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FAMILY COHESION AND FLEXIBILITY WHEN THE CHILD HAS CENTRAL AUDITORY PROCESSING DISORDER: MOTHERS' PERCEPTIONS

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Contributions:
A Study design/planning
B Data collection/entry
C Data analysis/statistics
D Data interpretation
E Preparation of manuscript
F Literature analysis/search
G Funds collection

Abstract

Introduction: Families with children with auditory processing disorder (APD) can experience stress when their child encounters difficulties in communication, speech and language development, and learning. Coping with these conditions depends, among other things, on the family's cohesion and flexibility, and so it is important to understand these factors in order to provide effective psychological support. Currently, no research has explored how families with an APD child function. This study investigated family dynamics in cases where the child had APD. Based on Olson's Circumplex Model, we studied how mothers perceived the situation and examined the relationships between family cohesion and flexibility, maternal trait anxiety, and a number of socio-demographic factors.

Material and methods: There were 106 mothers of children with APD (child's average age 10 years) who participated in the study. Three groups of families were distinguished: those where the child only had APD (APD1); those with APD and speech, language, and/or articulation disorders (APD2); and those with APD accompanied by other severe health conditions (APD3). Mothers completed the Flexibility and Cohesion Evaluation Scales (FACES-IV) in its Polish adaptation (SOR) and a State-Trait Anxiety Inventory (STAI X-2).

Results: The three groups of families differed significantly in terms of the 'unbalanced' dimensions of 'disengaged' and 'rigid'. APD2 and APD3 families had higher disengaged and rigid scores compared to APD1; these scores were also higher than in the general Polish population. The mothers who had a lower education level expressed a lower level of family cohesion and had higher levels of the enmeshed and chaotic dimensions. The anxiety traits of the mothers correlated significantly with all dimensions of cohesion and flexibility, except for rigidity.

Conclusions: Families which have children with APD, especially when accompanied by difficulties in speech and language development and/or articulation or other serious health problems, may experience changes in family cohesion due to increased level of disengagement between family members. Such families, including mothers with lower levels of education and/or higher trait anxiety, would benefit from various forms of psychoeducation and psychological intervention to improve family functioning.

Keywords: children • family • trait anxiety • auditory processing disorder • APD • FACES-IV questionnaire • STAI X-2

SPÓJNOŚĆ I ELASTYCZNOŚĆ SYSTEMÓW RODZINNYCH Z DZIECKIEM Z CENTRALNYMI ZABURZENIAMI PRZETWARZANIA SŁUCHOWEGO W PERCEPCJI MATEK

Streszczenie

Wprowadzenie: Rodziny z dzieckiem z centralnymi zaburzeniami przetwarzania słuchowego (APD) mogą doświadczać sytuacji stresujących, które wiążą się z trudnościami ich dzieci w sferze komunikowania się, rozwoju mowy i języka czy uczenia się. Radzenie sobie z nimi zależy m.in. od spójności i elastyczności systemów rodzinnych, jakie tworzą. Z tego względu istotne jest poznanie ich funkcjonowania, aby następnie efektywnie udzielać psychologicznego wsparcia. Obecnie nie ma badań na ten temat. Celem badania była ocena funkcjonowania systemów rodzinnych z dzieckiem z APD w świetle Modelu Kołowego Olsons w percepcji matek, a także weryfikacja zależności między ich spójnością i elastycznością a lękiem jako cechą u matek oraz wybranymi czynnikami socjodemograficznymi.

Materiał i metody: W badaniu uczestniczyło 106 matek dzieci z APD (średnia wieku 10 lat). W celu analizy wyodrębniono trzy grupy rodzin: grupę rodzin dzieci wyłącznie z APD (APD1), grupę rodzin dzieci z APD i zaburzeniami rozwoju mowy lub/i artykulacji (APD2) oraz grupę rodzin dzieci z APD wraz innymi zaburzeniami neurorozwojowymi lub poważnymi chorobami somatycznymi (APD3). Matki wypełniły: *Flexibility and Cohesion Evaluation Scales* (FACES-IV) w polskiej adaptacji: *Skale oceny rodziny* (SOR) i *Inwentarz stanu i cechy lęku* (STAI X-2).

Wyniki: Rodziny APD1, APD2 i APD3 różnią się istotnie w wymiarach oceniających niezrównoważenie systemów rodzinnych: niezwiązania i sztywności. Podwyższone wyniki w wymiarze niezwiązania i sztywności otrzymały rodziny z grupy APD2 i APD3 względem rodzin z grupy APD1, jak i w odniesieniu do populacji ogólnej według norm polskich. Niższe wykształcenie matek dzieci z APD pozostaje w związku z mniejszym nasileniem spójności systemów rodzinnych, a z większym nasileniem w wymiarze ich splątania i chaotyczności. Lęk jako cecha korelowała u badanych matek ze wszystkimi wymiarami spójności i elastyczności za wyjątkiem sztywności.

Wnioski: Rodziny z dzieckiem z APD wymagają różnych form wsparcia psychologicznego celem wzmocnienia więzi emocjonalnej i bliskości między członkami tych rodzin. Ponadto matkom dzieci z APD, zwłaszcza z niższym wykształceniem i wyższym poziomem lęku jako cechy, należałoby oferować różne formy psychoedukacji i interwencji psychologicznej umożliwiające ich systemom rodzinnym podjęcie pracy nad zwiększeniem zdolności do zmian.

Słowa kluczowe: dzieci • rodzina • lęk jako cecha • zaburzenia przetwarzania słuchowego • APD • kwestionariusz FACES-IV • STAI X-2

Key to abbreviations	
ADHD	attention deficit hyperactivity disorder
APD	auditory processing disorder
ASD	autism spectrum disorder
ASHA	American Speech-Language-Hearing Association
BAS	British Audiological Society
DD	developmental delay
DDT	dichotic digit test
DPT	duration pattern test
FACES-IV	Flexibility and Cohesion Evaluation Scales
FPT	frequency pattern test
IFPS	Institute of Physiology and Pathology of Hearing
SES	socioeconomic status
SLI	specific language impairment
SOR	Skale Oceny Rodziny [Polish adaptation of the FACES-IV]
STAI	State-Trait Anxiety Inventory
STAI X-1	State-Trait Anxiety Inventory – first part
STAI X-2	State-Trait Anxiety Inventory – second part

Introduction

Neurodevelopmental disorders or disabilities in children tend to change the way their families function. The changes affect the family's quality of life and well-being in various ways: how the roles and responsibilities within the family are shared, the quality of marital/partner relationships and social interactions, and new challenges concerning the child's rehabilitation or therapy [1–5]. In the view of Olson [6,7], a child with developmental disorders affects the functioning of the entire family, so that the effects of a child's rehabilitation/therapy and their further progress will also depend on the family's cohesion and flexibility.

The individual psychological make-up of the parents, including any psychopathology (e.g., depression, anxiety), stress, well-being, and ego-resiliency, are also important in

how the family functions. Research has shown that parents in low-cohesion families score lower on these key characteristics [8–11]. On the other hand, studies have shown that families with high cohesion and flexibility assist the cognitive development of preschool children, their adjustment during the early school years [12,13], their mental health [14], and outcomes from therapy or treatment [8,15].

Olson's Circumplex Model

In a systemic approach based on von Bertalanffy's General Systems Theory, the family is treated as a whole – i.e., an open social system subject to change, pursuing goals, and self-regulating [16]. The relationships between the elements of this system, which are the family members, are determined by the roles each perform and the rules they follow, and the functioning of the family system involves communication both within it and with the external environment [17]. A change affecting one element of the family system – e.g., the health of a child – will cause changes to others (parents, siblings, grandparents), as well as to how the family functions as a whole. If we adopt a system-based approach to the mental health of children and parents, then it is the family, not the individual, that exhibits a functional disorder [18]. So in a family where a child shows varying degrees of difficulties in speech and language development, or in emotional and social development (including a neurodevelopmental disorder), then it is the family and the child who are co-responsible [1,2,8,11–15].

A salient model of system-wide family functioning is the Circumplex Model of Marital and Family Systems by Olson and colleagues [6,7,19]. In its latest published version the model uses four dimensions to describe family life: cohesion, flexibility, communication, and, less explicitly, satisfaction with family life. Cohesion is defined as the emotional bond that exists between family members [6,7] and forms a continuum from very weak (called disengagement) through moderate (balanced), to very strong (enmeshment). The next dimension, flexibility, is a measure of what changes are able to take place within the family's leadership, roles, and rules [6,7], and is assessed on a continuum ranging from rigidity, to balanced, then chaos. The third of Olson's dimensions is communication, defined as the ability to communicate positively within a family system. Finally, satisfaction with family life is implied, rather than defined, as the degree to which family members feel happy and fulfilled with each other [7,19]. Putting the four dimensions together, a healthy family is expressed in the model as having

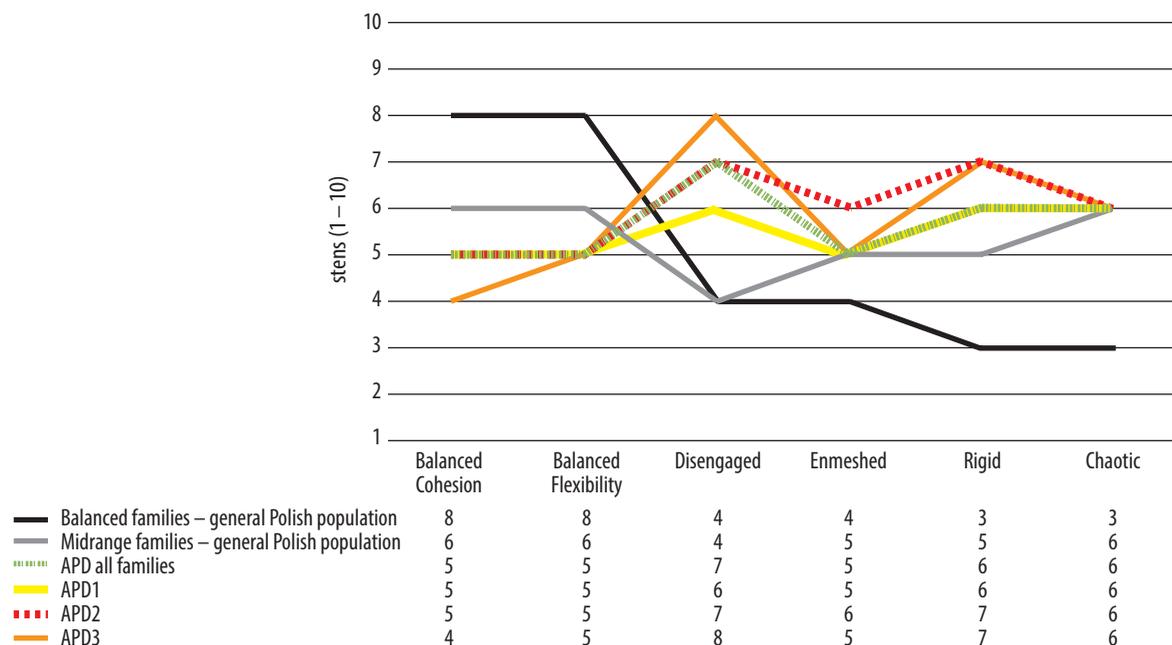


Figure 1. Profiles of families with a child with APD (FACES-IV/SOR) compared to balanced and midrange families in the Polish population

a dominance of balanced cohesion and balanced flexibility over unbalanced disengagement, enmeshment, rigidity, or chaos; it is also characterized by having effective family communication and being satisfied with family life [20].

In studies based on the Polish adaptation of the FACES-IV questionnaire, cluster analysis has been used to identify six types of families, which are somewhat different from those described by Olson [20,21]. The six types were: balanced, cohesively rigid, flexibly disengaged, midrange, rigidly disengaged, and unbalanced [21]. Balanced families were characterized by a high level of healthy functioning with high levels in the dimensions of balanced cohesion and balanced flexibility, and low levels of unbalanced disengagement, enmeshment, rigidity, and chaos (see **Figure 1**). Midrange families were those that had average scores in all balanced and unbalanced dimensions but low levels of disengagement. We regard these as generally well-functioning families, and they form the cornerstone of the present study. However, as **Figure 1** shows, the elevated level of chaos suggests these families may encounter difficulties in making joint decisions and taking action in stressful or crisis situations [21].

Research so far on families where the children have neurodevelopmental disorders or disabilities indicates that, using the theoretical Circumplex Model and the FACES-IV questionnaire, they have reduced balanced cohesion and balanced flexibility compared to healthy families. In other words, the level of unbalance generally increases, although it does seem that the level of balance or unbalance, and the deviations from the profiles typical of healthy families, can vary [11,22–25].

Studies of families where the child has been diagnosed with autism spectrum disorder (ASD) show that balanced

cohesion is significantly reduced. Unbalance is increased, leading to more disengagement and more enmeshed, rigid, and chaotic behaviour [22–24]. Communication is also low, falling below Polish standards for FACES-IV, while family satisfaction remains average. As the authors of one study summarise [22], families with an ASD child appear to be at higher risk of unbalanced and rigidly disengaged behaviour than families having a neurotypically developing child.

A similar pattern is observed in families where there are preschool children with delayed speech development. For example, families of children with reduced levels of speech understanding receive lower ratings (as scored by their parents) in cohesion, communication, and satisfaction, as well as higher disengagement [11]. As another point of comparison, families with prelingually deaf children show increased levels of disengagement (as assessed by the mothers), with communication and satisfaction at average levels according to Polish norms [25].

While these studies give some insight, there have been no studies on families with an APD child that allow us to understand what difficulties such families face or what assistance they might find most helpful. What can we offer such families in terms of helping to form emotional bonds (higher cohesion), adapting to difficult family circumstances (raised flexibility), or improving family communication and family satisfaction? In brief, what is needed to make a family more cohesive and flexible? This study aims to provide some tentative answers to those questions.

APD in children

APD, sometimes called central APD or (C)APD, refers to deficits in the analysis and processing of auditory

information at the level of the central nervous system, even though peripheral hearing remains normal. According to recent data, APD occurs in 0.2–5% of the pediatric population [27], and twice as frequently in boys [28]. Children with normal intellectual abilities can have the condition [26], although APD often co-occurs with other neurodevelopmental disorders [29] – developmental dyslexia [30], attention deficit hyperactivity disorder (ADHD) [31,32], and ASD [33]. Children with APD often experience difficulties in the motor and emotional-social spheres [34–36].

The British Audiological Society (BAS) broadly characterizes APD as displaying abnormal discrimination, separation, grouping, localization, and organization of sound stimuli [37]. Difficulties associated with APD may manifest in terms of speech comprehension, especially in unfavorable acoustic conditions (for example, noise). Higher auditory functions are performed incorrectly, giving rise to difficulties in locating sound, distinguishing and recognizing sound patterns, and understanding distorted speech or speech accompanied by competing signals [38]. APD may contribute to speech and language development disorders and learning difficulties [37].

A feature of children with APD is that they react variably to auditory stimuli. Thus, they sometimes seem not to understand commands, and their response to a verbal command may be slow, as if they need more time to assimilate the information they hear. In addition, they may have difficulty remembering verbal information, especially understanding long or complex instructions, and will often ask for them to be repeated. They may also have difficulty discriminating volumes and different sound locations, and are easily distracted. Children with APD typically have difficulty concentrating and become fatigued during prolonged or complex auditory activities. Often there are reading, articulation, and language difficulties [39]. Some 47% of children aged 7–12 with APD have language development disorders and reading difficulties [40].

From the parents' point of view, APD has negative psychosocial consequences, and children diagnosed with this disorder often experience difficulties at school [34,35]. According to qualitative research conducted in New Zealand, children with APD can show increased levels of anxiety, anger, tantrums, and frustration due to difficulties in communicating with both teachers and peers. Children with APD may experience a lack of understanding from their peers, isolation in the social life of the school, and at the same time show a tendency to socialize with children with various disorders, such as ASD or apraxia [35]. In the cited studies, parents of children with APD report dissatisfaction with educational support, while parents in Poland have rated the quality of their family life low, with a lack of specialist support for families with APD children, support from other people, and level of social interaction [5].

Aim of the study

The aim of the study was to assess, based on mothers' perceptions, the cohesion and flexibility of families with children with APD – based on families where the child had been diagnosed with APD only, families where the child with APD had difficulties in speech and language

development and/or articulation, and families where the child had not only APD but other disorders/somatic diseases such as ASD, ADHD, asthma, and diabetes. For added perspective, the study looked at the level of trait anxiety in the mothers and how it related to the dimensions of family functioning as assessed by the Olson Circumplex Model [6,7].

Material and methods

Participants and procedure

The study invited the participation of mothers of children diagnosed with APD and was conducted between September 2024 and March 2025 while the children were undergoing auditory training organized by the Institute of Physiology and Pathology of Hearing. The research had a cross-sectional design and was anonymous and voluntary. Mothers were given pencil-and-paper questionnaires to complete during auditory training, which they placed in a designated box in the rehabilitation center. The response rate was approximately 60%. All participants lived in central Poland. The inclusion criteria for mothers and their children with APD were as follows: Polish nationality, children aged 6 to 17, diagnosis of APD in the child, and willingness of the child and its mother to participate in auditory training.

The mothers were aged between 28 and 55 ($M = 41.7$, $SD = 4.9$). Their children were diagnosed with APD according to the criteria published by the American Speech-Language-Hearing Association (ASHA) [38]. The children were aged between 82 and 204 months ($M = 124.3$, $SD = 30.3$). In all children the diagnosis of APD was made by a qualified audiologist who was a medical doctor and was based on a comprehensive assessment that included psychoacoustic tests: the dichotic digit test (DDT), the frequency pattern test (FPT), and the duration pattern test (DPT) [41].

During a consultation with three other specialists (a speech therapist, psychologist, and pedagogue), the mothers obtained information about their child's speech and language development and received reports about other health problems identified in their child, including ADHD, ASD, developmental delay (DD), specific language impairment (SLI), and dyslexia; they also received documents from relevant medical or educational institutions. The children and their mothers were divided into three groups for the study: APD1 – families with children with APD only and no other health problems; APD2 – families with children with APD plus speech/language development and/or articulation disorders (excluding SLI); and APD3 – families with children with APD plus serious health problems (e.g., ADHD, ASD, diabetes, asthma).

Tables 1 and 2 presents the sociodemographic data of the mothers and children according to APD1, APD2, and APD3. Statistically significant intergroup differences were found in the gender distribution of the children ($\chi^2 = 9.19$, $p = 0.01$), with the highest percentage of boys (91%) in the APD3 group.

Table 1. Maternal sociodemographic characteristics for children with APD; intergroup comparisons between APD1, APD2, and APD3

Mothers <i>n</i> = 106	APD1 <i>n</i> = 40	APD2 <i>n</i> = 44	APD3 <i>n</i> = 22	Significance of intergroup comparison
APD type – <i>n</i> (%)	40 (37.7%)	44 (41.6%)	22 (20.7%)	
Age (years) – M (SD)	43.0 (4.1)	41.04 (5.6)	40.9 (4.3)	$F = 2.089; p = 0.129$
Max	55	52	52	
Min	35	26	33	
Education				
Below master's degree – <i>n</i> (%)	11 (27.5%)	23 (52.3%)	8 (36.4%)	$\chi^2 = 5.49; p = 0.06$
Completed master's degree – <i>n</i> (%)	29 (72.5%)	21 (47.7%)	14 (63.6%)	
Marital/partnership status				
In a relationship – <i>n</i> (%)	34 (85%)	39 (89%)	21 (96%)	$\chi^2 = 1.54; p = 0.462$
Single – <i>n</i> (%)	6 (15%)	5 (11.4%)	1 (4.5%)	
Number of children – M (SD)	2.17 (0.93)	2.13 (0.76)	1.95 (0.78)	$H(2.106) = 0.72; p = 0.69^*$
Max	6	4	3	
Min	1	1	1	

* Kruskal–Wallis rank test

Table 2. Sociodemographic characteristics of children with APD; intergroup comparison between APD1, APD2, and APD3

Children with APD <i>n</i> = 106	APD1	APD2	APD3	Significance of intergroup comparison
Sex				
Girls <i>n</i> (%)	18 (45%)	19 (43.18%)	2 (9.1%)	$\chi^2 = 9.19; p = 0.01$
Boys <i>n</i> (%)	22 (55%)	25 (56.82%)	20 (90.9%)	
Age M (SD)	128.87 (35.5)	119 (25.85)	126.86 (28.36)	$F = 1.2; p = 0.304$
Max	204	200	196	
Min	84	82	85	
Children/adolescents (months)				
Children (0–131 mo) <i>n</i> (%)	22 (55%)	34 (77%)	13 (59%)	$\chi^2 = 5.01; p = 0.08$
Adolescents (132–215 mo) <i>n</i> (%)	18 (45%)	10 (23%)	9 (41%)	
Siblings				
None – <i>n</i> (%)	7 (18%)	8 (18%)	7 (32%)	$\chi^2 = 3.38; p = 0.49$
One – <i>n</i> (%)	25 (63%)	24 (55%)	9 (41%)	
Two or more – <i>n</i> (%)	8 (20%)	12 (27%)	6 (27%)	

The Bioethics Committee of the Institute of Physiology and Pathology of Hearing approved the study (IFPS/6/2024).

Measures

To assess the functioning of families with children with APD, we used the questionnaire Skale Oceny Rodziny (SOR) [21,42], which is a Polish adaptation of FACES-IV by Olson et al. [20]. SOR consists of 62 items that form

8 scales. Two of them assess balanced conditions: Balanced Cohesion and Balanced Flexibility, and 4 assess unbalanced conditions, namely Disengagement, Enmeshment, Rigidity, and Chaos. In addition, FACES-IV/SOR includes two more scales: Family Communication and Family Life Satisfaction. The first 6 scales (each containing 7 items) allow for ratings from 1 to 5, so that a score for each scale can be obtained in the range 7 to 35 points. The scales of Family Communication and Satisfaction are scored from

10 to 50 points. SOR also carries standard sten scores to compare results with the general Polish population [42].

The level of trait anxiety was assessed using the Polish adaptation of the State–Trait Anxiety Inventory (STAI) [43] developed by Spielberger et al. [44]. The STAI questionnaire consists of two parts, each containing 20 statements. The first part of the STAI (X-1) is used to assess the level of ‘state anxiety’ treated as a present emotional state, while the second part (X-2), which was used in this study, concerns ‘trait anxiety’ understood as an inherent personality trait. Trait anxiety is an individual’s disposition to perceive objectively harmless situations as threatening, and so responding to them with an unrealistically high level of anxiety. Responses are scored on a scale of 1 to 4, so the total score ranges from 20 to 80 points. A higher total score represents a higher level of trait anxiety. Again, the Polish adaptation of the STAI has sten standards for the Polish population [43].

The raw scores (M) were compared with Polish sten standards published in manuals for FACES-IV/SOR [41] or STAI-trait [42]. In this way they were assigned levels of low (1–3 sten), low average (4 sten), average (5–6 sten), high average (7 sten), and high (8–10 sten).

Statistical analysis

Statistical analyses were performed using SPSS v. 29. Descriptive statistics were calculated to assess data distribution and central tendencies. The Shapiro–Wilk test was used to verify the normality of the distributions. Pearson’s chi-square (χ^2) tests and ANOVA/Kruskal–Wallis rank tests were used to assess differences between the APD1, APD2, and APD3 groups in terms of sociodemographic characteristics (Tables 1 and 2).

Differences in FACES-IV/SOR between the three groups of mothers (APD1, APD2, APD3) were assessed using ANOVA or Kruskal–Wallis rank tests, and in STAI (X-2) using ANOVA (Table 3). A t -test or Mann–Whitney U -test was used to compare the results of mothers of children with APD in the FACES-IV and STAI (X-2) questionnaires according to their level of education (low, education below master’s degree; high, completed master’s degree). We also wanted to examine correlations between the family functioning dimensions of FACES-IV/SOR and the mothers’ anxiety traits (STAI-trait). Here, Pearson’s correlation coefficients or Spearman’s ρ coefficients were calculated for all participants and for the APD1, APD2, and APD3 groups. Statistical significance was set at $p < 0.05$.

Results

Table 3 presents intergroup comparisons (ANOVA or Kruskal–Wallis test) for groups of mothers of children with APD1, APD2, and APD3 for the FACES-IV/SOR and STAI-trait questionnaires. The columns show the scores (M , SD) for the entire group of mothers of children with APD, as well as for the three groups separately (APD1, APD2, APD3); they also list the results of the statistical tests used, along with the level of statistical significance.

For the present study we calculated Cronbach’s alpha reliability coefficients for SOR, and the findings were as follows: Balanced Cohesion 0.78, Balanced Flexibility 0.76, Disengagement 0.82, Enmeshment 0.55, Rigidity 0.60, Chaos 0.73, Family Communication 0.92, and Family Satisfaction 0.91.

For the purpose of creating a profile of all families with children with APD (APD all), as well as separate groups of families (APD1, APD2, and APD3), results from the FACES-IV questionnaire scales were converted to sten standards; they included Balanced Cohesion, Balanced Flexibility, Disengagement, Enmeshment, Rigidity, and Chaos, as shown in Figure 1. The figure also shows two types of family profiles (Balanced families and Midrange families) obtained from studies of the general Polish population [21,42].

Intergroup comparisons were statistically significant only for two scales of FACES-IV/SOR: Disengaged and Rigid (Table 3). Post hoc tests (Table 4) between the three groups of families of APD children (APD1, APD2, APD3) showed that, on the Disengaged and Rigid scales, the results for APD1 families were significantly lower than for APD2 and APD3 families; furthermore, the latter two groups of families did not differ significantly from each other.

The levels of anxiety trait (STAI-trait) were similar among the groups of mothers and were average according to Polish norms. All the families were elevated on the Disengaged scale (a high average).

Correlation analysis revealed that the correlations (Pearson’s r or Spearman’s ρ) between FACES-IV/SOR and STAI-trait questionnaires were statistically significant and, in the majority of them, of moderate magnitude both in the full group of families of children with APD and in the subgroups APD1, APD2, and APD3 (Table 5). Of some concern, there were significant relationships ($p < 0.05$ to $p < 0.001$) between most dimensions of FACES-IV/SOR and the level of anxiety trait in mothers. The notable exception was the Rigid dimension, where $p > 0.05$.

Among the sociodemographic variables, only the education level of the mothers appeared to play a significant role in the functioning of their families (Table 6). A comparison (t -test, Mann–Whitney U -test) of mothers with lower levels of education (below master’s degree in this study) with mothers with higher levels of education (beyond a master’s degree) revealed significant differences on three scales: Balanced Cohesion, Enmeshed, and Chaotic (Table 6). The results indicate that mothers with a lower level of education perceived their families as having lower Balanced Cohesion, but higher levels of Enmeshed and Chaotic.

Discussion

The present research has revealed how, as perceived by mothers, families with a child with APD function. The research used a system-based approach following Olson’s Circumplex Model. Comparisons were made between three groups: families of children with APD but no accompanying difficulties (APD1 group), children with APD and difficulties related to speech and language development

Table 3. Intergroup comparisons (ANOVA, Kruskal–Wallis rank test) of mothers of children with APD1, APD2, and APD3 based on scores on FACES-IV/SOR and STAI-traits. Scores are also compared to Polish sten standards (1–10) [41]

Measures	APD <i>n</i> = 106 <i>M</i> (<i>SD</i>) stems 1–10	APD1 <i>n</i> = 40 <i>M</i> (<i>SD</i>) stems 1–10	APD2 <i>n</i> = 44 <i>M</i> (<i>SD</i>) stems 1–10	APD3 <i>n</i> = 22 <i>M</i> (<i>SD</i>) stems 1–10	ANOVA, <i>F</i> (<i>p</i>); Kruskal–Wallis rank test, <i>H</i> (<i>p</i>)
FACES-IV/SOR Balanced Cohesion (range 7–35)	28.51 (5.12) 5 sten (average)	29 (5.45) 5 sten (average)	28.4 (4.26) 5 sten (average)	27.86 (6.18) 4 sten (low av.)	<i>H</i> = 1.07; <i>p</i> = 0.586
FACES-IV/SOR Balanced Flexibility (range 7–35)	24.82 (5.33) 5 sten (average)	24.57 (5.63) 5 sten (average)	24.79 (5.10) 5 sten (average)	25.31 (5.47) 5 sten (average)	<i>H</i> = 0.629; <i>p</i> = 0.73
FACES-IV/SOR Disengaged (range 7–35)	13.54 (5.68) 7 sten (high av.)	11.82 (5.04) 6 sten (average)	14.31 (6.15) 7 sten (high av.)	15.13 (5.21) 8 sten (high)	<i>H</i> = 7.661; <i>p</i> = 0.022
FACES-IV/SOR Enmeshed (range 7–35)	13.66 (4.29) 5 sten (average)	12.82 (3.78) 5 sten (average)	14.47 (4.77) 6 sten (average)	13.54 (4.00) 5 sten (average)	<i>H</i> = 2.562; <i>p</i> = 0.278
FACES-IV/SOR Rigid (range 7–35)	18.3 (4.70) 6 sten (average)	16.6 (4.61) 6 sten (average)	19.04 (4.18) 7 sten (high av.)	19.9 (5.07) 7 sten (high av.)	<i>H</i> = 6.866; <i>p</i> = 0.032
FACES-IV/SOR Chaotic (range 7–35)	16 (5.53) 6 sten (average)	15.55 (5.17) 6 sten (average)	16.61 (5.78) 6 sten (average)	15.59 (5.81) 6 sten (average)	<i>F</i> = 0.457; <i>p</i> = 0.634
FACES-IV/SOR Family Communication (range 10–50)	38.09 (8.44) 5 sten (average)	39.4 (7.19) 5 sten (average)	37.31 (9.53) 5 sten (average)	37.27 (8.28) 5 sten (average)	<i>H</i> = 1.033; <i>p</i> = 0.596
FACES-IV/SOR Family Satisfaction (range 10–50)	37.26 (8.02) 6 sten (average)	38.45 (7.64) 7 sten (high av.)	36.86 (7.85) 6 sten (average)	35.90 (9.07) 5 sten (average)	<i>F</i> = 0.802; <i>p</i> = 0.451
STAI (X-2)-trait total (range 20–80)	(<i>n</i> = 101) 42.68 (9.61) 5 sten (average)	(<i>n</i> = 39) 43.94 (9.63) 6 sten (average)	(<i>n</i> = 42) 41.95 (8.89) 5 sten (average)	(<i>n</i> = 20) 41.75 (11.16) 5 sten (average)	<i>F</i> = 0.548; <i>p</i> = 0.58

Table 4. Post hoc comparison between APD1, APD2, and APD3 families based on the Disengaged and Rigid scales of FACES-IV/SOR

	Comparison	<i>p</i>
FACES-IV/SOR Disengaged	APD1 – APD2	0.043
	APD1 – APD3	0.010
	APD2 – APD3	0.352
FACES-IV/SOR Rigid	APD1 – APD2	0.034
	APD1 – APD3	0.021
	APD2 – APD3	0.574

and/or articulation (APD2 group), and children who had other serious health problems (APD3 group). The relationships between family functioning and anxiety trait in mothers, as well as sociodemographic factors, were also examined, and of the latter only the mothers' educational level was found to be significant.

We found (**Figure 1**) that the profile of all families with children with APD, created on the basis of the FACES-IV/SOR questionnaire, differed from the profile obtained for families regarded as healthy (i.e., balanced and mid-range family types, according to Polish standards [21,42]). The levels of Balanced Cohesion and Balanced Flexibility

(5 sten) were lower, although still average according to Polish standards. The levels of unbalanced dimensions, primarily Disengagement (7 sten) and Rigidity (6 sten), were higher than in balanced and midrange families, as illustrated in the figure.

Based on the functioning assessments of all families with children with APD (FACES-IV/SOR) (**Figure 1**), it can be said that there is a risk of reduced family cohesion in these families. This is indicated in the figure by the average level of Balanced Cohesion (which is lower than in balanced and midrange families), as well as the increased level of Disengagement. This is especially the case in families

Table 5. FACES-IV/SOR and STAI-trait questionnaire correlations (r Pearson, ρ Spearman) for the whole group of mothers of children with APD and of the groups separately (APD1, APD2, APD3)

Groups of families with children with APD	All APD $n = 101$	APD1 $n = 39$	APD2 $n = 42$	APD3 $n = 20$
Variables	STAI (X-2)-trait total			
FACES IV/SOR Balanced Cohesion	$\rho = -0.47^{***}$	$\rho = -0.44^{**}$	$r = -0.51^{***}$	$\rho = -0.56^{**}$
FACES IV/SOR Balanced Flexibility	$\rho = -0.46^{***}$	$r = -0.45^{**}$	$r = -0.40^{**}$	$\rho = -0.50^*$
FACES IV/SOR Disengaged	$\rho = 0.44^{***}$	$\rho = 0.34^*$	$r = 0.60^{***}$	$r = 0.56^{**}$
FACES IV/SOR Enmeshed	$\rho = 0.31^{**}$	$\rho = 0.38^*$	$r = 0.46^{**}$	$\rho = 0.01$ ns
FACES IV/SOR Rigid	$\rho = -0.02$ ns	$r = -0.31$ ns	$r = 0.02$ ns	$\rho = -0.11$ ns
FACES IV/SOR Chaotic	$r = 0.48^{***}$	$r = 0.45^{**}$	$r = 0.48^{**}$	$r = 0.61^{**}$
FACES IV/SOR Family Communication	$\rho = -0.54^{***}$	$\rho = -0.37^*$	$\rho = -0.72^{***}$	$\rho = -0.60^{**}$
FACES IV/SOR Family Satisfaction	$\rho = -0.62^{***}$	$r = -0.43^{**}$	$r = -0.70^{***}$	$r = -0.69^{***}$

Note: ns – not significant; $*p < 0.05$; $**p < 0.01$; $***p < 0.001$

Table 6. Intergroup comparisons (t -test, Mann-Whitney U -test) of mothers' education level – below master's degree (low) or completed master's degree (high) – based on scores of FACES-IV/SOR

FACES-IV/SOR	Mothers' education		Statistical test
	Low (below master's degree) $n = 42, M (SD)$	High (completed master's degree) $n = 64, M (SD)$	
Balanced Cohesion (range 7–35)	27.23 (5.44)	29.35 (4.77)	$U = 1700.5$ $p = 0.021$
Balanced Flexibility (range 7–35)	23.90 (5.85)	25.42 (4.92)	$t = -1.43$ $p = 0.153$
Disengaged (range 7–35)	14.73 (5.94)	12.76 (5.41)	$U = 1063.5$ $p = 0.069$
Enmeshed (range 7–35)	14.88 (4.58)	12.85 (3.92)	$U = 995.5$ $p = 0.024$
Rigid (range 7–35)	18.90 (4.41)	17.90 (4.87)	$t = 1.07$ $p = 0.287$
Chaotic (range 7–35)	17.95 (5.35)	14.71 (5.310)	$U = 878$ $p = 0.003$
Family Communication (range 10–50)	36.45 (9.45)	39.17 (7.58)	$U = 1562.5$ $p = 0.158$
Family Satisfaction (range 10–50)	36.28 (7.77)	37.90 (8.18)	$U = 1540.5$ $p = 0.204$

in the APD3 and APD2 groups. Families characterized by a higher disengagement rate may have rigid boundaries, which manifest themselves in indifference, low support, and emotionally distant relationships between family members. They are also characterized by low levels of positive affect, as well as diminished engagement and parental intrusiveness [12]. As shown by Sturge-Apple et al. (2010) [12], a family characterized as disengaged is likely to have a child who adjusts poorly to school during the early years.

The profile of APD3 families shown in **Figure 1** is noteworthy. Such families have reduced Balanced Cohesion (orange line), which is the same level (4 sten) as seen in cases of families with autistic children [23,24] or children with speech delay [11]. At the same time, the level of disengagement (8 stens) and rigidity (7 stens) is high relative to the norms for the general population (black and grey lines). Based on these results, as well as the other findings from the FACES-IV questionnaire, we hypothesize that

APD3 families tend towards a rigidly-disengaged family profile, and this points to a level of difficulty in these families. A similar conclusion can be drawn with regard to APD2 families (red dotted line), as they do not differ significantly in terms of disengagement and rigidity. The rigidly-disengaged family was identified in studies by Margasiński on the Polish general population [21,42] and also by Everri et al. [45] on Italian adolescents. Both studies found that in difficult situations, family members tended to become rigid in their attitudes, exercise excessive control, and impose strict rules – all at the expense of family cohesion. The rigidly-disengaged family is characterized by a lack of emotional closeness and support, leading to feelings of loneliness and misunderstanding within the family, as well as to difficulties in communicating feelings and needs [21,42].

Following Olson's model [6], family communication is linked to the formation of family bonds. Improved functioning in this area can be a starting point for changes in cohesion and flexibility, including of course in families of children with APD who are at risk of disengagement and rigidity in relationships and decision-making. It is worth noting that, regardless of the group of families of children with APD, the mothers thought that family communication remained at a similar average level (Table 6). This is a somewhat surprising result and requires further research. We still do not know how family communication is assessed among the balanced and midrange families of the Polish population [21,42]. Nevertheless, the level of family communication we observed was higher than that in families of children with delayed speech development [11] or with ASD [23,24].

In other dimensions of Olson's Circumplex Model – cohesion, flexibility, and communication – satisfaction with family life depends on how the family functions [21,42]. This also includes families where the child has a disorder, disability, or illness, as demonstrated, for example, in families with a deaf child [25]. In our study of APD families, satisfaction with family life also proved to be average relative to the norms for the general Polish population. Nevertheless, as noted above, there is still no data on the satisfaction of balanced or midrange families in Poland, a situation that also applies to the dimension of family communication [21,42]. The highest level we saw (high average) was from families in the APD1 group. Note also that these families also scored a high average in the other dimensions of family functioning.

Despite the high average scores, the level of family satisfaction as assessed by mothers of children with APD was generally lower (7 stens) than that obtained in other studies of Polish adults, mostly women, concerning family functioning, life satisfaction, and emotional intelligence [46]. This general consistency indicates that APD families are usually less satisfied with family life, a result also found in families where the child has ASD [47] or hearing loss [25].

We found that mothers of children with APD exhibited an average level of trait anxiety compared to the general Polish population [44], irrespective of APD1, APD2, or APD3. However, the level is higher than in parents of typically developing children found in other Polish studies

on parents of children with nephrotic syndrome [48]. This result is also supported by the reduced level of emotional stability in mothers of children with APD [49] in which the Big Five personality trait of emotional stability negatively correlated with anxiety [50]. We suggest that psychological interventions aimed at reducing anxiety should be offered to mothers of children with APD who report elevated levels of anxiety.

As the results indicate, lower anxiety traits co-occur with higher levels of Balanced Cohesion and Flexibility in families. On the other hand, the higher the intensity of trait anxiety, the higher were the levels of the three dimensions of family unbalance – disengagement, enmeshment, and chaos – with the exception of the dimension of rigidity of the family system (Table 6). The rigidity deserves comment. The rigidity dimension of all APD families was average, but it was higher than in the balanced and midrange families [21,42], as shown in Figure 1. No significant correlation was found between rigidity and the severity of anxiety in mothers of children with APD. Similarly to other studies, there was no association between rigidity and other psychological dimensions such as life satisfaction [25,46] or emotional intelligence [46], suggesting that family system rigidity is independent of individual psychological characteristics. The validity of the Rigidity scale in the FACES-IV/SOR questionnaire may be questioned too, implying that Rigidity may be measuring a construct other than the targeted one (that is, is the rigidity of the family system as perceived by family members).

Among the sociodemographic factors, the education level of the mothers of children with APD was found to play a significant role in terms of balanced cohesion, enmeshment, and chaos. Mothers with lower education levels belonged to families which functioned, in the mothers' view, with lower cohesion; these families also functioned with more enmeshment and chaos. A relationship between lower family cohesion and socioeconomic status (SES), a component of which is the parent's level of education, can be identified indirectly, in that we found that lower SES was associated with higher stress, lower parental availability, and limited access to developmental resources. Together these factors are expected to co-occur with lower cohesion, communication, and adaptability [51,52].

It remains something of a paradox, however, that other Polish studies on the functioning of family systems have not found such a relationship, even though they all followed Olson's Circumplex Model [11,23,25]. This implies that further research is required here. In resolving the paradox, the criterion we used to categorize mothers as having lower or higher education probably needs more scrutiny. In studies where no correlation between level of education and cohesion or flexibility was found, higher education was defined as having completed a bachelor's degree. We do not know whether the difference between a bachelor's and a master's degree is significant in terms of APD. Other limitations of our study include the manner in which families of children with APD were recruited – mothers were selected exclusively from those who participated in our Institute's rehabilitation programs of auditory training for APD children. These mothers may have been especially proactive and caring in taking action on

behalf of their children. The families studied lived in central Poland and therefore might have had better access to services for children with APD. Another limitation is that the source of information about comorbid conditions in children with APD was the mothers themselves, rather than the child's medical records.

Of course, a larger sample size would be better for identifying the types of families of children with APD according to Olson's Circumplex Model and for relating the findings to the broader Polish population [21,42]. As well as examining the validity of the Rigid scale from the FACES-IV-SOR questionnaire, the question of what level of satisfaction with family life characterizes balanced and mid-range families (considered to be "healthy families") needs to be addressed.

Conclusions

The results of the study show that APD in children, especially when accompanied by difficulties in speech and language development and/or articulation or other serious health problems, can modify the way their families function. In terms of Olson's Circumplex Model, the

impact primarily affects cohesion, so that there is an increase in disengagement. If there is a problem, it is advisable that the affected family receives some form of psychological diagnosis [53].

Mothers of children with APD who have lower levels of educational attainment, or show elevated levels of trait anxiety, also need psychological assistance. This would hopefully improve the functioning of the entire family system. For a start, psychological interventions need to focus on effective communication between family members, and thus on maintaining and strengthening emotional bonds and a sense of closeness.

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