Results

The clinical characteristics of female college students are summarized in Table 1. A total of 375 subjects (96.4 %) were analyzed. ASRS, Part A scores and AQ scores were  $2.6 \pm 1.5$  and  $19.7 \pm 5.6$ , respectively. Fourteen subjects (3.7 %) among 375 students were taking medications such as those for anemia. Four suspected ADHD subjects (3.9 %) and ten not suspected ADHD subjects (3.7 %) were taking medications. But no suspected ASD subjects were taking medications.

The number of subjects with suspected ADHD is summarized in Fig. 1. One hundred and two subjects (27.2 %) were over the level of 4 items and defined as having suspected ADHD. On the other hand, it was determined that four subjects (1.1 %) were over the level of 33 points and defined as suspected with ASD from the AQ score (Fig. 2). Only one subject (0.3 %) of these 4 subjects had both suspected ADHD and ASD (Fig. 3). In addition, the

score of AQ in subjects with suspected ADHD ( $21.0 \pm 5.2$ ) was significantly higher than in subjects without suspected ADHD ( $19.3 \pm 5.6$ ) (Fig. 4).

It has been shown that unhealthy lifestyles correlate with ADHD. We evaluated the link between lifestyle and suspected ADHD in female college students (Table 2), and the analysis did not show significant differences in the lifestyles between both groups.

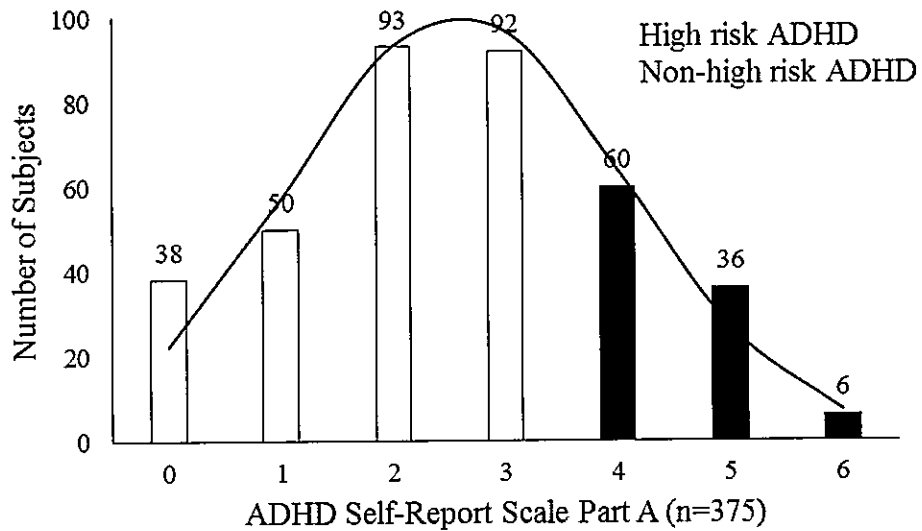


Fig. 1 The prevalence of ADHD using the ADHD Self-Report Scale-v1.1 Part A



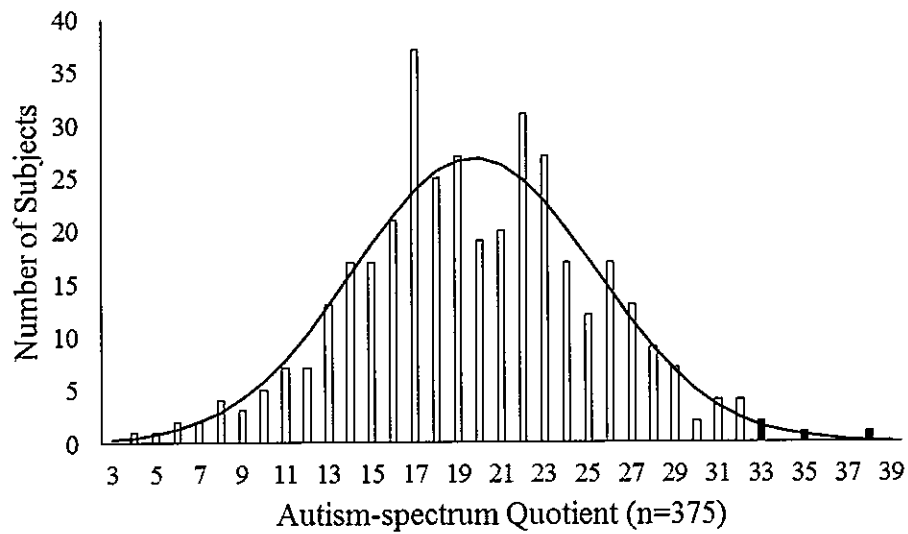


Fig. 2 The prevalence of ASD using the Autism-Spectrum Quotient

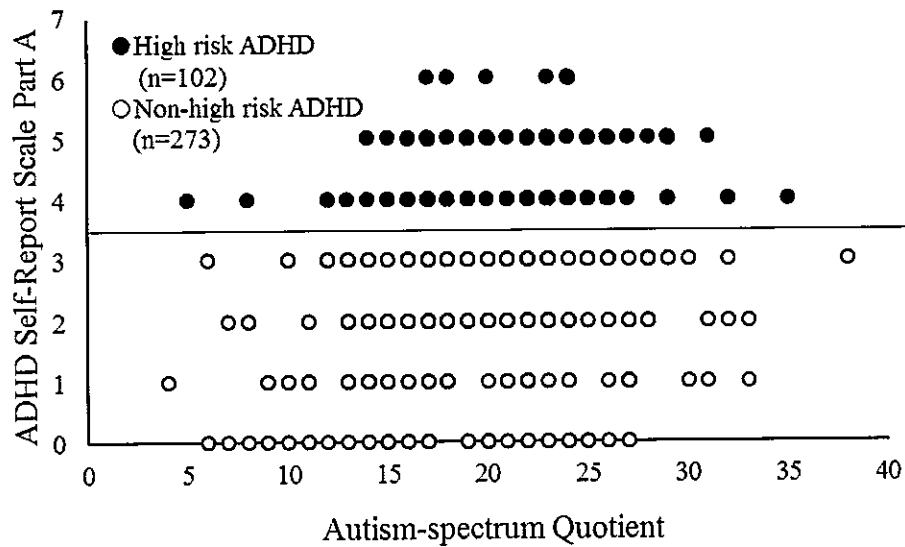
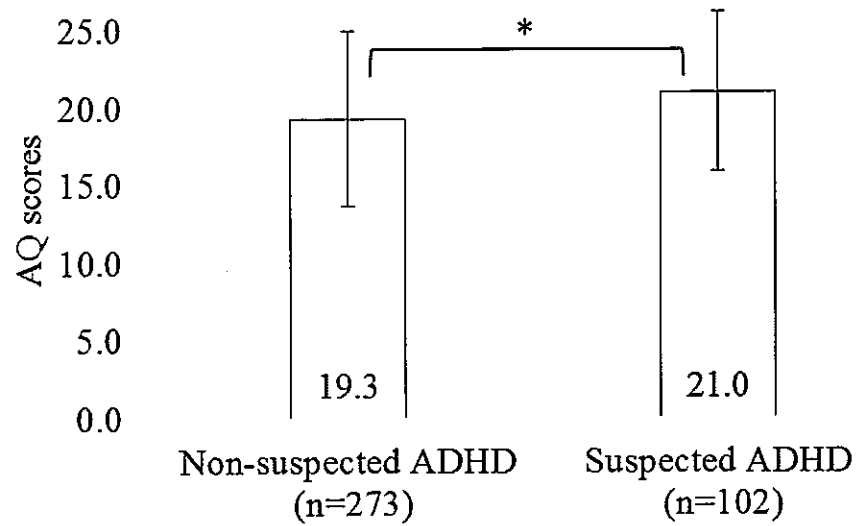


Fig. 3 Comparison of Autism-Spectrum Quotient scores between subjects with and without suspected ADHD



**Fig. 4** Comparison of AQ scores between suspected ADHD and non-suspected ADHD. Data are expressed as mean  $\pm$  SD. Asterisk expresses that p is less than 0.05. ADHD attention deficit hyperactivity disorder, AQ Autism-Spectrum Quotient

**Table 2** Comparison of lifestyles between subjects with and without suspected ASD

|                          | ADHD(+) (n=101) | ADHD(-) (n=270) | <i>p</i> |
|--------------------------|-----------------|-----------------|----------|
|                          | %               | %               |          |
| Medications              | 3.8             | 3.7             | 0.962    |
| Exercise habits          | 43.8            | 48.5            | 0.551    |
| Cigarette smoking habits | 1.0             | 2.6             | 0.329    |
| Alcohol drinking habits  | 21.0            | 13.0            | 0.074    |
| Not Easy to fall asleep  | 31.4            | 28.5            | 0.640    |
| Nocturnal awakening      | 20.0            | 21.9            | 0.727    |
| Early morning awakening  | 17.1            | 13.0            | 0.334    |
| Shortage of sleep        | 48.6            | 57.4            | 0.300    |
| Bad sleep quality        | 30.5            | 37.8            | 0.288    |
| Daytime sleepiness       | 62.9            | 65.9            | 0.741    |

ADHD: Attention deficit hyperactivity disorder

Statistical analysis was performed by  $\chi$  square test

Lifestyles were subjects who answered "Yes".

## Discussion

In this study, we evaluated the prevalence of ADHD and/or ASD by self-reported questionnaire and its relation to lifestyle in female college students in Japan. The suspected prevalence of ASD and that where both ADHD and ASD were suspected were similar to those in previous reports [7, 8]. However, the prevalence of suspected ADHD was higher than that in previous reports, in female college students in Japan [8].

In Japan, the total prevalence of ADHD, ASD and LD (learning disability) was 6.5 % in elementary and junior high school students, and the

prevalence of ADHD and LD decreased with age [20]. ADHD, ASD and LD in this report were defined by classroom teachers, and not by medical doctors. Therefore, proper diagnosis might not have been made. In addition, Schlack reported that the prevalence of ADHD in boys was 4.5 times higher than in girls. The prevalence of ADHD in low-income households was also 2.5 times higher than those with high income [21]. It is noteworthy that, in this study, the prevalence of suspected ADHD was 27.2 % in female college students. The prevalence of ADHD was clinically diagnosed [2, 3, 8, 20, 21]. The prevalence of suspected ADHD in this study was defined using the ADHD Self-Report Scale (ASRS)-v1.1 Part A. ASRS was the screening test and over 1 SD of ASRS was defined with suspected ADHD and a clinically accurate diagnosis was necessary. In addition, the enrolled students in this study were female college students belonging to one local women's college. Taken together, there are potential ADHD sufferers in female college students, and they may need proper support in clinical practice and/or educational support.

Although the prevalence of lifestyle-related diseases was not obviously associated with ADHD and/or ASD, there are some reports that lifestyle choice is associated with ADHD and/or ASD [3–5]. Lambert reported that cigarette smoking habits were closely linked to ADHD [3]. Ohlmeier described that 35 % of adult ADHD patients were thought to be alcohol addicts and 76 % were dependent on nicotine [4]. In addition, Breyer reported that patients, whose ADHD symptoms in childhood continued to young adulthood, often experienced serious gambling problems compared with patients whose ADHD symptoms in childhood did not continue [5]. However, in this study, there were no clear relationships between lifestyle and ADHD and/or ASD in female college students without sleep problems. Exercise habits of enrolled students in this study were comparably higher than those in the reports of the National

Health and Nutrition Survey [10]. In addition, the exercise habits of enrolled students were higher, and smoking and drinking habits were lower compared with some previous reports [22–25].

Taken together, unhealthy lifestyles might not be typical and screening would be necessary for preventing and improving ADHD and/or ASD.

Potential limitations still remain in this study. First, this study was a cross-sectional, and not longitudinal study. Second, we could not evaluate male students. Third, we also could not evaluate diet in their lifestyle. Choi reported an association between ADHD and dietary habits [26]. In addition, the prevalence of suspected ADHD (27.2 %) and/or ASD (1.1 %) was comparatively low. Therefore, the relation between lifestyle and suspected ADHD and/or ASD was not accurately evaluated in this study. However, it is reasonable that there are some suspected ADHD and/or ASD cases in female college students. Screening of suspected ADHD and/or ASD might be necessary for proper management in clinical practice and/or educational support. Further ongoing and longitudinal studies including other college students at various sites in Japan are urgently required.

**Compliance with ethical standards**

**Conflict of interest** There are no conflicts of interests in this study.

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