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Research Article

APPLICATION OF THE SNAP-IV QUESTIONNAIRE IN SCHOOL-AGED CHILDREN WITH ACADEMIC UNDERACHIEVEMENT

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Abstract

Objective: To screen for Attention Deficit Hyperactivity Disorder (ADHD) diagnosis in children with academic underachievement (AU), by applying the Swanson, Nolan, and Pelham (SNAP-IV) questionnaire, furthermore to identify associated epidemiologic factors. **Methods:** A cross-sectional observational and epidemiological study, conducted through the medical records and their respective score in the SNAP-IV questionnaire of school-aged children, evaluated at academic underachievement outpatient clinic of a university hospital. The analyzed variables were SNAP-IV score, gender, Body Mass Index (BMI), grade and age. **Results:** of the 56 participants, 36 (66.1%) were male, the mean age was 8.7 years, and most were in the 3rd and 4th grades. About 38 (67.9%) of the subjects had positive score for ADHD diagnosis, being 28 (50.0%) boys and 10 (17.9%) girls, with a ratio of 2.8 boys:1 girl. There was association between inattention and obese children, which had higher inattention levels (p = 0.0362). There wasn't association among another variables. **Conclusion:** The SNAP-IV questionnaire is an effective tool for screening of symptoms of inattention, hyperactivity and impulsivity. There was association between inattention and obesity.

Keywords: Child, Underachievement, Attention Deficit Hyperactivity Disorder, Surveys and Questionnaires, Obesity.

INTRODUCTION

Attention-deficit hyperactivity disorder (ADHD) is one of the most common neurobehavioral disorders in childhood[1]. It is a neuropsychiatric dysfunction characterized by symptoms of inattention, hyperactivity, and impulsivity[2,3], associated with adverse emotional, cognitive-behavioral, and socioeconomic outcomes, including educational underachievement[4,5]. Academic underachievement (AU) is dimensional, involving family, social and individual factors, and is often identified by parents and teachers at the beginning of schooling[4-6], when many children with AU are diagnosed with ADHD[7]. Worldwide prevalence of ADHD is estimated at 3.4% in children and adolescents, rising to 5% in school-aged children between the ages of 6 and 12[8]. Screening questionnaires are useful tools in the diagnosis and follow-up of ADHD, some examples of these are: the ADHD Scale, the CBCL, the Conner`s Scale and the Swanson, Nolan and Pelham Questionnaire (SNAP-IV)[9]. The SNAP-IV has 18 items, the first 9 corresponding to inattention symptoms and the next 9 to hyperactivity/impulsivity symptoms, which must be answered by parents and/or teachers, in accordance with a four-level scale of severity[10].

This study aimed to screen children for ADHD diagnosis by applying the SNAP-IV questionnaire, to identify possible associated epidemiologic factors.

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METHODS

Epidemiologic, cross-sectional, and observational study, conducted from March/2022 to March/2023, with children of both gender, aged 6 to 12 years, followed in a academic underachievement outpatient clinic of a university hospital. The variables analyzed were: SNAP-IV score, gender, Body Mass Index (BMI), grade and age. BMI is the ratio of weight (in kilograms) to the square of height (in meters). In this study, weight was measured with a Líder® digital scale weight balance (model P-300C, series 31403, year 2014; Brazil) and height measured with a wall stadiometer (model E150 A, *Tonelli Equipamentos Médicos Ltda*., Brazil). All students were assessed for age, gender, and BMI, according to the World Health Organization anthropometric tables (WHO, 2007) for children and adolescents aged five to 19 years. By percentile, the participants were classified as: thinness (p<3), eutrophic (p ≥3 and ≤85), overweight (>85 and ≤97) and obesity (>97). All the participants were also categorized according to their school age into 1st and 2nd graders, 3rd grade, 4thgrade and 5th grade or higher.

Each item on SNAP-IV has four response options: not at all, just a little, quite a bit and very much. For each item, the parents and/or teacher must check the column which best describes this child. The score is the sum of the responses, ordered as follows: if at least 6 items from 1 to 9 are qualified as quite a bit or very much, more inattention symptoms are present; if at least 6 items from 10 to 18 are qualified as quite a

bit or very much, more hyperactivity/impulsivity symptoms are present. At the medical appointment and clinical evaluation, the form was sent to the school, which returned the SNAP-IV filled out by the student's teacher, and at a new medical appointment, the results were collected. Participants who didn't fill out the form or filled it out incompletely were excluded, as were those without parental consent and those who completed the form twice. Thus, after the diagnostic screening using the SNAP-IV form, the students were classified into four groups: inattention, hyperactivity, combined type, and normality.

All the information obtained was tabulated in an Excel® spreadsheet, grouped and subjected to a statistical analysis carried out with XLStat program, version 2014.5.03 Copyright Addinsoft (New York, NY, USA, 2014). Qualitative variables are presented as absolute (n) and relative (%) frequencies, while quantitative variables are presented as means and respective standard deviation (SD). The levels of inattention and hyperactivity were individually quantified by the score on the form and then tested for normality by the Shapiro-Wilk test. Since the assumption of normality was not accepted, non-parametric tests were conducted for each separate predictor. Assuming a Gaussian distribution, Linear Generalized Models were used to correlate inattention and hyperactivity levels with the predictors in interaction (gender, BMI, and school grade). An interaction between the inattention and hyperactivity levels and the predictor gender was defined using the Mann-Whitney-U two sample test, presented by the medians and interquartile ranges (IR). The Kruskal-Wallis test was used to compare those levels with the predictors BMI and grade, and the results are presented as means and respective SD. In addition, for the predictor age in interaction with the inattention and hyperactivity levels, dispersion diagrams were constructed to calculate Spearman's Correlation Coefficients and corresponding p-values to assess significance, also presented as means and respective SD. At last, since the screen diagnosis is a qualitative variable described as inattention, hyperactivity, combined type, and normality, to compare it with the predictors in interaction, a Chi-square Test of Independence was applied, using adjusted residuals as a post-hoc analyses. All analyses assumed p-values <0.05 statistically significant.

This research was approved by the Research Ethics Committee of the Western Paraná State University, by the number 5,262,877 on February 24th, 2022.

RESULTS

Of the 80 selected medical records, 24 students were excluded. The final sample evaluated included 56 children, their respective medical records, and the corresponding score SNAP-IV, filled out by the student's teachers. The subjects characteristics and frequencies of all variables analyzed are presented in Table 1.

Table 1. Absolute (n) and relative (%) frequencies, mean age with standard deviation

Variables	Categories	n	%
Result on SNAP-IV[1]	Inattention	25	44.6
	Hyperactivity	3	5.4
	Combined type	10	17.9
	Normal behavior	18	32.1
Gender	Male	37	66.1
	Female	19	33.9
BMI[2]	Thinness-Eutrophic	30	53.6
	Overweight	13	23.2
	Obesity	13	23.2
Grade	1st and 2nd	11	19.6
	3rd	16	28.6
	4th	20	35.7
	5th or higher	9	16.1
	6	3	5.4
	7	9	16.1
	8	17	30.4
	9	10	17.9
Age (years old)	10	9	16.1
	11	5	8.9
	12	3	5.4
Age (Mean ± SD)	8.71 ± 1.55		

[1]SNAP-IV: IV Version of Swanson, Nolan e Pelham Questionnaire.
[2]BMI: Body Mass Index.

Statistical correlations between inattention and hyperactivity symptoms and predictors in interaction (gender, BMI, school grade and age) are indicated in Table 2. The association between inattention values and BMI were statistically significant, indicating that obese children had higher inattention levels than thinness/eutrophic children (p = 0.0362). Otherwise, no significant association was found for other predictors. Of both gender, 75.7% (n = 28) of the boys and 52.6% (n = 10) of the girls had ADHD symptoms. Among all subjects, 50.0% (n = 28) were boys and 17.9% (n = 10) were girls with a screening diagnosis of ADHD, with a ratio of 2.8 boys to 1 girl.

Table 2. Correlations between inattention and hyperactivity and predictors in interaction

Predictor	Inattention				Hyperactivity		
	n	Median	IR[1]	p value	Median	IR	p value
Gender							
Male	37	7	[3 – 9]	0.746	3	[0 – 7]	0.091
Female	19	7	[3.5 – 8.25]		2	[0 – 3]	
	n	Mean	SD[3]	p value	Mean	SD	p value
BMI [2]							
Thinness-Eutrophic	30	4.83	3.37	0.055	2.80	3.26	
Overweight	13	7.00	3.29	0.077	1.77	1.79	0.285
Obesity[4]	13	6.77	2.49	0.036	4.39	3.82	
Grade							
1st and 2nd	11	6.00	3.44		4.36	3.30	
3rd	16	4.81	3.56	0.237	2.56	3.16	0.352
4th	20	5.85	2.89		2.40	2.80	
5th or higher	9	7.11	3.44		3.00	4.06	
Age							
6 to 12 years old	56	8.63	1.477	0.924	8.46	1.71	0.080

[1] *IR: Interquartile Range.*
[2]*BMI: Body Mass Index.*
[3]*SD: Standard deviation.*
[4]*Significative p value: < 0.05*

Table 3. Frequencies of screening diagnosis and association to predictors in interaction

Predictor	Categories	Frequencies (%)				p value
		Normal	*Inattention*	*Hyperactivity*	*Combined*[1]	
Gender	Male	24.3	43.2	8.1	24.3	0.102
	Female	47.4	47.4	0.0	5.3	
BMI[2]	Thinness-Eutrophic	43.3	33.3	6.7	16.7	0.290
	Overweight	30.8	46.2	0.0	23.1	
	Obesity	7.7	69.2	7.7	15.4	
Grade	1st and 2nd	18.2	45.5	9.1	27.3	0.495
	3rd	43.8	37.5	12.5	6.3	
	4th	35.0	50.0	0.0	15.0	
	5th or higher	22.2	44.4	0.0	33.3	
Age[3]	6 to 7	16.6	50.0	16.7	16.7	0.658
	Only 8	35.3	47.1	0.0	17.7	
	9 to 10	36.8	42.1	0.0	21.1	
	> 10	37.5	37.5	12.5	12.5	

[1]*Combined: Inattention with Hyperactivity type (ADHD).*
[2]*BMI: Body Mass Index.*
[3]*Age in years old.*

All frequencies of screening diagnosis and associations with the predictors are presented in Table 3.

DISCUSSION

Among the childhood neurobehavioral disorders, ADHD is directly related to AU and runs through development, especially inattention symptoms, that seem to be more persistent in adulthood. The negative consequences extend to essential areas of human life, as ADHD is a risk factor not only for academic, economic, and social failure, but also for other mental disorders, obesity, committing crimes, drug addiction, and other dependencies[2,3,7]. Considering the current literature, the association between boys and girls in the ADHD diagnosis in school-aged children is well established, with a predominance of males, in a ratio of 3:1 of boys to girls[11-13], as in this research. When evaluated, males had higher ADHD levels in all subtypes[11] and trended to have more often hyperactive-impulsive behaviors, while females trended to have more symptoms of inattention[12,13]. In this research it was also consistent with the literature, as there was a male predominance of ADHD diagnoses in the sample, as well as more hyperactivity-impulsivity in males and more inattention in females. However, there were no statistically significant differences in the prevalence of inattention or hyperactivity, possibly due to the lack of gender homogeneity in the sample, since this was an observational study.

Because obesity and ADHD have many overlapping mechanisms, some studies have indicated a significant association between them[14]. This relation is highly relevant, as impulsivity and inattention contribute to dysfunctional eating patterns, that trend to persist into adulthood if untreated[14,15]. Studies have shown that children with ADHD have higher incidence of overweight and obesity[14-19], as found in this study. Also, due to the higher prevalence of overweight in children with ADHD, especially in boys[14-18], the absence of treatment predisposes to 1.5 more chances of developing adult obesity, while those treated had significantly lower their BMI[14-19]. Although the interaction between ADHD treatment and obesity was not the focus in this study, these findings highlight the importance of early diagnosis and treatment, since without proper clinical management, ADHD affects maintenance of adult obesity.

The inattentive type is the most common ADHD type in the general population, while the hyperactivity is the less common[11,12], as well as observed in this casuistic.

Prospective studies observed that inattention symptoms are intense and constant during the school-aged, and trend to persist throughout life, while hyperactive-impulsive behaviors trend to decrease with age[11,20].

This research found no association between school grades and ADHD, although inattention symptoms remained constant throughout the school years, while hyperactivity was higher at the beginning of school life and decreased over the years, which resembles the development of ADHD as described in literature. In addition, the prevalence of the combined type increases slightly before elementary school, tends to decrease over the years, and increases again at the beginning of middle school[11,20], as presented in this study, with higher prevalence in the extreme school age groups analyzed.

Concerning average age, individuals with only hyperactivity trend to be younger when compared than those with inattentive or combined types[11,20], which was observed in the participants of this study. Besides that, the estimated prevalence of ADHD is higher in population samples aged six to 12 years[8,11], reaching 26% in some studies[11]. Likewise, ADHD symptoms were present in 67.9% of the subjects in this sample, at the same age, which is very different from the literature. Thus, since all children included in this research had AU and it predominates in males, as well as ADHD[4,8], the application of the SNAP-IV questionnaire in this sample selected subjects predisposed to ADHD symptoms, which may have created a selection bias and explain such an overestimated proportion and prevalence.

The SNAP-IV questionnaire is a widely used screening tool for both diagnosis and follow-up of ADHD symptoms[9,10]. This rating scale should be used at different times during the child's life, because of the subjective nature of the answers, which depend on the perceptions of family members and teachers[9,10]. Thus, a limitation of this study was to fill out the SNAP-IV form only once, by only the teacher in charge of the student, when the ideal recommendation requires at least three observers in frequent contact with the student. If well indicated, the use of screening scales helps to achieve an early diagnosis and to conduct an effective management of ADHD. In this research, there was relation between ADHD and obesity, configuring ADHD as a risk factor for excessive weight in school-aged children, that becomes a risk for maintaining obesity in adulthood. Therefore, beyond the family, the pediatrician should be aware to complaints of AU and inattention or hyperactivity symptoms, since adverse outcomes

like obesity can be changed, especially if the timely treatment is offered to children with ADHD.

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