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Comparing the Executive Functions of Mothers with and Without Autistic Children

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Abstract

Background: Measuring the executive functioning in parents of children with autism is a way to specify the role of different aspects of executive functioning in the etiology of autism.
Objectives: This study aimed to compare the executive functioning in mothers of children with and without autism.
Methods: Following a case-control design, this study was conducted on 60 people (mothers of children with (n = 30) and without autism (n = 30) referred to the welfare rehabilitation centers of Zahedan, South East of Iran, in 2017 (March to September). Participants were selected by convenience sampling techniques. Participants were assessed using the Cognitive Flexibility Inventory, cognitive emotion regulation questionnaire (Garnefski block design), digit span, and picture arrangement subscales of Wechsler Adult Intelligence (WAIS-IV) scale.
Results: Data analysis showed no significant difference between the executive functioning in mothers of children with and without autism ($P > 0.05$), except for other-blame that belongs to the emotional regulation subscale (from the executive function factors) ($P = 0.048$).
Conclusions: This study demonstrated that the parents of children with autism do not necessarily have executive functioning deficits. Therefore, it is necessary to consider other psychological and neuropsychological aspects in future studies.

Keywords: Autism, Emotion Regulation, Executive Function

1. Background

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by persistent deficiencies in social communication, behavioral patterns, and repetitive and limited interests or activities (1). The global prevalence of autism has increased significantly in recent years (2, 3). A comprehensive review estimated a global prevalence of 17 per 10,000 carriers (2). While the main symptom of autism is social failure (4), some researchers believe that failure in executive functions constitutes the main disorder of those who suffer from autism (5, 6). Executive functions are a set of processes that enable individuals to consciously control their behavior and thoughts with respect to their future goals (7). As crucial nerve structures, these functions are generally referred to as the high psychological processes involved in controlling and regulating the cognition, thinking, goal-oriented behavior, and anticipation functions (8, 9). Executive functions include impulse control, self-regulation, initiation, working memory, mental flexibility, ability to deal with new things, social thinking, sustained attention, etc. (10, 11).

Emotion regulation (ER) is a construct that may provide explanatory power for understanding the observed emotional and behavioral problems in ASD (12). Impaired ER has been associated with several disorders, including anxiety, mood disorders, borderline personality disorder, and ASD (13, 14). ER is conceptualized as an executive function that plays a role in regulating and inhibiting behaviors. While this executive function has a neurobiological basis, parents play a central role in the development of ER via soothing, organizing, and refocusing. Indeed, they enhance the development of more independent regulatory strategies in typically developing children (15).

Previous findings suggested that adolescents who rely on reappraisal may have more cognitive resources to help them remain attentive and well-regulated in their daily lives. On the other hand, if better executive functions facilitate the use of reappraisal, adolescents' ability to regulate

their emotions could potentially be enhanced via supports for executive functions (16). Parenting is a cognitive, emotional, and behavioral endeavor; Shaffer and Obradovic (17) reported that direct assessment of parent inhibitory control was positively associated with sensitive/responsive behaviors, whereas parent self-reported difficulties in using emotion regulation strategies were associated with lower levels of positive and collaborative dyadic behaviors. In addition, Hinnant et al. (18) indicated that children from more co-operative dyads, who possessed higher executive function skills, had higher moral reasoning scores than other children. Besides, they reported that children lower in both emotion regulation and executive function had lower moral reasoning scores than other children (18).

Many children with autism suffer from impaired executive function (19, 20). Measuring the executive functioning in parents of children with autism is a way to indicate aspects of executive functions, which may play an important role in the development of this disorder (21). Bolte and Poustka (22) investigated and compared executive functioning in parents of children with autism and schizophrenia and mental retardation and parents of healthy children. They found no statistically significant differences in the executive functioning between parents of children with autism and other parents (22). Another study, which compared the executive functioning of parents and siblings of autistic children and those with normal children, mentioned some weaknesses in some executive functioning abilities (e.g., planning) in parents and siblings of autistic children (23). Also, Moazzen et al. (21) investigated executive functioning of first-degree relatives of autistic patients and reported difficulties in inhibition and cognitive flexibility functions.

2. Objectives

Accordingly, the current study aimed to compare the executive functioning in mothers of children with and without autism.

3. Methods

The current descriptive and case-control study is approved by the ethical committee of Zahedan University of Medical Sciences. Informed written consent was obtained from all participants (code no.: 7889). The study population included all parents with autistic children referred to welfare rehabilitation centers of Zahedan, South East of Iran, in 2017 (March to September). The study sample consisted of 60 mothers who were selected by convenience sampling technique (30 mothers with autistic children and 30 mothers without autistic children). Those with a history of psychiatric disorders, head injury, or brain tumor were excluded from the study. Furthermore, participants were matched in terms of age, education, and culture of mothers, the order of birth, gender, and age of children. Demographic characteristics of mothers of children with and without autism are presented in Table 1.

Table 1. Demographic Characteristics of Mothers of Children with and Without Autism

Variable	No. (%)
Age, y	
Mothers	
25 - 30	28 (46)
31 - 35	16 (26)
36 - 40	4 (6)
41 - 45	8 (13)
46 - 50	4 (6)
Children	
2 - 5	24 (40)
6 - 10	32 (53)
11 - 15	4 (6)
Education	
Below high school diploma	2 (3)
High school diploma	4 (6)
Undergraduate	44 (73)
Graduate	10 (16)
Birth order of children	
First-born	32 (53)
Second-born	20 (33)
Third-born	8 (13)
Child's gender	
Boy	48 (80)
Girl	12 (20)

3.1. Instruments

3.1.1. Wechsler Adult Intelligence Scale (WAIS-IV)

This test includes some subscales such as digit span, block design, and picture arrangement, which are explained below.

3.1.1.1. Digit Span

In this test, participants hear a series of numbers, which starts from three-digit numbers and ends with nine-digit numbers and should repeat them. Two-digit sequences with different numbers are given to the participants. The total score is equal to the number of correct repetitions. The test ends after one mistake. The other form of

this test involves repeating the list of numbers in reverse order (24). In the present study, this test was used to measure working memory.

3.1.1.2. Block Design

This test features 9 colored cubes (white, red, and red-white). The participant must arrange the cubes at the specified time as required by Wechsler test. The sooner s/he makes the related arrangements, the greater will be the performance. This test is used to measure organization and problem-solving items (25).

3.1.1.3. Picture Arrangement

It contains 8 components arranged as a series of illustrated cards that tell a story when put in a certain order. The picture arrangement test intends to examine the social relationships (26).

These three tests are the subscale of the Revised Wechsler Adult Intelligence scale. The validity of these three subscales is reported between 0.76 and 0.97 (27).

3.2. Cognitive Emotion Regulation Questionnaire (CERQ)

This 36-item questionnaire intends to measure the subscale of cognitive-emotional regulation: self-blame, other-blame, rumination, catastrophizing, putting into perspective, positive refocusing, positive reappraisal, acceptance, and refocus on planning. In other words, it is designed to evaluate the cognitive strategies that each person uses after experiencing threatening events or life stresses (28). In Iran, reported Cronbach's alpha coefficient for the subscales of this questionnaire range from 0.76 to 0.92; and the values reported for Kendal's coefficient range from 0.81 to 0.92 (29).

The scoring method according to the Likert scale was as follows: never (1), rarely (2), sometimes (3), often (4), and always (5). The minimum score was 36, and the maximum score was 180. Based on the calculated scores, the cognitive emotion regulation rate was poor, medium, and strong (36 - 72, 72 - 108, and > 108, respectively).

3.3. Cognitive Flexibility Inventory (CFI) (Denis and Vander Wal)

The CFI contains two subscales and intends to measure cognitive flexibility. The alternatives and control subscale measures three aspects of cognitive flexibility: (A) the tendency to perceive difficult situations as controllable; (B) the ability to perceive multiple alternative explanations for life occurrences and human behavior; and (C) the ability to generate multiple alternative solutions to difficult situations. Each item is scored on a seven-point Likert scale (1 = strong disagree, 2 = disagree, 3 = slightly disagree, 4 = no idea, 5 = agree a bit, 6 = agree, and 7 = strong agree). The total score ranges from 20 to 140. The concurrent validity of the CFI was -0.39 as obtained by Beck Depression Inventory-II (BDI-II), and its convergent validity was 0.75 using the Cognitive Flexibility scale (CFS) proposed by Martin and Rubin (30). In Iran, Cronbach's alpha coefficient for the subscales and the whole questionnaire are reported at 0.90 and 0.71, respectively (27).

3.4. Data Collection

The participants were tested individually in a quiet room. Each day two participants were examined. First, the respondents answered CFI and CERQ. Then, the respondents had a break for 5 to 15 minutes. After the break, the Wechsler subscales, including block design, digit span test, and picture arrangement, were administered.

3.5. Statistical Analysis

Analysis of variance (ANOVA) test was used to perform intra-group and intergroup comparisons of executive functions. Data were analyzed using SPSS version 16. Statistical significance was considered when P-value < 0.05.

4. Results

Mean executive functioning scores (organization, problem-solving, cognitive flexibility, emotional adjustment, working memory, and Social relations) of mothers of children with and without autism are shown in Table 2. The results showed no significant difference between the executive functioning scores of parents of children with and without autism, as shown in Table 3 (P > 0.05). However, the evaluation of the organization and problem-solving components between the two groups showed marginally insignificant differences (P = 0.083). A significant difference was found in one of the factors of emotional regulation (i.e. other-blame), in which parents without autistic children had a higher score (P = 0.048).

5. Discussion

The purpose of this study was to compare the executive functions (e.g. organization, problem-solving, cognitive flexibility, working memory, and social relations) in parents of children with and without autism. According to the findings, there was no significant difference between mothers of children with and without autism concerning executive functions, except for other-blame.

Numerous studies reported that families with autistic disorder experience more stress than parents with typically developing children (31). It has been shown that parents with poor emotion regulation tend to perceive parenting responsibilities as more stressful than those with

Table 2. Mean and Standard Deviation of Cognitive Emotion Regulation Variables for Both Groups (Mothers with Autistic Children (Case Group) and Mothers Without Autistic Children (Control Group))

Cognitive Emotion Regulation Variables	Mean ± SD
Organization	
Case	23.37 ± 7.867
Control	26.80 ± 7.203
Problem-solving	
Case	23.37 ± 7.867
Control	26.80 ± 7.203
Cognitive flexibility	
Case	90.60 ± 14.642
Control	93.73 ± 11.659
Positive emotional regulation	
Case	46.37 ± 10.193
Control	47.30 ± 8.603
Negative emotional regulation	
Case	61.63 ± 12.732
Control	63.13 ± 11.181
Working memory	
Case	14.17 ± 3.705
Control	15.63 ± 3.605
Social relations	
Case	12.77 ± 4.546
Control	13.40 ± 5.117

better emotion regulation (32). This might be particularly true for parents of children with ASD as the stress associated with parenting these children is already overwhelming. In a study on parents of children with ASD, Ekas et al. (33) reported that mothers' and fathers' use of emotional support from their partners could highly predict their relationship satisfaction. Cognitive emotion regulation is useful when someone is confronted with unpleasant and stressful events. It is believed that the use of cognitive emotion regulation strategies such as rumination, thought suppression, reevaluation, and problem-solving may be an important diagnostic criterion in different forms of psychopathology (34). Salimi et al. (35) conducted a study to investigate the effectiveness of group-based acceptance and commitment therapy on cognitive emotion regulation strategies in mothers of children with autism. They asked the respondents to fill the cognitive emotion regulation questionnaire both before and after the intervention. Their results showed that group-based acceptance and commitment therapy had a significant effect on positive/planning strategy refocusing, positive reappraisal, self-blaming, and blaming others, considering a situation as disastrous, reception (35).

Kim et al. (36) reported an intergenerational association concerning the risk of ASD in executive function between mothers and children. In another study, Chico et al. (37) reported a significant correlation between the executive function of mothers and their children. Moreover, according to the literature, there is a gender-specific difference in the parent-reported executive functioning and adaptive behavior in children and young adults with ASD (38). Furthermore, some studies suggested that parents of autistic children might have a range of autism problems (39, 40).

Moazzen et al. (21) found that the relatives of patients with autism had poorer performance in terms of cognitive flexibility and inhibition than the control group. Wong et al. (23) demonstrated that the relatives of patients with autism had poorer cognitive flexibility and performance than the control group, while there was no significant difference between the two groups concerning inhibition. In the same vein, Hughes et al. (41) also investigated planning, cognitive flexibility, and working memory in the parents and siblings of patients with autism and then compared the results with the control group as well as parents and siblings of people who had other developmental disorders. They concluded that relatives of autistic people had poorer planning and cognitive flexibility as compared with the two groups; however, they mentioned no difference between the three groups concerning the spatial working memory and the capacity of working memory (41). Our results are not consistent with the mentioned findings.

This discrepancy can be attributed to the differences in the methodology adopted by each study. In the present study, Wechsler test subscales, CFI, and CERQ were used to measure executive functions, while the other studies had employed Wisconsin and Stroop tests. Also, the above-mentioned studies have been conducted on first-degree relatives of autistic patients, including parents and siblings, but this study was carried out on mothers with autistic children.

Given the considerable effects of cultural differences on many aspects of human development and personality, the findings of the present study are not an exception, so that one may explain the higher level of 'other-blame' in parents without autistic children by reference to such variations (42). As mentioned before, this study was performed in the city of Zahedan, whose inhabitants generally have more solid spiritual beliefs and interpret events and life experiences from a spiritual perspective. Hence, it can be speculated that people who grow in this cultural community are less likely to accuse and criticize others for various

problems. Because of the extreme and unusual nature of the incident or problem in question, they are less likely to hold others responsible, instead relate it to Providence.

It is necessary to mention some limitations of this study, including the small sample size. Besides, the current study was conducted in a homogenous population of Zahedan, in which the two groups (mothers with and without autistic children) were finely matched regarding the age, education, and culture of mothers, as well as the order of birth, gender, and age of children. Moreover, we evaluated six items of executive functions in the present study, while previous studies mostly used two or three items. Against some previous studies, we replaced the Denis and Vander Wal questionnaires instead of the Wisconsin card test. Because before the implementation of the study, we carried out a Wisconsin test on a group of students (medical, nursing, environmental health students, and staff of the Zahedan University of Medical Sciences) as well as uneducated people. We found that due to the complexity of test execution, the majority of participants were reluctant to take the test. Therefore in the current study, Denis and Vander Wal questionnaires were used in order to, firstly, avoid tiredness of participants tired and, secondly, interfering with the results of the test.

This study demonstrated that the parents (mothers) of children with autism did not have any impairment in their executive functioning abilities, and it is likely that parents who do not have an autistic child might experience such impairments because parents of children with autism had once children who did not have this disorder. As we could not find any similar study to compare the executive functions addressed in the present study (e.g. as organization, problem-solving, emotional regulation, and social relations), it is recommended to perform further studies in this field.

Future studies, with a larger sample size, are needed to extend our knowledge. Also, considering both parents will provide considerable biological-psychological-cultural information for assessing variations among study participants.

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Footnotes

Authors' Contribution: Drafting of the manuscript, analysis and interpretation of data, critical revision of the manuscript for important intellectual content, statistical analysis: NM. Study concept and design: N.B. Drafting of the manuscript, statistical analysis: JSY.

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Table 3. Results of ANOVA for Cognitive Emotion Regulation Variables Between Groups, Intergroup, and Total Participants

Cognitive Emotion Regulation Variables	SS	df	MS	F	Sig
Organization				3.108	0.083
Between groups	176.817	1	176.817		
Intergroup	3299.767	58	56.893		
Total	3476.583	59			
Problem-solving				3.108	0.083
Between groups	176.817	1	176.817		
Intergroup	3299.767	58	56.893		
Total	3476.583	59			
Cognitive flexibility				0.841	0.363
Between groups	147.267	1	147.267		
Intragroup	10159.067	58	175.156		
Total	10306.333	59			
Working memory				2.414	0.126
Between groups	32.267	1	32.267		
Intragroup	775.133	58	13.364		
Total	807.400	59			
Social relations				0.257	0.614
Between groups	6.017	1	6.017		
Intragroup	1358.567	58	23.424		
Total	1364.583	59			
Positive emotional regulation				0.147	0.703
Between groups	13.067	1	13.067		
Intragroup	5159.267	58	88.953		
Total	5172.333	59			
Negative emotional regulation				0.235	0.630
Between groups	33.750	1	33.750		
Intragroup	8326.433	58	143.559		
Total	8360.183	59			
Self-blame				0.432	0.514
Between groups	6.017	1	6.017		
Intragroup	807.633	58			
Total	813.650	59	13.925		
Acceptance				0.156	0.695
Between groups	1.667	1	1.667		
Intragroup	620.733	58	10.702		
Total	622.400	59			
Rumination				0.184	0.669
Between groups	2.017	1	2.017		
Intragroup	634.567	58	10.941		
Total	636.583	59			
Positive refocus				0.931	0.339
Between groups	11.267	1	11.267		
Intragroup	701.667	58	12.98		
Total	712.933	59			
Planning refocus				0.005	0.947
Between groups	.67	1	0.67		
Intragroup	857.867	58			
Total	857.933	59	14.791		
Positive reappraisal				0.641	0.427
Between groups	9.600	1	9.600		
Intragroup	868.733	58			

Total	878.333	59	14.978		
Putting into perspective				0.083	0.774
Between groups	1.067	1	1.067		
Intragroup	744.933	58	12.844		
Total	746.000	59			
Catastrophizing				1.665	0.202
Between groups	20.417	1	20.417		
Intragroup	711.233	58	12.263		
Total	731.650	59			
Other-blame				4.093	0.048
Between groups	64.067	1	64.07		
Intragroup	907.867	58	15.653		
Total	971.933	59			