

## SLEEP HABITS IN CHILDREN AFFECTED BY AUTISM SPECTRUM DISORDERS: A PRELIMINARY CASE-CONTROL STUDY

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### ABSTRACT

**Introduction:** The core of autism spectrum disorders (ASD) consists of alterations of neurological functions that affect the typical developmental trajectory leading to deficits in social interaction and non-verbal behaviors. In general, ASD is diagnosed at age three and many other frequent neurological signs may be present, such as sleep disorders.

The aim of study is evaluating sleep habits in a sample of ASD children.

**Material and methods:** The study population consists of 65 ASD children (43 males and 22 females), aged between 2 and 11 years (mean  $5.73 \pm 2.39$  years). The control group consists of 114 children with typical development (68 males and 46 females), aged between 3 and 10 years (mean  $5.91 \pm 2.23$  years).

The diagnosis of ASD was confirmed by the evaluation ADOS -2, while the evaluation of sleep habits with the SDSC tests.

**Results:** The two groups were matched for age ( $p = 0.633$ ) and sex distribution ( $p = 0.483$ ).

The ASD subjects show a significantly higher rate of sleep disorders in all categories explored by SDSC tests (Table 1).

**Discussion:** The sleep of people with ASD is compromised at any age and regardless of the severity of social impairment and communication, but not the level of development.

Still, ASD is a very important risk factor for the development of sleep disorders, although the report could also be interpreted in the opposite manner.

**Keywords:** Autism Spectrum Disorders, sleep problems, DIMS, SDSC.

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### Introduction

The core of autism spectrum disorders (ASD) consist in alterations among neurological functions impacting typical developmental trajectory with consequent deficits in social interaction and non-verbal behaviors. Generally, ASD is diagnosed at the age of three years and many frequent other neu-

rological signs may be present such as sleep troubles<sup>(1-6)</sup>.

The more common sleep problems identified in ASD children include delayed sleep onset, night wakings after sleep onset, early morning wakings, decreased total sleep time, bedtime resistance, and sleep-onset association problems (eg, sleeping with a parent, sleeping in places other than the child's

own bed, and requiring idiosyncratic objects to initiate sleep onset). In general, sleep disturbances can interfere with cognition, attention, memory consolidation, and daytime behavioral adjustment in general. Therefore, in ASD children, sleep troubles may amplify already delayed social interactions, repetitive behaviors, affective problems, and inattention/hyperactivity<sup>(7-12)</sup>.

The aim of the present study is evaluating the sleep habits in a sample of ASD children.

## Material and methods

### Population

65 children (43 males and 22 females) affected by ASD according to the DSM-5 criteria, aged 2 to 11 years (mean age  $5.73 \pm 2.39$ ) were recruited.

The diagnosis of ASD according to the Diagnostic and Statistical Manual of Mental Disorders 5th ed. (DSM-5) criteria was confirmed by an Autism Diagnostic Observation Schedule-2 (ADOS-2) assessment considered the gold-standard assessments. The average score at the ADOS scale in ASD children was 12.24 (SD  $\pm 3.29$ ).

Exclusion criteria were the following: overweight ( $z\text{-BMI} > 85$  pc) and obesity ( $z\text{-BMI} > 95$  pc), cognitive disability (IQ  $< 70$ ), neurological disorders (ie headaches, epilepsy), chromosomal syndromes (eg. Down, Prader-Willi, Crouzon, Pierre-Robin, trisomy 18), psychiatric illness (ie. mood disorders, anxiety disorders, psychosis) and specific neuropsychological disorders.

The control group consists of 114 typically developing children (68 males and 46 females), aged between 3 and 10 years (mean age  $5.91 \pm 2.23$ ). Children of both groups are all Caucasians, and were recruited in the same urban area and similar for socio-economic status.

All parents have signed a specific informed consent prior psychological assessment and dissemination of results to scientific purposes.

The clinical study was conducted according to the principles of the Declaration of Helsinki.

### Autism Diagnostic Observation Schedule (ADOS -2)

The ADOS is a semi-structured standardized observational assessment in which a clinician rates a participant's communication, reciprocal social behavior, and repetitive behaviors and stereotyped interest patterns. The ADOS consists of five modules and selection of the appropriate module is

based on an individual's chronological age and expressive language level. Module 4 emphasizes interview questions and conversations and is appropriate for use with verbally fluent older adolescents and adults who possess at least a minor level of independence in terms of relationships and goals. Inter-rater reliability for the ADOS algorithm ranged from 83 to 100 % for exact agreement, with  $\kappa$  ranging from .41 to .84<sup>(1-6)</sup>.

### Sleep Disturbance Scale for Children (SDSC)

To evaluate sleep habits and disturbances, all of the subjects' mothers filled out the Sleep Disturbances Scale for Children (SDSC), 30 a standardized questionnaire for the assessment of sleep problems during development, consisting of 26 items grouped into six subscales: Disorders in Initiating and Maintaining Sleep (DIMS), Sleep Breathing Disorders (SBD), Disorders of Arousal (DA), Sleep-Wake Transition Disorders (SWTD), Disorders Of Excessive Somnolence (DOES), and Nocturnal Hyperhidrosis (SHY). Both the original or modified versions of this measure are widely used in school-aged children. According to the SDSC validation criteria,<sup>30</sup> scores  $\geq 71$  for the SDSC total score,  $\geq 17$  for DIMS,  $\geq 7$  for SBD,  $\geq 6$  for DA,  $\geq 14$  for SWTD,  $\geq 13$  for DOES, and  $\geq 7$  for SHY<sup>(39)</sup>.

### Statistic analysis

Chi-square and t-test were performed when appropriated, in order to compare the two population (ASD and typical developing children) for age, gender, sleep habits assessment.

Moreover, the logistic regression analysis (OR) was performed to evaluate the putative inter-relationship between ASD and sleep troubles. P values  $\leq 0.05$  were considered as statistical significant.

## Results

The two groups are comparable for age ( $p = 0.633$ ) and sex distribution ( $p = 0.483$ ).

The ASD subjects show a significantly higher rate of sleep disorders in all categories explored by SDSC tests (Table 1).

## Discussion

ASD is a neurodevelopmental disorder and can present with varying severity. During developmental age, sleep problems in ASD subjects may

ranging to about 80% versus the 25% in general pediatric population. Particularly, insomnia tends to range between 40-80% of ASD subjects.

	ASD (n = 65) (%)	Controlli (n = 114) (%)	OR	95% IC	Z	p
DIMS	30.77	2.63	16.44	4.655 - 58.088	4.349	0.0001
DRS	53.85	10.53	9.92	4.583 - 21.455	5.827	0.0001
DA	36.92	8.77	6.09	2.677 - 13.843	4.31	0.0001
DTVS	49.23	10.53	8.24	3.813- 17.817	5.363	0.0001
DES	29.23	7.89	4.82	2.027- 11.45	3.561	0.0004
IPN	23.08	4.39	6.54	2.252 - 18.991	3.453	0.0006
TOT	18.46	3.51	4.82	1.916- 20.224	3.043	0.0023

**Table 1:** shows comparison between children affected by autism spectrum disorders (ASD) and typical developing ones among Sleep Disturbance Scale for Children (SDSC) scales: Disorders in Initiating and Maintaining Sleep (DIMS); Sleep Breathing Disorders (SBD); Disorders of Arousal (DA); Sleep-Wake Transition Disorders (SWTD); Disorders Of Excessive Somnolence (DOES); Nocturnal Hyperhidrosis (SHY).

For comparison between the two groups (ASD and controls) t- Test was applied.

Logistic regression analysis was performed in order to calculate odd ratio (OR) and interval of confidence (IC). P values < 0.05 were considered statistically significant.

Among ASD children sleep problems are multifactorial, with genetic, environmental, immunological, and neurological factors such as melatonin rhythms impairment with alterations in this synchronization of the melatonin rhythm causing sleep problems<sup>(40-45)</sup>. Moreover, other neurotransmitters such as serotonin, and GABA are required for establishing a regular sleep wake cycle.

In autism, GABAergic interneurons migration and maturation may be affected. A region of genetic susceptibility has been identified on chromosome 15q that contains GABA-related genes. ASD represents a complex disease and articulated in several respects. Besides the core symptoms, in fact, there are many other complications that the clinician, therapist and parents are forced to face. The neurodegenerative disorders are, among these, the key for feeding difficulties notes, to pain and sensory perception. In this plight, an impairment in role of the orexin system regulation on the hypothalamus-pituitary-thyroid axis in ASD subjects may not be excluded<sup>(40-45)</sup>.

The sleep of people with ASD is compromised at any age and independently of the severity of impaired social and communicative sphere, but not the level of development (excluded in our study)<sup>(46-50)</sup>.

What emerges from the results of our survey shows that ASD is a very significant risk factor for developing sleep disorders, although the report could also be interpreted in the opposite manner: that have a disturbed sleep can be an aggravating factor in the nuclear symptoms ASD subjects, although further studies are needed in this respect

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