Application of the SNAP-IV's and Conners' Scales for screening of attention deficit-hyperactivity disorder

Marina Fabíola Rodoy Bertol[1], Maíra Yamaguchi[2], Fabiano Sandrini[3], Adriana Chassot Bresolin[4], Marcos Antonio da Silva Cristovam[4]

[1] Pediatric Resident Physician, 3rd grade, University Hospital of Western Paraná, Cascavel City, PR, Brazil.
[2] Undergraduate Medical School at Western Paraná State University, Cascavel City, PR, Brazil.
[3] Ph.D. Assistant Professor of Pediatrics, Medical School at Western Paraná State University, Cascavel City, PR, Brazil.
[4] M.Sc. Assistant Professor of Pediatrics, Medical School at Western Paraná State University, Cascavel City, PR, Brazil.
Institution: Western Paraná State University's University Hospital of Western Paraná, Cascavel City, PR, Brazil.
Corresponding author: Marcos Antonio da Silva Cristovam
Rua João de Matos, 1145, bloco B, ap. 09, Coqueiral, Cascavel, PR, Brazil
ZIP CODE: 85807-530

ABSTRACT:

Objective: this study aimed screening for the diagnosis of Attention Deficit-Hyperactivity Disorder (ADHD) using the SNAP-IV's and Conners' Scales, this Brazilian version of Francisco Rosa Neto, further of comparison between these two scales and children's Body Mass Index.

Method: it was descriptive, exploratory and cross-sectional study conducted by applying the SNAP-IV and Conners Scale questionnaires, filled by teachers and parents of children and adolescents respectively, from 5 to 14 years old, of both gender, evaluated in a university hospital's outpatient clinic of academic underachievement.

Results: 101 questionnaires were filled. 30 (29.7%) were excluded because were lack of any information, hence, the sample was constituted of 71 (70.2%) children, of this, 33 SNAP-IV and 60 Conners' Scale questionnaires were filled, 53 (74.6%) male and 18 (25.4%) female, all referred to the university hospital's outpatient clinic presenting academic underachievement. 17 (51.5%) presented symptoms of ADHD by SNAP-IV scale and 46 (76.6%) by Conners' Scale. In this study there was prevalence of global ADHD in boys and overall 16 (42.1%) students presented overweight or obesity.

Conclusion: There was higher prevalence of global ADHD in male than female and boys presented higher incidence of excessive weight.

KEY-WORDS: hyperactivity, attention deficit, questionnaire, child, adolescents.

I.   INTRODUCTION

Attention Deficit-Hyperactivity Disorder (ADHD) is a disorder characterized by a lack of control of motor activity, impulses, and inattention, his prevalence ranges from 3% to 6% of school-age children, with a higher prevalence in boys, and it is the third most common mental disorder. It grows exponentially in Brazil and in the world and presents multifactorial etiology that encompasses environmental and genetic factors. It manifests itself early in the first years of life, may accompany the individual for his entire life, and manifests three distinct clinical presentations: inattentive type, hyperactive-impulsive type, and mixed type, most often with severe impairment of academic performance[1,2,3].

The symptoms must be present before the age of seven years, occuring in at least two differents environments, and evident problems should be in school, social environment, and/or family life because of the symptoms[4]. The treatment involves multidisciplinary team (psychologist, educational psychologist, psychiatrist, pediatrician, social worker, language therapist and others).

There are several tools for screening ADHD, including the Conners Scale[5], the SNAP-IV questionnaire[6], Vanderbilt Assessment Scales (National Initiative for Children's Healthcare Quality)[7], ADHD-RS-IV[8], K-SADS-

---

PL[9], among others that, in addition to assisting the diagnosis, are also important in monitoring these children and evaluating the response to treatment.

Since the prevalence of ADHD is increasing in school-aged children, this study aimed to apply two screening scales for ADHD in this population, further to evaluate their Body Mass Index (BMI).

II.   METHODS

It was a cross-sectional, descriptive, exploratory study, with children and adolescents of both genders, regularly enrolled in seven public schools in Cascavel City, PR, Brazil, who were referred by them to an outpatient clinic for low academic performance at a University Hospital.

The SNAP-IV (Swanson, Nolan, and Peham)[10] questionnaire consists in analyzing the response to 18 questions about the routine behavior and/or basic/essential activities of the child, which can be answered by parents or guardians of the child or by the child's teachers; in this study, the SNAP-IV questionnaires were filled by teachers. The time spent for completion is approximately 10 minutes. The answers are divided into: "not at all", "just a little", "quite a bit", and "very much". And the questions are divided into two subgroups: 1st through 9th - inattention symptoms; 10th through 18th - hyperactivity and impulsivity symptoms. One score within a subgroup if there are at least 6 items marked as "quite a bit" or "very much".

The Conners Scale, Brazilian version by Francisco Rosa Neto[5], here in after referred to as Rosa Neto, classifies into five diagnostic possibilities: hyperactivity/impulsivity, attention deficit, conduct disorder, hyperactivity with attention deficit, and global ADHD (attention deficit, hyperactivity/impulsivity, conduct disorder). The scale consists of 20 questions and the answers vary from 0 to 3 points, in which the parentes, guardians and/or teachers answer according to the child's conduct in the last six months. The completion time is around 20 minutes and the answers are validated if it is confirmed that a certain symptom or behavior is repeated in two or more environments. In this study, the Rosa Neto questionnaire was filled by the child's parents or guardians.

The following variables were analyzed in this study: age, gender, grade, height, weight, and BMI, which classified the participant as severe thinness, thinness, eutrophy, overweight, obesity, and severe obesity using the references of the World Health Organization (2007) and data from the Scientific Department of Nutrition of the Brazilian Society of Pediatrics[11], besides the score in the SNAP-IV and the Rosa Neto questionnaire.

This research was approved by the Research Ethics Committee from Western Paraná State University, Cascavel City, Paraná, Brazil, document number 2.515.424/2017.

III.   RESULTS

101 medical records of children and adolescents evaluated at the Outpatient Clinic of Academic Underchievement were reviewed, of which 71 (70.2%) were evaluated for suspected or confirmed diagnosis of ADHD. The medical records were answered between March 2017 and December 2020. Age ranged from 5 to 14 years (mean age of 8.7 years). The gender split showed higher prevalence in boys, with 53 (74.6%) and 18 (25.4%) girls, respectively. There were 33 filled SNAP-IV questionnaires and 60 completed Conners Scale - Francisco Rosa Neto questionnaires. Among the girls, nine (50%) SNAP-IV´s Scale were filled by teachers and 15 (83.3%) the Rosa Neto were completed by parents, and among the boys, 24 (45.3%) answered the SNAP-IV and 45 (84.9%) the Rosa Neto's questionnaire.

Concerning the evaluation of the SNAP-IV questionnaire among both genders, 11 (33.3%) scored for inattention, one (3%) for hyperactivity, five (15.2%) for combined inattention and hyperactivity, and 16 (48.5%) had a normal evaluation. When discriminated by gender, nine girls who were assessed with the SNAP-IV: four (44.4%) scored for inattention, none for hyperactivity, one (11.1%) for inattention and hyperactivity combined, and four (44.4%) were normal. Among the 24 boys: seven (29.2%) scored for inattention, one (4.2%) for hyperactivity, four (16.7%) for combined inattention and hyperactivity, and 12 (50%) were normal, as illustrated in table 1.

Table 1 - Results found when applying the SNAP-IV questionnaire

	Female		Male		Total	
	(n)	**%**	**(n)**	**%**	**(n)**	**%**
Inattention	4	44.4%	7	29.2%	11	33.3%
Hyperactivity	0	0.0%	1	4.2%	1	3%
Both	1	11.1%	4	16.7%	5	15.2%
Normal	4	44.4%	12	50%	16	48.5%
Total	9	100%	24	100%	33	100%

The Conners' Scale - Francisco Rosa Neto evaluated 45 boys: two (4.4%) with isolated attention deficit disorder; two (4.4%) with conduct disorder; one (2.2%) with hyperactivity/impulsivity and attention deficit disorder; 29 (64.4%) scored for global ADHD, and 11 (24.4%) had no score suggestive of any diagnosis. In the group of girls, there were fewer subdivisions scored. Of the 15 female students: three (20%) scored for hyperactivity/impulsivity and attention deficit hyperactivity; nine (60%) scored for global ADHD, and three (20%) had no score suggestive of some diagnosis, as shown in table 2.

**Table 2** - Results found in the application of the Conners Scale - Rosa Neto's Brazilian version

	Female		Male		Total	
	(n)	**%**	**(n)**	**%**	**(n)**	**%**
Hyperactivity/impulsivity	0	0.0%	0	0.0%	0	0.0%
Attention Deficit Disorder	0	0.0%	2	4.4%	2	3.3%
Conduct disorder	0	0.0%	2	4.4%	2	3.3%
Hyperactivity/impulsivity + Attention deficit	3	20%	1	2.2%	4	6.7%
Global ADHD	9	60%	29	64.4%	38	63.3%
None score	3	20%	11	24.4%	14	23.3%
Total	15	100%	45	100%	60	100%

When relating the samples of children with global ADHD and BMI, 22 (57.9%) children were eutrophic, 10 (26.3%) were overweight, two (5.3%) were obese, and four (10.5%) were severely obese. When dividing between girls and boys, the proportion was distributed as follows: six (66.7%) eutrophic girls, two (22.2%) overweight, and one (11.1%) obese; 16 (55.2%) eutrophic boys, eight (27.6%) overweight, one (3.4%) obese, and four (13.8%) severely obese, as described in table 3.

Table 3 - Correlation between global ADHD and BMI

	Female		Male		Total	
	(n)	**%**	**(n)**	**%**	**(n)**	**%**
Severe thinness	0	0.0%	0	0.0%	0	0.0%
Thinness	0	0.0%	0	0.0%	0	0.0%
Eutrophic	6	66.7%	16	55.2%	22	57.9%
Overweight	2	22.2%	8	27.6%	10	26.3%
Obesity	1	11.1%	1	3.4%	2	5.3%
Severe obesity	0	0.0%	4	13.8%	4	10.5%
Total	9	100%	29	100%	38	100%

The graphic 1 illustrates the relationship between global ADHD, gender and BMI.
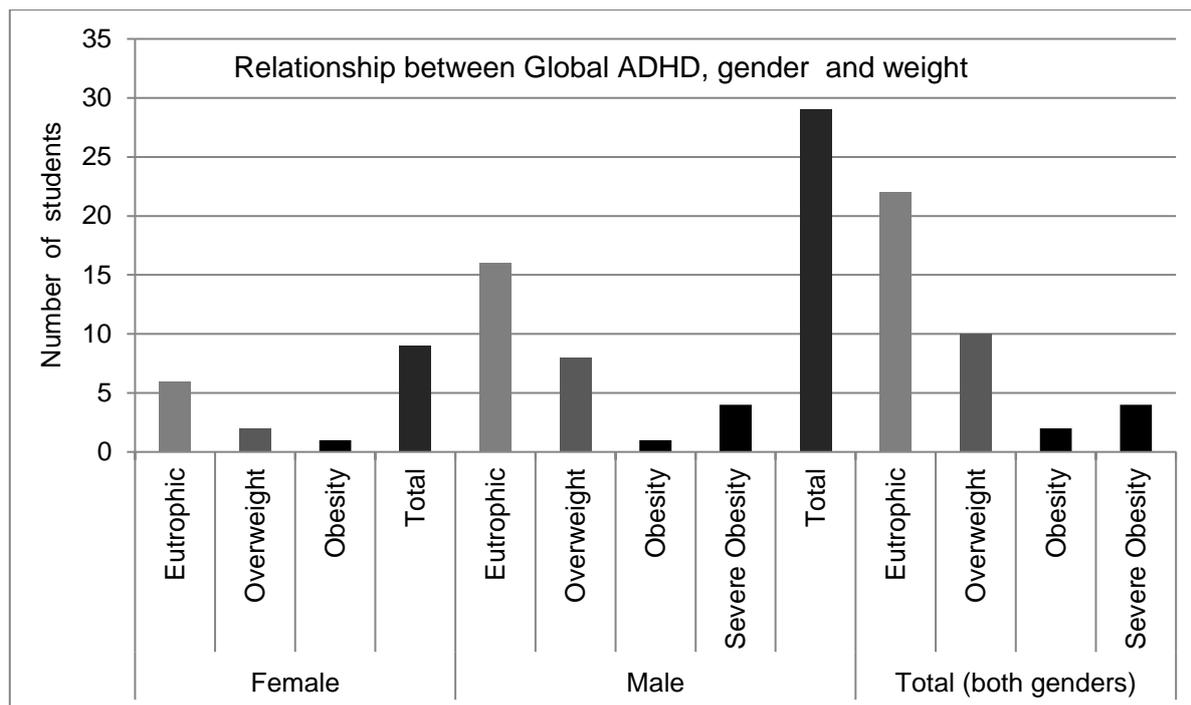
Graphic 1: relationship between Global ADHD, gender and BMI.

IV.   DISCUSSION

The Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-V) sub-classifies ADHD into several types and different levels of presentation. The SNAP-IV questionnaire, validated in Brazil, helps to characterize the diagnosis, but it is based on clinical history, observation of the patient in more than one environment, and physical and neurological examination of the child or adolescent[12].

The Conners Scale aims to demonstrate the consistency of its items and is characterized by easy application and interpretation. It is one of the most widespread instruments, although there are other scales with the same objective. In this study, the Conners Scale was more complete and more accurate in the evaluation of symptoms of both hyperactivity/impulsivity and inattention, as well as jointly.

In this research it was noted that the assessment of the SNAP-IV questionnaire was more sensitive for inattention symptoms, which showed a higher percentage in girls, which corroborates other studies[13]. In girls also noticed more internalizing symptoms such as anxiety and depression which can lead to alternative diagnoses. In this study, as in the literature, boys showed more hyperactivity symptoms. Boys with ADHD are often characterized by having more hyperactivity/impulsivity and associated behavioral variations such as oppositional defiant disorder and conduct disorder[14]. This study reflected these common gender characteristics since the data showed that boys are referred for evaluation more often than girls because they manifest more symptoms of hyperactivity, which impair the learning environment; moreover, inattention in girls is seen as less of a problem than in boys, and this causes girls to seek less care and are less referred for evaluation, often delaying diagnosis.

Nazar *et al* in a systematic review and meta-analysis study demonstrated that people with ADHD have a higher risk of developing an eating disorder as well as associated comorbidities, as patients with ADHD associated with an eating disorder have more impulsive traits compared to those with these conditions alone[15]. Reinblatt *et al* reported that children with ADHD have significantly higher odds of developing binge eating disorder than children without ADHD and that children with the eating disorder have less control of impulsivity than those without[16]. The present study showed a high percentage of children with ADHD symptoms who were overweight.

V.   CONCLUSION

This study is in line with the literature consulted that there is a greater predominance of ADHD in boys than in girls. It also suggests that there is a relationship between impulsivity in children with ADHD and obesity.

REFERENCES

[1]. Chang L, Wang M, Tsai P. Diagnostic Accuracy of Rating Scales for Attention-Defi cit/Hyperactivity Disorder: A Meta-analysis. *Pediatrics*. 2016; 137(3):e20152749 https://doi.org/10.1542/peds.2015-2749.

[2]. Polanczyk GV, Salum GA, Sugaya LS, Caye A, Rohde LA. Annual research review: A meta-analysis of the worldwide prevalence of mental disorders in children and adolescents. *Journal of child psychology and psychiatry, and allied disciplines*. 2015; 56(3):345-65. doi: 10.1111/jcpp.12381. Epub 2015 Feb 3. PMID: 25649325.

[3]. Sayal, K., Prasad, V., Daley, D., Ford, T., & Coghill, D. ADHD in children and young people: prevalence, care pathways, and service provision. *The Lancet Psychiatry*. 2018; 5(2), 175–186. doi:10.1016/s2215-0366(17)30167.

[4]. Boarati, M.A.; Lima, S.M.; Dreyer, M.R.M.; Pereira, V.R.S.P.. Intervenção Multidisciplinar em Crianças e Adolescentes com Déficit de Atenção e Hiperatividade, Transtornos Motores e Transtornos da Comunicação e de Aprendizagem. *In*: Boarati, M. A.; Pantano, T.; Scivoletto, S. Psiquiatria da Infância e Adolescência. Cuidado Multidisciplinar. Barueri, SP: Manole, 2016. p. 293-349.

[5]. Areces, D., Rodríguez, C., García, T., & Cueli, M. Is an ADHD Observation-Scale Based on DSM Criteria Able to Predict Performance in a Virtual Reality Continuous Performance Test? *Applied Sciences*. 2020; *10*(7):2409. doi :10.3390/app10072409.

[6]. Hall, C. L., Guo, B., Valentine, A. Z., Groom, M. J., Daley, D., Sayal, K., & Hollis, C. The Validity of the SNAP-IV in Children Displaying ADHD Symptoms. *Assessment*. 2020; *27*(6):1258–1271. https://doi.org/10.1177/1073191119842255.

[7]. Peppers, K. H., Eisbach, S., Atkins, S., Poole, J. M., & Derouin, A. An Intervention to Promote Sleep and Reduce ADHD Symptoms. *Journal of pediatric health care : official publication of National Association of Pediatric Nurse Associates & Practitioners*. 2016; *30*(6):e43–e48. https://doi.org/10.1016/j.pedhc.2016.07.008.

[8]. Navarro Soria, I., Fenollar, J., Carbonell, J y Real Fernández, MMemoria de trabajo y velocidad de procesamiento evaluado mediante WISC-IV como claves en la evaluación del TDAH. *Revista de Psicología Clínica con Niños y Adolescentes*. 2020; 7 (1):23-29. doi: 10.21134/rpcna.2020.07.1.3.

[9]. Costa DS, de Paula JJ, Malloy-Diniz LF, Romano-Silva MA, Miranda DM. Parent SNAP-IV rating of attention--deficit/hyperactivity disorder: accuracy in a clinical sample of ADHD, validity, and reliability in a Brazilian sample. *Jornal de Pediatria.* 2019; 95:736-43. https://doi.org/10.1016/j.jped.2018.06.014.

[10]. Wagner, D. J., & McLennan, J. D. An Alternative Approach to Scoring the MTA-SNAP-IV to Guide Attention-Deficit/Hyperactivity Disorder Medication Treatment Titration towards Symptom Remission: A Preliminary Consideration. *Journal of child and adolescent psychopharmacology*. 2015; *25*(10):749–753. https://doi.org/10.1089/cap.2015.0081.

[11]. Weffort, V.R.S.; Oliveira, F. L. C.; Escrivão, M. A. M. S. Diagnóstico. *In*: Weffort, V.R.S. Obesidade na infância e adolescência – Manual de Orientação/ Sociedade Brasileira de Pediatria. Departamento Científico de Nutrologia. 3ª. Ed. – São Paulo: SBP. 2019; p. 30-38.

[12]. Andrade P.F.S.M, Vasconcelos M.M. Transtorno do déficit de atenção com hiperatividade. *Residência Pediátrica*. 2018; 8(Supl.1): 64-71 doi: 10.25060/residpediatr-2018.v8s1-11.

[13]. Chang, T. M., Yang, R. C., Chiang, C. T., Ouyang, C. S., Wu, R. C., Yu, S., & Lin, L. C. Delay Maturation in Occipital Lobe in Girls With Inattention Subtype of Attention-Deficit Hyperactivity Disorder. *Clinical EEG and neuroscience*. 2020; 51(5), 325–330. https://doi.org/10.1177/1550059419899328.

[14]. Mowlem, F., Agnew-Blais, J., Taylor, E., & Asherson, P. Do different factors influence whether girls versus boys meet ADHD diagnostic criteria? Sex differences among children with high ADHD symptoms. *Psychiatry research*. 2019; 272, 765–773. https://doi.org/10.1016/j.psychres.2018.12.128 .

[15]. Nazar, B. P., Bernardes, C., Peachey, G., Sergeant, J., Mattos, P., & Treasure, J. The risk of eating disorders comorbid with attention-deficit/hyperactivity disorder: A systematic review and meta-analysis. *The International journal of eating disorders*. 2016; *49*(12):1045–1057. https://doi.org/10.1002/eat.22643.

[16]. Reinblatt, S. P., Mahone, E. M., Tanofsky-Kraff, M., Lee-Winn, A. E., Yenokyan, G., Leoutsakos, J. M., Moran, T. H., Guarda, A. S., & Riddle, M. A. Pediatric loss of control eating syndrome: Association with attention-deficit/hyperactivity disorder and impulsivity. *The International journal of eating disorders*. 2015; *48*(6):580–588. https://doi.org/10.1002/eat.22404.