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# SLEEP AND EATING DISORDERS - EARLY SIGNS IN AUTISTIC SPECTRUM DISORDERS

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## ABSTRACT

In this paper, based on a descriptive study, eating and sleep disorders in children aged 0-1 years are investigated to determine whether they may be early signs of autism spectrum disorder (ASD). Sleep disturbances and eating disorders are commonly found in the population diagnosed with ASD, can negatively influence the progression and prognosis of these children and their presence has to be investigated from children's first years of life in order to be able to integrate them into both screening programs for early diagnosis and in the intervention plans addressed to this category of patients. The analysis of collected data shows the presence of sleeping and eating problems from the first year of life in children with ASD in the studied group. Eating disorders were present in all children enrolled in the study. A percentage of 63% of participants experienced sleep problems during the period 0 to 12 months. Although the degree of severity is an easy-moderated one, the fact that sleep and eating problems are present at this stage of development may be an early sign of alarm for ASD. The results suggest that atypical manifestations related to sleeping and eating behaviors in the first year of life in children with autistic spectrum disorder are similar to those encountered in different age categories described in the literature, despite the difficulty of identifying them in the child under 12 months of age. In conclusion, the study confirms the need to investigate this lifetime of children with ASD and the importance of including atypical sleeping and eating manifestations in the screening of early signs of autistic spectrum disorders.

**Keywords:** autism spectrum disorder, sleep disorders, eating disorders, children, early signs, atypical manifestations.

## INTRODUCTION

Autism Spectrum Disorders (ASD) are neurodevelopment disorders, usually diagnosed in childhood, which have implications throughout the individual's life. The number of people diagnosed with this disorder is steadily increasing, and the prevalence of autism spectrum disorders is currently estimated at around 1% of the population [1]. Many of these patients need social care services and require long-term therapeutic interventions that involve hard-to-cover costs.

Barbaro and Dissanayake have argued since 2009 [2] the need for early diagnosis

and the introduction of children with ASD into a personalized intervention program that can maximize their development potential by facilitating their social integration and independence. The faster the onset of intervention, the better the prognosis of these children and the quality of family life is improving [3]. Clinical experience and studies investigating parental concern about child development show that early signs of ASD appear in the first few months from birth, which justifies the effort to investigate children's behavioral manifestations in their first year of life [4].

Many of the children diagnosed with ASD have other associated medical conditions and atypical behavioral manifestations, including sleep and eating disorders. In the first year of life, changes in the child's sleep and feeding behavior may be signs of atypical development. In the neonatal and postnatal period, sleeping serves as a method of measuring cognitive integrity. Gertner et al., in a study published in 2002, shows that sleep patterns in prematurely or on time born children predict subsequent cognitive development [5].

Sleep disturbances occur in approximately 80% of children with ASD [6]. Studies investigating sleep behavior have so far been performed on populations of children with ASD aged over 2 years. The most extensive study investigating sleep patterns in young children with ASD is the one conducted by Krakowiak et al. in 2008 [7]. The review by Cohen and colleagues in 2014 highlights the relationship between atypical sleep behavior and ASD, but also the influence this behavior has on the severity of the basic symptoms [8].

Problems in the diet of children with ASD are much more common than those of typical children. It is estimated that more than 50% of children with ASD have eating disorders [9]. Moreover, as Dominick and colleagues in the paper published in 2007 [10], children with ASD often exhibit more specific behaviors such as food selectivity and food refusal than children with other developmental disorders. In the same paper, Dominick and colleagues conclude that the age of occurrence of food problems in children with ASD is within the range of 0 to 12 months. In 2013, Olsson and colleagues published a paper in which they investigated the link between food problems that occurred in the first two years of life and the diagnosis of ASD received by the respective children [11]. Their results show that children diagnosed with ASD at the age of 3 years had more medical consultations

made by a nutritionist in their medical history.

However, there are few studies in the literature that investigate sleep and food behavior in the first year of life of children with ASD. In a review published in 2018, Seiverling explains the need to obtain detailed nutrition information in the first years of life of children diagnosed with ASD, noting that most of the studies conducted so far have been aimed at research into eating behavior in children with ASD aged over 3 years [12]. It is necessary to determine whether eating disorders can be included in the general picture of early symptoms of ASD and may be early signs of this disorder.

### **Objectives**

This paper has several objectives:

1. Investigating the presence of sleep disorders in the first year of life in children diagnosed with ASD.
2. Investigating the presence of eating disorders in the first year of life in children diagnosed with ASD.
3. Assessing the degree of severity of sleep and eating disorders in the first year of life in children with ASD.
4. Illustration of atypical manifestations of sleep behavior in the first year of life in children with ASD.
5. Description of the specific nutritional problems present in the first year of life in children with ASD by stages of age: 0 - 4 months, 4 - 6 months, 6 - 9 months and 9 - 12 months.

### **METHODS**

The present paper was designed on the basis of a descriptive study carried out between 1 January 2018 and 1 August 2018 in the Clinic of Child and Adolescent Psychiatry at the Clinical Psychiatric Hospital „Prof. Dr. Alexandru Obregia“. During this time, the data was collected through parental questionnaires that will be presented below.

The criteria for inclusion in the study were the diagnosis of ASD in accordance with the DSM 5 criteria and the age of patients for at least 2 years. The group of patients consisted of 56 children aged between 2 and 17 years. From this batch, 4 children did not meet the criterion for the diagnosis of ASD according to DSM 5 and were excluded. The final lot consisted of 52 children diagnosed with ASD.

The following questionnaires were used to collect the data:

### 1. Children's Sleep Habits Questionnaire (Infant Version)

The CSHQ-I questionnaire, designed to investigate sleep behavior in children under 12 months, is an adaptation made by Dias, Figueiredo and Pinto in 2017 after the CSHQ retrospective questionnaire [13]. The CSHQ-I questionnaire consists of 33 items scaled on a 4-point Likert scale (often, sometimes, rarely, not applicable) and distributed in 4 subscales:

- Subcategory Sleep Resistance composed of items 2, 3, 5, 7, 9, 10, 13, 14, 17, 24, 25, 31.
- Sleep Related Anxiety Subscale composed of items 11, 12, 16, 19, 20, 21, 22, 23, 27, 33.
- Positive Sleep habits include items 1, 6, 8, 15, 26, 32.
- Daytime somnolence subset includes items 4, 18, 28, 29, 30.

10 items (1, 2, 3, 6, 8, 14, 15, 25, 26, 32) are counted in reverse order to produce a Total Representative Score for sleep problems and to avoid desirable responses. A 33-point limit score was set to differentiate between children with ASD and associated sleep disorders and those who did not experience sleep problems.

### 2. The Infant and Child Feeding Questionnaire (ICFQ)

This questionnaire was developed in 2016 by a multidisciplinary team of specialists from the POPSICLE Medical Council to facilitate the detection of eating problems present in typical children from the first months of life. Although the questionnaire is not yet validated, the study published by Barkmeier-Kraemer and collaborators in 2017 shows that ICFQ can differentiate children with eating disorders from those without these disorders in a population aged between 0-36 months [14]. The ICFQ questionnaire consists of 4 sections by stages of age: 0 - 4 months, 4-6 months, 6-9 months, and 9-12 months. Each section is composed of closed questions with dichotomous answers. In order to assess the severity degree of eating problems by age group, the following ranges were established:

The two mentioned questionnaires were included in the 3-section form addressed to parents. Other general information about the subjects was collected through the questions in the first section of the form.

## RESULTS

### Overall characteristics of the participants

The study group consisted of 52 children diagnosed with ASD aged between 2 and 18 years. The number of participants in each age category is shown in Table no. 2

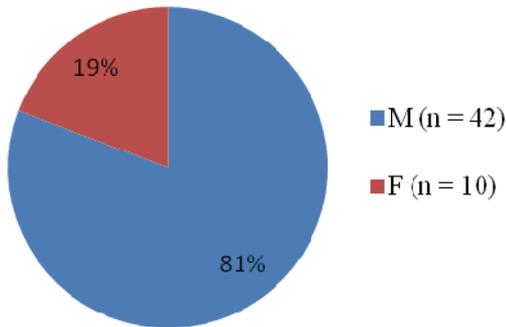
Of the 52 participants, 42 are boys and 10 girls (Figure No. 1). Regarding the rank at birth, 44 children are of rank 1 and 8 children of rank 2 (Figure No. 2). None of the participants have brothers diagnosed with ASD.

Table 1 - Severity degree (No. of positive answers)

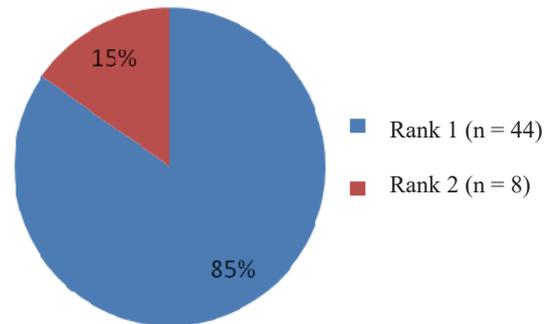
Age category	mild	moderate	severe
0 - 4 months	≤10	11 - 22	≥23
4 - 6 months	≤12	13 - 24	≥24
6 - 9 months	≤12	13 - 26	≥27
9 - 12 months	≤13	14 - 25	≥26

**Table 2. The distribution of participants by age**

Age (years)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Participants (n = 52)	12	9	9	5	5	5	0	0	1	2	1	0	0	1	1	1



**Figure 1 - The distribution of participants by sex**



**Figure 2 - The distribution of participants by rank of birth**

The data on the pregnancy and child-birth period collected in the general information section of the form are shown in Figure no. 3. Of the total number of people who completed the questionnaires, one third said they had a problematic pregnancy. 7% of the mothers gave birth prematurely and 11% had birth complications requiring special interventions for mother and / or child. Most mothers gave birth by caesarean section.

Among the investigated participants, 42 children have a diagnosis of ASD, 6 children are diagnosed with ASD and ADHD and 4 children have ASD diagnoses associated with other disorders: intellectual disability, epilepsy, language disorder and muscular dystrophy (Figure no. 4).

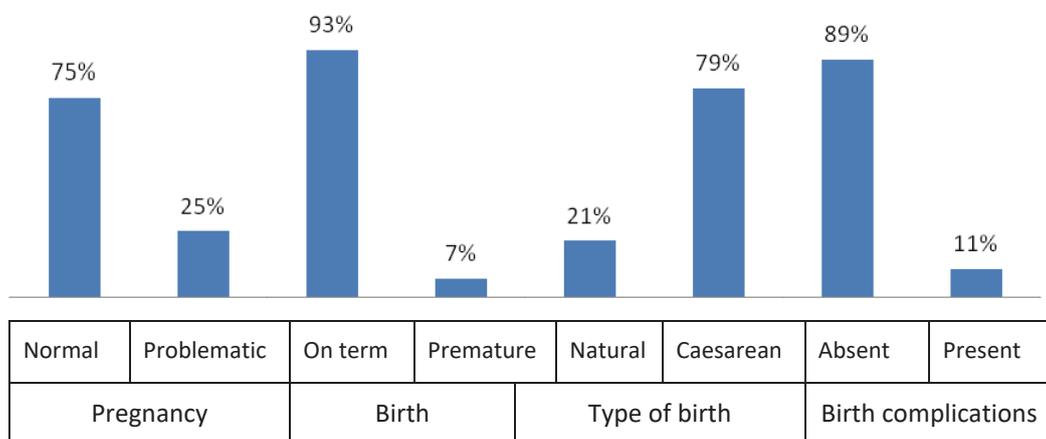
*Results and interpretations*

*Results - Sleep questionnaire CSHQ-I*

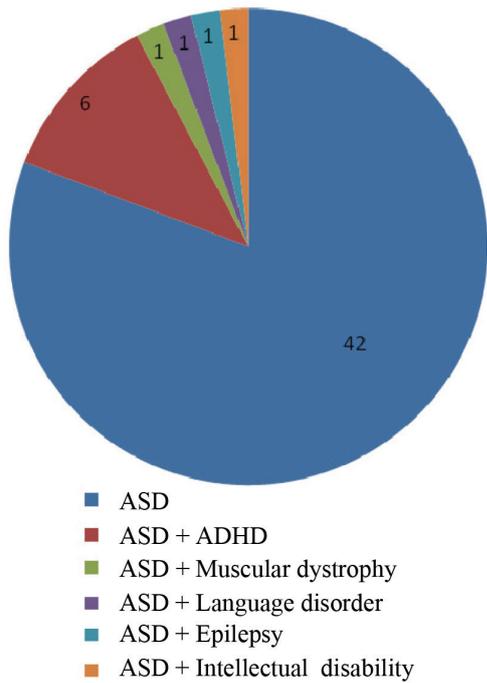
After completing the questionnaire designed to investigate first-year sleep problems in children diagnosed with ASD, the following information was obtained.

A total of 33 participants scored above the 33-point score. This means that 63% of the children with ASD investigated had sleep problems in their first year of life, while 37% (19 participants), did not show inappropriate sleep behaviors. The average score was 37. The median score range was 36 and the standard deviation of the total score was 12.69.

Given that the score range of the CSHQ-I questionnaire is between 0 and 99 and the maximum score of participants was 62,



**Figure 3 - Pregnancy and birth information**



**Figure 4 – The distribution of participants by diagnostic categories**

with an average score of 37, we can say that sleep problems occurring between 0 and 12 months for children with ASD were mild and moderate.

Although 19 participants scored below the score of 33, 14 of them had scores close to this value.

Children with ASD and ADHD had higher total scores. The average score obtained in the CSHQ-I questionnaire by children diagnosed with ASD associated with ADHD was 45, while 37 was the average score obtained by those with ASD (Figure no. 6).

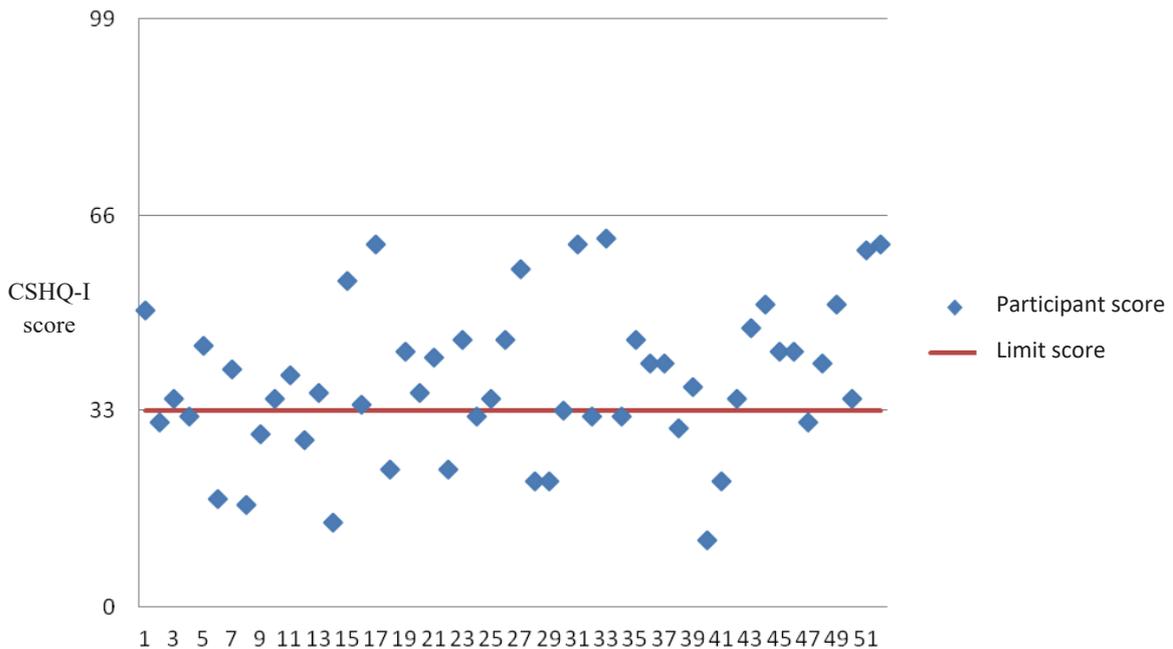
The participant with ASD and Intellectual disability obtained a score of 47 points and the one with ASD and muscular dystrophy scored 44 points.

The other two participants with associated disorders had scores below the limit score, respectively 21 points the one with ASD and epilepsy disorder, and 17 points the one with ASD and associated language disorder.

Regarding the analysis of sleep behavior data, on the 4 subscales of the questionnaire, the results are presented in Table no. 3.

All 33 participants with sleep problems present in the first year of life achieved high scores on the Sleep resistance subscale.

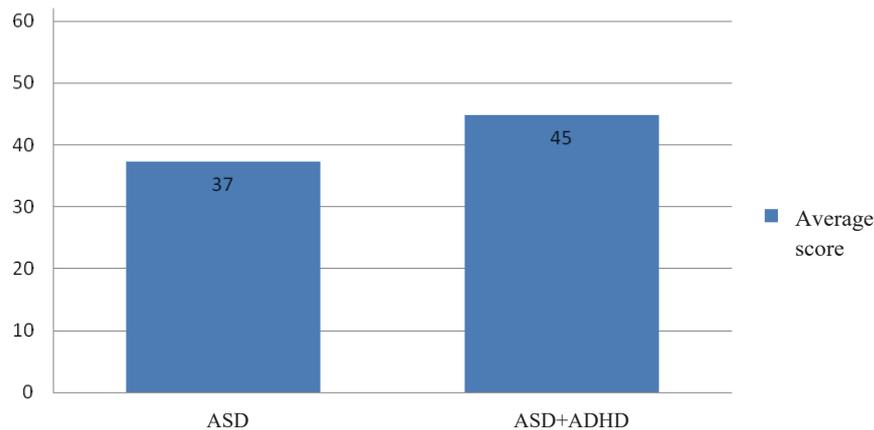
Out of the 52 children with ASD, 38 had high scores on this scale. This means that about 70% of the children surveyed had problems in initiating and maintaining sleep in their first year of life, regardless of the total



**Figure 5 – The distribution of the scores obtained in the CSHQ-I questionnaire around the limit score**

**Table 3 - Descriptive Statistics of the CSHQ-I Sleep Questionnaire**

	Rarely		Sometimes		Often		Not applicable	
	n	(%)	n	(%)	n	(%)	n	(%)
<i>Sleep resistance</i>		19,4%		17,1%		36,4%		28,4%
Item 2 - fell asleep in the first 20 minutes	9	17,3%	17	32,7%	21	40,4%	5	9,6%
Item 3 - fell asleep alone in his bed	7	13,5%	7	13,5%	15	28,8%	31	59,6%
Item 5 - needed rhythmic movements to fall asleep	4	7,7%	6	11,5%	31	59,6%	11	21,2%
Item 7 - the presence of a parent was necessary	2	3,8%	3	5,8%	44	84,6%	3	5,8%
Item 9 - was resistant to falling asleep	17	32,7%	15	28,8%	11	21,2%	9	17,3%
Item 10 - tantrum/crying at bedtime	16	30,8%	8	15,4%	8	15,4%	20	38,5%
Item 13 - slept very little	17	32,7%	5	9,6%	6	11,5%	24	46,2%
Item 14 - was sleeping enough	5	9,6%	7	13,5%	39	75,0%	1	1,9%
Item 17 - was moved to the parents' bed overnight	2	3,8%	7	13,5%	8	15,4%	35	67,3%
Item 24 - woke up more than once a night	17	32,7%	9	17,3%	18	34,6%	8	15,4%
Item 25 - fell asleep without help	14	26,9%	10	19,2%	16	30,8%	12	23,1%
Item 31 - woke up very early in the morning	11	21,2%	13	25,0%	10	19,2%	18	34,6%
<i>Sleep anxiety</i>		17,9%		14,8%		13,1%		54,2%
Item 11 - was afraid of the darkness	7	13,5%	3	5,8%	8	15,4%	34	65,4%
Item 12 - was afraid to sleep alone	7	13,5%	7	13,5%	15	28,8%	23	44,2%
Item 16 - was anxious, moved a lot in his/her sleep	14	26,9%	14	26,9%	12	23,1%	12	23,1%
Item 19 - snored with a lot of noise	7	13,5%	6	11,5%	6	11,5%	33	63,5%
Item 20 - stopped breathing in his sleep	2	3,8%	2	3,8%	4	7,7%	44	84,6%
Item 21 - had trouble sleeping outside the home	4	7,7%	11	21,2%	8	15,4%	29	55,8%
Item 22 - woke up at night crying and/or screaming	8	15,4%	7	13,5%	4	7,7%	33	63,5%
Item 23 - was scared by a nightmare	9	17,3%	6	11,5%	4	7,7%	33	63,5%
Item 27 - woke up in a bad mood	18	34,6%	7	13,5%	5	9,6%	22	42,3%
Item 33 - seemed tired during the day	17	32,7%	14	26,9%	2	3,8%	19	36,5%
<i>Positive sleep habits</i>		10,6%		19,9%		57,1%		12,5%
Item 1 - slept at the same hour every night	7	13,5%	17	32,7%	24	46,2%	4	7,7%
Item 6 - needed a special object to fall asleep	5	9,6%	4	7,7%	12	23,1%	31	59,6%
Item 8 - seemed ready to sleep at bedtime	14	26,9%	14	26,9%	23	44,2%	1	1,9%
Item 15- Slept about the same no. of hours every day	0	0,0%	15	28,8%	37	71,2%	0	0,0%
Item 26 - woke up by himself/herself	2	3,8%	3	5,8%	46	88,5%	1	1,9%
Item 32 - had a good appetite in the morning	5	9,6%	9	17,3%	36	69,2%	2	3,8%
<i>Daytime Sleepiness</i>		19,6%		7,3%		15,4%		57,7%
Item 4 - fell asleep in parent's or sibling's bed	7	13,5%	8	15,4%	28	53,8%	9	17,3%
Item 18 - ground his/her teeth during sleep	3	5,8%	6	11,5%	6	11,5%	37	71,2%
Item 2- adults/siblings woke up the child	12	23,1%	3	5,8%	3	5,8%	34	65,4%
Item 29 - had difficulty getting out of bed	13	25,0%	0	0,0%	1	1,9%	38	73,1%
Item 30 - took a long time to become alert in the morning	16	30,8%	2	3,8%	2	3,8%	32	61,5%



**Figure 6 - Comparison of average CSHQ-I scores obtained by children with ASD and those with ASD and ADHD**

score obtained in the CSHQ-I questionnaire. Within this subscale, over 50% of participants had high scores on the questions «He needed rhythmic movements to fall asleep», «He resisted falling asleep», and «Wake up more than once a night».

On the Sleep Anxiety subscale, high scores were obtained by 19 participants (37% of the children enrolled in the study). Two of the questions had considerably higher scores for more than 40% of the participants: «She was anxious, she moved a lot in sleep,» and «She was afraid to sleep alone.»

Data collected on the Positive sleep habits subscale reflects that 31% of children did not have an integrated sleep routine in their first year of life with inappropriate behavioral manifestations regarding sleep.

On the Daytime sleepiness subscale, only 15% of children frequently had behaviors

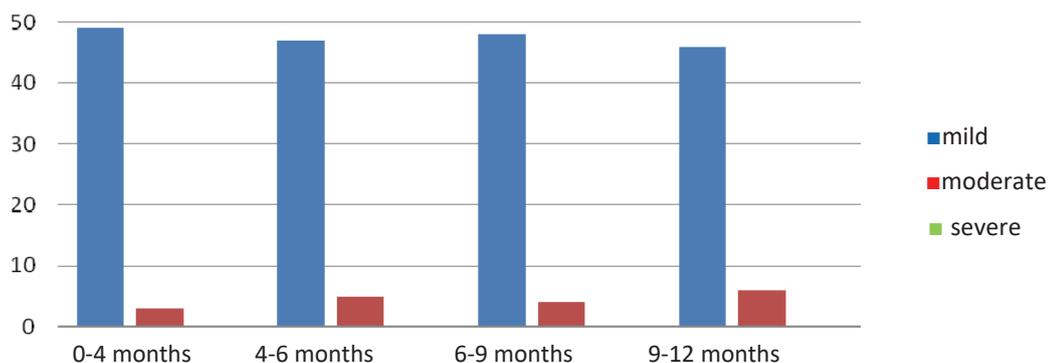
that indicate an increased level of daytime sleepiness. However, it should be borne in mind that nearly 60% of the parents did not report a frequency of the behaviors investigated in this section because they considered the questions were irrelevant for the child's age.

#### *Results - ICFQ Questionnaire*

The quantitative analysis of the data shows that all children with ASD experienced eating problems in the first 12 months of life. 90% of them had mild eating problems, while 10% fit into the category of moderate eating problems.

None of the investigated children fell into the category of those with severe food problems (Figure no. 7).

In terms of qualitative analysis, a first piece of information is about the way children



**Figure 7 - The severity of eating problems by age group**

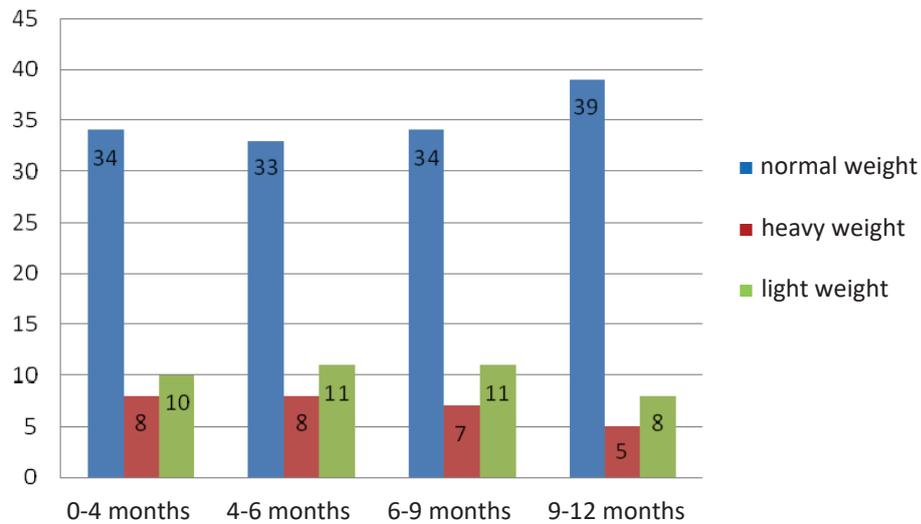


Figure 8 - Weight variation by age group

were fed. Thus, a quarter of the investigated mothers said they did not breastfeed the baby during 0-4 months of age.

Their percentage increased to 33% during the 4 - 6 months period.

Most participants had a normal weight in the first year of life (Figure no. 8). The data on the duration of feeding at a meal shows that it was in the majority of cases in the range of 5 to 30 minutes (Figure no. 9).

Answers to questions about how the child communicated and communicated their needs reflected a downward trend in the level of communication as they progressed to the next age category (Figure no. 10). 44 children with ages between 0 and 4 months,

respectively 42 children with ages between 4 and 6 months had visual contact with the parent, they were attentive and managed to give the parent information about their hunger or satiety level.

In the period 9-12 months, the number of children who managed these behaviors dropped to 37, indicating a depreciation of the communication skills.

In this study, it was also investigated the presence of food refusal in the first 12 months of life.

The results show an increasing trend of this behavior, with an accelerated growth rate starting at 6 months of age (Figure No. 11).

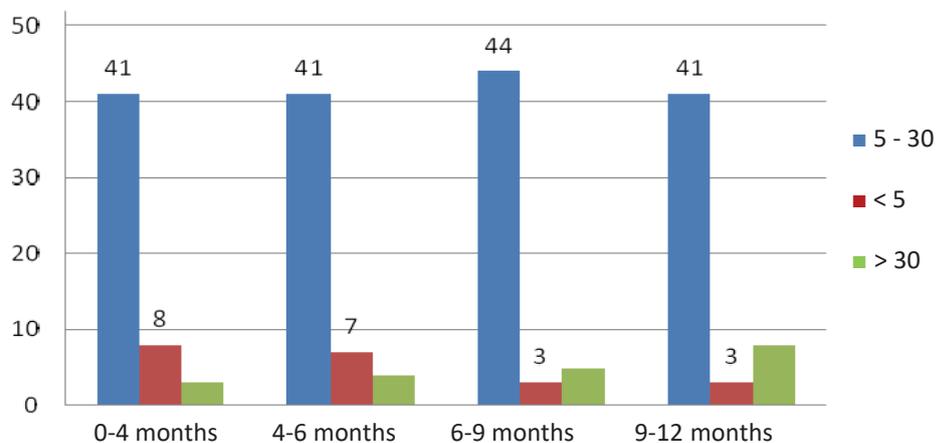
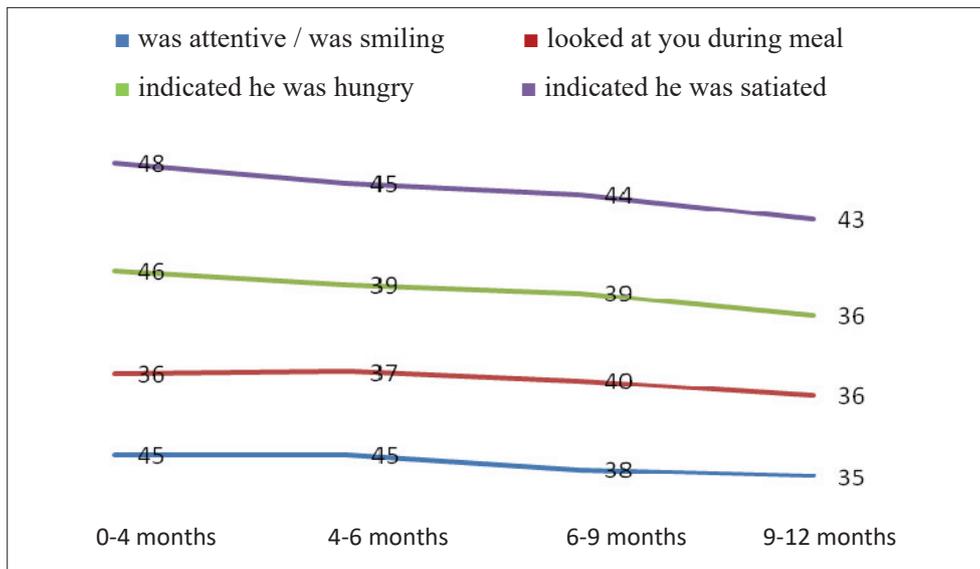
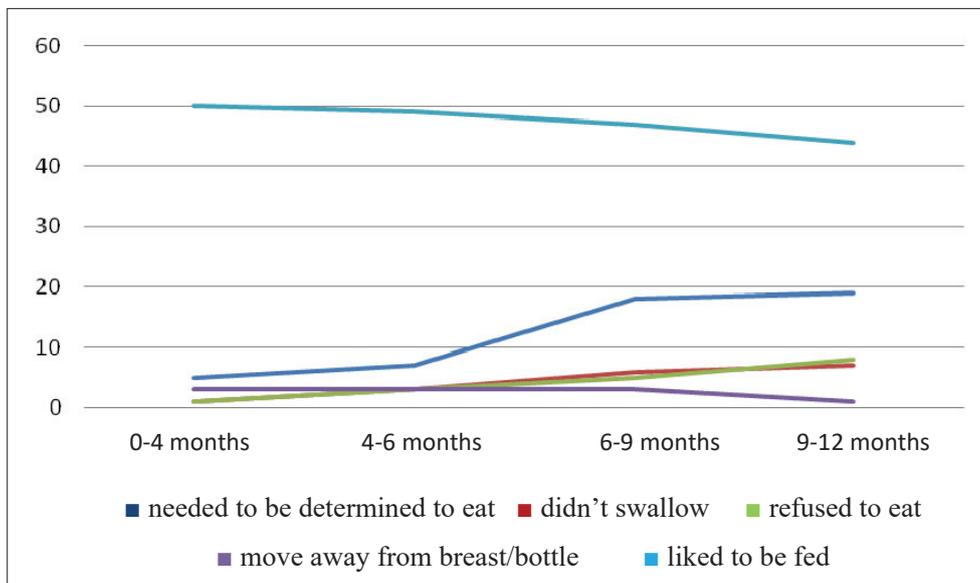


Figure 9 – Meal duration by age category



**Figure 10 - The evolution of age-related communication regarding eating behavior**



**Figure 11 – The evolution of food refusal in the first year of life**

The following are the results obtained for each item in the ICFQ questionnaire by age group: 0-4 months (Table No. 4), 4-6 months (Table No. 5), 6-9 months (Table No. 6) and 9-12 months (Table No. 7).

Table 4 - Descriptive statistics of ICFQ (0 - 4 months)

	Feeding behavior for 0 - 4 months			
	+		-	
	n	(%)	n	(%)
1. He/she liked to be fed	50	96,2%	2	3,8%
2. Was calm/attentive during breastfeeding	45	86,5%	7	13,5%
3. Looked at you during breastfeeding	36	69,2%	16	30,8%
4. Was fed more often than every 2 hours	36	69,2%	16	30,8%
5. Notified you when he was hungry (ex: cried)	46	88,5%	6	11,5%
6. He/she ate enough	46	88,5%	6	11,5%
7. Feeding duration < 5 min sau > 30 min	41	78,8%	11	21,2%
8. Had to be convinced to eat	47	90,4%	5	9,6%
9. Notified you when he/she he was full	48	92,3%	4	7,7%
10. Did not seem to want to stop feeding	42	80,8%	10	19,2%
11. Sucked the milk vigorously, "with lust"	46	88,5%	6	11,5%
12. Injures/pain from breastfeeding*	36	69,2%	16	30,8%
13. Concerns about child's weight	34	65,4%	18	34,6%
14. Seemed satisfied after the meal	47	90,4%	5	9,6%
15. Was disturbed when feeding stopped	43	82,7%	9	17,3%
16. The routine of feeding was a pleasant activity	39	75,0%	13	25,0%
17. Turned to grab the breast/bottle	43	82,7%	9	17,3%
18. Was held in your arms during feeding	44	84,6%	8	15,4%
19. Was disturbed by your touches	50	96,2%	2	3,8%
19. Did not swallow	51	98,1%	1	1,9%
20. Refused to be fed	51	98,1%	1	1,9%
21. Turned away form the bottle/breast	49	94,2%	3	5,8%
22. He/she arched his body	47	90,4%	5	9,6%
23. He/she choked	46	88,5%	6	11,5%
24. He/she coughed	51	98,1%	1	1,9%
25. He/she had vomiting reflex	46	88,5%	6	11,5%
26. He/she cried a lot	47	90,4%	5	9,6%
27. He/she made noises during breathing	49	94,2%	3	5,8%
28. He/she turned blue	52	100,0%	0	0,0%
29. Was exhausted before the end of the meal	50	96,2%	2	3,8%
30. Was asleep before the end of the meal	34	65,4%	18	34,6%
31. Vomited after the meal	43	82,7%	9	17,3%
32. Concerns about the way of feeding	39	75,0%	13	25,0%

\* 11 mothers said they did not breastfeed the baby during this period

Table 5 - Descriptive statistics of ICFQ (4 - 6 months)

	Feeding behavior for 4 - 6 months			
	+		-	
	n	(%)	n	(%)
1. He/she liked to be fed	49	94,2%	3	5,8%
2. Was calm/attentive during breastfeeding	45	86,5%	7	13,5%
3. Looked at you during breastfeeding	37	71,2%	15	28,8%
4. Showed excitement through body movements	41	78,8%	11	21,2%
5. Opened his mouth to indicate he was hungry	41	78,8%	11	21,2%
6. Was fed more often than every 2 hours	41	78,8%	11	21,2%
7. Notified you when he was hungry(ex: cried)	39	75,0%	13	25,0%
8. He/she ate enough	43	82,7%	9	17,3%
9. Feeding duration < 5 min sau > 30 min	41	78,8%	11	21,2%
10. Had to be convinced to eat	45	86,5%	7	13,5%
11. Notified you when he/she he was full	45	86,5%	7	13,5%
12. Did not seem to want to stop feeding	43	82,7%	9	17,3%
13. Sucked the milk vigorously, "with lust"	42	80,8%	10	19,2%
14. Injures/pain from breastfeeding*	46	88,5%	6	11,5%
15. Concerns about child's weight	33	63,5%	19	36,5%
16. Seemed satisfied after the meal	46	88,5%	6	11,5%
17. Was disturbed when feeding stopped	44	84,6%	8	15,4%
18. Feeding the baby was a pleasant activity	39	75,0%	13	25,0%
19. Turned to grab the breast/bottle	42	80,8%	10	19,2%
20. Was held in your arms during feeding	41	78,8%	11	21,2%
21. Liked to put various objects in his mouth	45	86,5%	7	13,5%
22. Had a vomit reflex when he held something in his mouth	52	100,0%	0	0,0%
23. Was disturbed by your touches	50	96,2%	2	3,8%
24. Did not swallow	49	94,2%	3	5,8%
25. Refused to be fed	49	94,2%	3	5,8%
26. Turned away form the bottle/breast	49	94,2%	3	5,8%
27. He/she arched his body	44	84,6%	8	15,4%
28. He/she choked	49	94,2%	3	5,8%
29. He/she coughed	50	96,2%	2	3,8%
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31. He/she cried a lot	46	88,5%	6	11,5%
32. He/she made noises during breathing	50	96,2%	2	3,8%
33. He/she turned blue	51	98,1%	1	1,9%
34. Was exhausted before the end of the meal	51	98,1%	1	1,9%
35. Was asleep before the end of the meal	39	75,0%	13	25,0%
36. Vomited after the meal	47	90,4%	5	9,6%
37. Concerns about the way of feeding	42	80,8%	10	19,2%

\* 16 mothers said they did not breastfeed the baby during this period

Table 6 - Descriptive statistics of ICFQ (6 - 9 months)

	Feeding behavior 6 - 9 months			
	+		-	
	n	(%)	n	(%)
1. He/she liked to be fed	47	90.4%	5	9.6%
2. Smiled when he saw the breast/bottle	38	73.1%	14	26.9%
3. Looked at you during breastfeeding/meal	40	76.9%	12	23.1%
4. Opened his mouth to indicate he was hungry	40	76.9%	12	23.1%
5. Was fed more often than every 2 hours	46	88.5%	6	11.5%
6. Notified you when he was hungry (ex cried)	39	75.0%	13	25.0%
7. He/she ate enough	41	78.8%	11	21.2%
8. Meal duration <5 min or> 30 min	44	84.6%	8	15.4%
9. He had to be determined to eat	34	65.4%	18	34.6%
10. Notified he/she was full	44	84.6%	8	15.4%
11. Did not seem to want to stop feeding	45	86.5%	7	13.5%
12. Sucked the milk vigorously, "with lust"	39	75.0%	13	25.0%
13. Wounds/pains caused by breastfeeding*	47	90.4%	5	9.6%
14. Concerns about the child's weight	34	65.4%	18	34.6%
15. Seemed satisfied after the meal	48	92.3%	4	7.7%
16. Was disturbed when breastfeeding stopped	47	90.4%	5	9.6%
17. Showed signs of being hungry right after the meal	50	96.2%	2	3.8%
18. Feeding routine was a pleasant activity	41	78.8%	11	21.2%
19. Was held in your arms during feeding	33	63.5%	19	36.5%
20. Liked to put various objects in his mouth	42	80.8%	10	19.2%
21. Vomiting reflex when he held something in his mouth	51	98.1%	1	1.9%
22. Diversification went well	41	78.8%	11	21.2%
23. Diversification could not be achieved	47	90.4%	5	9.6%
24. Allergies were discovered	48	92.3%	4	7.7%
25. Was disturbed by your touches	50	96.2%	2	3.8%
26. Did not swallow	46	88.5%	6	11.5%
27. Refused to be fed	47	90.4%	5	9.6%
28. Turned away from breast/bottle	49	94.2%	3	5.8%
29. He/she arched his body	44	84.6%	8	15.4%
30. He/she choked	49	94.2%	3	5.8%
31. He/she coughed	51	98.1%	1	1.9%
32. He/she had vomiting reflex	48	92.3%	4	7.7%
33. He/She cried a lot	46	88.5%	6	11.5%
34. He/she made noises during breathing	51	98.1%	1	1.9%
35. He/she turned blue	52	100.0%	0	0.0%
36. Was exhausted before the end of the meal	51	98.1%	1	1.9%
37. Was asleep before the end of the meal	47	90.4%	5	9.6%
38. Vomited after the meal	48	92.3%	4	7.7%
39. Concerns about the way of feeding	42	80.8%	10	19.2%

\* 17 mothers said they did not breastfeed the baby during this period

Table 6 - Descriptive statistics of ICFQ (9 - 12 months)

	Feeding behavior 9 - 12 months			
	+		-	
	n	(%)	n	(%)
1. He liked to be fed	44	84.6%	8	15.4%
2. Smiled when he saw the breast/bottle/spoon	35	67.3%	17	32.7%
3. Watched you during breastfeeding/meal	36	69.2%	16	30.8%
4. Opened his mouth to indicate he was hungry	36	69.2%	16	30.8%
5. He/she was fed more often than every 2 hours	49	94.2%	3	5.8%
6. Notified when he/she was hungry (ex: cried)	36	69.2%	16	30.8%
7. He/she ate enough	41	78.8%	11	21.2%
8. Meal duration < 5 min or > 30 min	41	78.8%	11	21.2%
9. He/she had to be determined to eat	33	63.5%	19	36.5%
10. Notified you he/she was full	43	82.7%	9	17.3%
11. Concerns about the child's weight	39	75.0%	13	25.0%
12. He/She seemed satisfied after the meal	46	88.5%	6	11.5%
13. Was disturbed when feeding stopped	51	98.1%	1	1,9%
14. Showed signs of being hungry right after a meal	51	98.1%	1	1,9%
15. Feeding routine was a pleasant activity	40	76.9%	12	23.1%
16. He liked to put various objects in his mouth	40	76.9%	12	23.1%
17. He/she had a vomiting reflex when he held something in his mouth	51	98.1%	1	1,9%
18. Diversification went well	40	76.9%	12	23.1%
19. He/she ate a large variety of foods	37	71.2%	15	28.8%
20. Diversification could not be achieved	48	92.3%	4	7.7%
21. Allergies were discovered	47	90.4%	5	9.6%
22. Set in a chair during feeding	34	65.4%	18	34.6%
23. Was disturbed by your touches	50	96.2%	2	3.8%
24. Did not swallow	45	86.5%	7	13.5%
25. Refused to be fed	44	84.6%	8	15.4%
26. Turned away from breast/bottle	51	98.1%	1	1,9%
27. He/she arched his/her body	46	88.5%	6	11.5%
28. He/she choked	51	98.1%	1	1,9%
29. He/she coughed	50	96.2%	2	3.8%
30. He/she had a vomiting reflex	48	92.3%	4	7.7%
31. He/She cried a lot	46	88.5%	6	11.5%
32. He/she made noises during breathing	51	98.1%	1	1,9%
33. He/she turned blue	52	100.0%	0	0.0%
34. Was exhausted before the end of the meal	51	98.1%	1	1,9%
35. Was asleep before the end of the meal	49	94.2%	3	5.8%
36. Rejected the food	45	86.5%	7	13.5%
37. Vomited after the meal	48	92.3%	4	7.7%
38. Concerns about the way of feeding	42	80.8%	10	19.2%

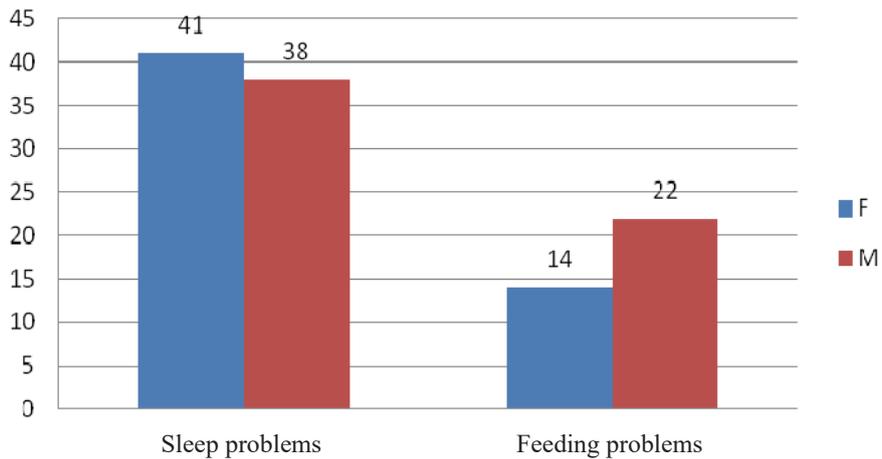


Figure 12 - Average scores obtained in CSHQ-I and ICFQ questionnaires based on gender

According to the data analyzed, there is a gender difference in feeding and sleep problems in the first year of life in children with ASD. Girls obtained higher scores in the CSHQ-I questionnaire, while boys had more feeding problems in the first year of life, with higher scores in the ICFQ questionnaire (Figure no. 12).

Children with ASD and ADHD had higher scores in the CSHQ-I questionnaire, with more sleep problems in the 0-12 months period. Regarding food problems, there were no significant differences between them and children with ASD (Figure no. 13).

Concerning the correlation between the scores obtained in the ICFQ and CSHQ-I questionnaires, a correlation index of 0.3 was obtained.

### DISCUSSIONS

The results show that 63% of the children with ASD investigated had sleep problems in their first year of life and all those enrolled in the study have experienced eating problems in varying degrees of manifestation. The prevalence rate of first-year sleep problems in the studied population falls within the range of 44% to 85% reported by Souders et al in the study published in 2009 (15), which investigated the association of sleep disorders in children with ASD. In the study published in January 2018, Seiverling and colleagues concluded that eating problems occur more frequently in children with ASD than those with typical development or those with language delays and tend to manifest in the first years of life [12].

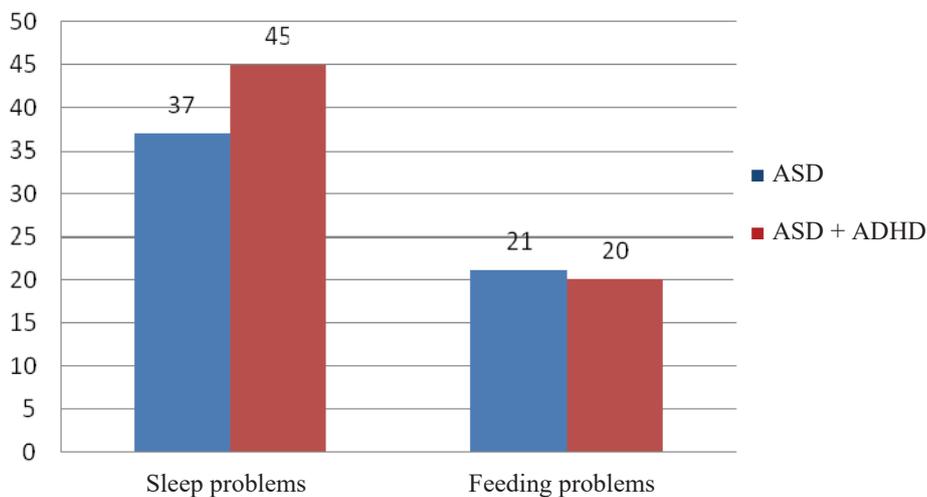


Figure 13 - Average scores based on the diagnostic category

In terms of sleep disorders, the results obtained are close to those reported in previous studies. Polimeni, Richdale and Francis, in the study published in 2005 [6] claim that the percentage of children with ASD and associated sleep problems is 73% , while Krakowiak et al. reports a percentage of 53% [7]. Also, the data analyzed support Nguyen et al in the study published in January 2018, suggesting that first-year sleep problems may be an early sign of ASD [16].

In the investigated population, children with ASD and comorbid ADHD obtained higher scores than those with ASD in the CSHQ-I sleep questionnaire. The fact that parents of children with ASD associated with ADHD reported more sleep problems in the children's first year of life can be explained by the presence of higher internalization problems in this category of patients, as shown by Reynolds and collaborators in the study published in 2017 [17]. Both work written by Thomas, Monahan, Lukowski and Cauffman in 2015 [18] and Green, Sciberras, Anderson, Rinehart and Efron in 2016 [19] supports this explanation. Given the limited pool of participants from this diagnostic category, further studies that include larger batches of subjects with these characteristics are required in order to observe a statistically significant difference.

Regarding the specific manifestations of sleep-related problems in the first year of life, the results of the study show that all participants who had sleep problems between 0 and 12 months of age (with a total score above the limit score of 33) and some of those with a score below the limit, experienced problems with initiating and maintaining sleep. Also, about 37% of children with sleep problems in infancy have achieved high scores on questions related to sleep anxiety. This shows that the specific sleep problems experienced in the first year of life by children with ASD are similar to those observed in older children with ASD. Giannotti, in his published work

in 2008, describes the sleeping problems of children with ASD that include various manifestations related to sleep resistance [20]. In 2006, Malow concludes that the main symptom of sleep disorders present in children with ASD is the difficulty of falling asleep [21]. Many nocturnal awakenings in children with ASD are mentioned by Thirumulai in the work published in 2002 [22] and by Doo and Wing in their study published in 2006 [23].

All participants in the present study experienced eating problems in the first year of life, but most of them had scores corresponding to minor eating problems. Although the percentage obtained differs from that reported by other studies with the same pathology population (50% in the study published by Williams, Gibbons and Schreck in 2005 [9]), the high value obtained in this study can be explained by the small age of the participants. While in most studies the presence of eating disorders in children with ASD was analyzed for children over 2 years of age, the present study investigated their presence between 0 and 12 months, during which it is difficult to reveal atypical behavior related to diet due to the absence of a clear delimitation between normal and pathological.

Regarding the presence of atypical manifestations in food behavior in the first 12 months of life, the data analyzed show that children with ASD manifest an increased rate of food refusal and a poor expression of their needs including low visual contact while breastfeeding and lack of communication about their hunger and satiety. Similar data was obtained by Dominick et al. in the study published in 2007 [10], and Bachmeyer et al. in the paper published in 2009 [24]. These atypical manifestations, aggravated by aging, may be an alarm signal, targeting parents to a specialist for a thorough evaluation that can establish an early diagnosis of ASD, improving the prognosis of these children. The ICFQ questionnaire used in this study is

designed to identify eating disorders in typical children. Therefore, an ample study is needed, one with psychometric instruments tailored to the specific feeding problems that occur in the first year of life in children with ASD.

#### *Limitations of the study*

Two of the study's limitations are represented by the small group of participants and the lack of a control group. For these reasons, it was not possible to compare the sleep and feeding problems encountered in children with ASD with those encountered in typical children in the age range 0 - 12 months. However, this paper is a starting point for further analysis, providing a description of behavioral manifestations related to sleep and eating behavior occurring in the first year of life in children diagnosed with ASD.

Another possible limitation is the use of parental questionnaires. Studies comparing parental data and those resulting from the use of objective psychometric instruments have shown that there are, however, no significant differences. Wiggs and Stores, in the study published in 2004 [25], have demonstrated the accuracy of information provided by parents. In addition, the results of this study are similar to those reported by Couturier and collaborators in 2005 [26] and Krakowiak et al in 2008 following the application of the CSHQ questionnaire [7].

#### **CONCLUSIONS**

This work is the first attempt to assess the presence of sleep and eating disorders in the first year of life in children with ASD in Romania.

The study confirms the need to investigate this lifetime of children and the importance of including atypical sleep and feeding manifestations in the screening of ASD early signs. Given that early inclusion in an appropriate therapy program is currently the only chance to recover this diagnostic category of

patients, a complex assessment and identification of children at risk may prompt a diagnosis with favorable effects on the progression of these patients.

The analysis of collected data shows that sleeping and eating problems are present from the first year of life in people with ASD in the studied group. Eating problems were present in all children included in the study. 63% of the participants experienced sleep problems in the age range 0 - 12 months. Although the degree of severity is a mild-moderate one, the fact that sleep and eating problems are present at this stage of development may be an early sign of alarm for ASD.

In addition, the results suggest that atypical manifestations related to sleep and eating behaviors are similar to those encountered in different age groups, despite the difficulty of identifying them in the child under 12 months of age. In the first year of life, children's development is different from one child to another, with large variations being determined by the particularities of each case. In this context, drawing a clear boundary between normal behavioral and pathological characteristics is difficult.

In conclusion, this work represents a first step in investigating sleep and eating disorders present in the first year of life in children with ASD, shows that they may constitute early signs of this neurodevelopment disorder and may be the subject of a wider study.

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