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Research Article

The Effectiveness of Psychosocial Intervention on Internalized Stigma and Quality of Life in Parents of Children with Autism Spectrum Disorder

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Abstract

Background: Improving parental awareness and skills regarding autism spectrum disorder (ASD) can ease caregiving challenges and mitigate stigma-related stress in mothers.

Objectives: This study aimed to evaluate the effectiveness of a psychosocial intervention on internalized stigma and quality of life among parents of children with autism.

Methods: This quasi-experimental study utilized a pre-test and post-test design with a control group and a two-month follow-up. Targeting parents of children with ASD in Tehran, diagnosed at least four years prior, 30 parents were conveniently sampled and randomly matched by child age into experimental and control groups. The sample size was estimated based on previous studies and statistical power calculations, resulting in 15 participants per group. Parents aged 25 - 50, children aged 3 - 12 with a confirmed autism diagnosis at least four years prior, and willingness to participate were eligible criteria. Participants were excluded if they missed more than two sessions or had recent involvement in similar programs within the past six months. The experimental group underwent 10 psychosocial intervention sessions, while the control group received only necessary rehabilitative services. Assessments were conducted using the World Health Organization Quality of Life Scale (WHOQOL-100) and an Internalized Stigma Questionnaire (ISQ) at three intervals, with data analyzed using SPSS version 25 through analysis of covariance (ANCOVA) and repeated measures ANOVA.

Results: Participants averaged 40.3 ± 9.85 years, with no significant age differences between groups, and their children's mean age was 10.17 years. The ANCOVA revealed significant improvements in internalized stigma and overall quality of life in the experimental group post-intervention, with 27% and 23% of variance explained, respectively. Effect sizes indicated that participation accounted for 23%, 16%, and 43% of the variance in psychological health, social relationships, and environment domains. Repeated measures ANOVA confirmed significant group and time effects on internalized stigma and quality of life, with 61% and 12% of variance attributable to the intervention. Only the social relationships subscale showed significant differences ($P < 0.05$), explaining 15% of its variance; other subscales showed no significant change. Other subscales, including physical health, psychological health, and environment, did not exhibit significant differences ($P > 0.05$).

Conclusions: The psychosocial intervention program significantly improves stigma perception and quality of life for parents of children with ASD, offering strategies to cope with autism-related challenges effectively.

Keywords: Autism, Psychosocial Intervention, Quality of Life, Stigma

1. Background

Autism spectrum disorder (ASD) is classified in the DSM-5-TR as a neurodevelopmental condition marked by challenges in social interaction, communication, and repetitive behaviors. The prevalence of ASD has been on the rise globally, currently estimated at approximately 1 in 36 live births (1). In Iran, this rate closely mirrors the

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global figures, implying that nearly 790,000 individuals may require varying levels of support, based on a 1% lifetime prevalence and the country's 2016 population of over 79 million (2).

Despite increasing awareness, the diagnosis process remains primarily clinical, lacking definitive biological markers, which can influence diagnostic accuracy and add stress for families navigating uncertain and complex pathways. The genetic underpinnings of autism remain contentious, creating added complexity for parents and caregivers, who often face significant emotional and logistical challenges following an ASD diagnosis. These challenges may result in varied responses, including the need to seek specialized support services and modify educational environments for their children (3).

Caregiving for children with ASD is associated with elevated stress levels and compromised psychological well-being (4, 5). Underlying these challenges is the persistent social stigma surrounding autism, rooted in outdated perceptions of social withdrawal, which continues to impede social integration and exacerbate parent distress (6). This stigma manifests as negative societal beliefs, leading to social rejection, and can internalize into self-stigmatization, where individuals and parents perceive themselves negatively due to societal judgments (7, 8). The public's critical responses to children's behaviors can further isolate parents, fueling this cycle of shame and social withdrawal (9).

Given the increasing prevalence of autism and the detrimental impacts of stigma on parental well-being and family quality of life, there is a pressing need for targeted interventions. Evidence suggests that psychosocial programs — integrating education, cognitive restructuring, narrative sharing, and empowerment — can mitigate internalized stigma and enhance resilience (10).

Psychosocial interventions emerge as instrumental in equipping parents with the necessary tools to face these challenges. These interventions, rooted in social support, emotional regulation, and personal empowerment frameworks, hold promise for improving parental functioning. Despite strong evidence supporting psychosocial approaches worldwide to reduce stigma and enhance parental resilience (10), there remains a critical lack of culturally tailored programs that address the specific needs and social context of Iranian mothers of children with autism. These mothers often face compounded social and emotional challenges, and existing interventions do not adequately resonate with local cultural norms or directly target internalized stigma to improve their quality of life.

Addressing this gap is essential for developing effective support systems within Iran that can mitigate internalized stigma and promote family functioning, which is the primary motivation for this study's goal to design and evaluate a culturally appropriate psychosocial intervention aimed at empowering these mothers.

2. Objectives

By providing these mothers with practical strategies to combat internalized stigma and enhance their overall well-being, this study aims to contribute to both the academic literature and practical applications in supporting families affected by autism. Its findings will inform future interventions and foster a supportive environment for both children with autism and their caregivers.

3. Methods

The present study employed a quasi-experimental design incorporating a pre-test, post-test, and a control group, along with a two-month follow-up. The study population comprised all parents of children with autism in Tehran during the 2023 - 2024 academic years. The minimum sample size was determined using the formula below, supported by similar studies (11, 12), resulting in 13 participants per group. To account for a 15% dropout rate, 15 individuals were randomly allocated for each of the experimental and control groups, totaling 30 participants. The sample size calculation was based on the following parameters: Type I error probability (α) = 0.05; statistical power ($1 - \beta$) = 0.80; with the formula:

$$n = 2\frac{(1.96 + 0.84)^2 0.31^2}{(2.44 - 2.09)^2} = 12.56 \approx 13$$

This formula uses the specified values and yields approximately 13 participants per group. Participants were recruited through convenience sampling at the Autism Rehabilitation Center in Tehran, adhering to specific inclusion criteria — such as the willingness to participate, having at least one child diagnosed with autism (the children's diagnoses were confirmed through psychiatric diagnostic interviews conducted at the time of their initial visit to the rehabilitation center), parental age between 25 and 50 years, child's age between 3 and 12 years, and a minimum of four years since diagnosis — and exclusion criteria like missing more than two intervention sessions or participation in similar programs within the past six months.

The study sample size was relatively small (n = 30), and the non-randomized sampling approach and limited sample size could affect the generalizability of the findings and introduce ambiguity in the results. Parents were matched based on their children's ages and randomly assigned to either the experimental or control group. In this study, none of the fathers expressed willingness to participate. All participating parents were mothers of the children, both in the experimental and control groups.

The study assessed quality of life and parental stigma at three points: Pre-intervention, post-intervention, and two months after intervention, using the World Health Organization Quality of Life (WHOQOL) Scale and the Internalized Stigma Scale. The severity of the children’s symptoms and the overall stress levels of the mothers and families were not evaluated during the study. The experimental group participated in a psychosocial intervention consisting of 10 weekly sessions (each lasting 75 minutes), while the control group continued with standard rehabilitation services. To prevent information exchange, groups were scheduled at different times, and parents were instructed to focus solely on their experiences during sessions without providing advice to others.

The researcher implemented the sessions and collected questionnaires, while a trained research assistant, unaware of group assignments, scored the questionnaires. Post-intervention assessments were conducted using the Internalized Stigma Questionnaire (ISQ) and the Quality-of-Life Questionnaire. Ethical considerations were upheld by subsequently presenting the intervention content to the control group in a 100-minute session.

The primary outcomes of the study were measures of quality of life and internalized stigma, assessed using the World Health Organization Quality of Life Scale (WHOQOL-100) and ISQ at pre-, post-, and two-month follow-up. Secondary outcomes, such as children’s symptom severity and family stress levels, were not evaluated. Data were gathered through the utilization of the WHOQOL-100 and the ISQ.

3.1. World Health Organization Quality of Life Scale

In 1991, the World Health Organization (WHO) introduced the WHOQOL-100, a 100-item questionnaire designed to standardize quality of life assessments in research. In response to the need for brevity, the WHOQOL-BREF was developed in 1996, condensing the original tool to 26 items. This shorter version evaluates four domains: Physical health (7 items), psychological health (6 items), social relationships (3 items), and environment (8 items), alongside 2 overall quality of life items. Each question is rated using a five-point Likert scale, from 1 (not at all) to 5 (very much), with inverse scoring for items 3, 4, and 26. Higher scores signal better quality of life in each domain. The WHOQOL-BREF has demonstrated scores comparable to the WHOQOL-100, exhibiting a discriminative validity of 0.96, and internal consistency with Cronbach’s alpha values of 0.82 for physical health, 0.81 for psychological health, 0.68 for social relationships, and 0.80 for the environment. A study in Tehran assessed the Persian version's validity and reliability across 1,167 participants, revealing satisfactory reliability (Cronbach's alpha > 0.70), except for social relationships (0.55), confirming its appropriateness for use in both healthy and clinical populations (13, 14).

3.2. Internalized Stigma Questionnaire

The ISQ was developed by Rezaei Dehnavi and Hemati Alamdarloo (15) through an extensive review of stigma theories, consultations with parents and autism experts, and adaptations of existing scales, including the Chinese version for parents of children with autism and the Internalized Stigma Scale for mothers of children with Down syndrome. This questionnaire, tailored for Iranian cultural contexts, comprises 49 items scored on a five-point Likert scale (0 to 4), ranging from "never" to "always". Higher scores reflect a greater degree of internalized stigma, with total scores possible from 0 to 156, as there is no predetermined cutoff. The questionnaire evaluates two attitudinal domains: Belief in stereotypes held by others about autism and belief in one's own stereotypes regarding autism. It also assesses a behavioral domain related to social separation and discrimination behaviors towards individuals with autism. Combined scores across these domains yield an overall internalized stigma score, indicating the severity of stigma. Reliability analysis showed high Cronbach's alpha coefficients: 0.96 for attitudinal domains, 0.87 for the behavioral domain, and 0.93 for the overall questionnaire, resulting in a total reliability of 0.97 (15).

3.3. Psychosocial Intervention Protocol

The psychosocial intervention protocol in this study is an adaptation of the Stigma of Life Intervention for parents of children with autism (SOLACE) (16). This short-term program, initially comprising eight sessions, is grounded in psychosocial support and incorporates group discussions, video clips, and parent experience sharing. After consultations with psychology experts, it

Table 1. Psychosocial Intervention Program Content by Session

Sessions	Main Goal	Key Topics and Techniques	Activities
1	Introducing autism and address stereotypes	Autism overview, cultural beliefs, stigma	Group discussion
2	Recognizing and confronting stigma	Personal experiences, labeling	Sharing stories and discussion
3	Fostering parental self-respect	Caregiving changes, visual aids	Video viewing and discussion
4	Building resilience and reduce social isolation	Examples of stigma situations	Group sharing and discussion
5	Highlighting importance of social support	Types of formal/informal support	Support awareness activities
6	Promoting self-compassion and acceptance	Self-kindness techniques	Group discussion and experience sharing
7	Expanding coping skills for stigma	Thought cycles, misconceptions, forgiveness	Interactive discussion and role-playing
8	Preventing internalized stigma	Acceptance/resistance strategies	Group dialogue
9	Improving understanding of others' perceptions	Raising awareness, response strategies	Challenging discussion
10	Empowering and planning for disclosure	Self-esteem, support network	Summary, discussion on disclosure and support

was enhanced to include ten sessions, integrating components focused on quality of life and mental health for parents. The content of the psychosocial intervention sessions, detailed in Table 1, is provided separately.

3.4. Statistical Analysis

For descriptive analysis of quantitative data, frequencies, percentages, means, and standard deviations were calculated. Normality was evaluated using the Shapiro-Wilk test. Repeated measures ANOVA was employed to analyze pre-test, post-test, and follow-up scores within both groups. A significance level of 0.05 was adopted. Data analysis was performed using SPSS version 25. To test the hypotheses, one-way and multivariate analysis of covariance (ANCOVA) models were utilized to control for pre-test effects, while repeated measures ANOVA was applied during follow-up assessments to evaluate the durability of the intervention's effects. A Bonferroni post-hoc test was conducted to further analyze group effects across time points.

4. Results

The mean age of participants was 40.26 ± 9.85 years, with the experimental group averaging 39.33 ± 9.15 years and the control group 41.22 ± 10.09 years. An independent *t*-test confirmed no significant age difference between groups [t (49) = 2.49; $P > 0.05$], indicating they were age-matched. The mean age of children among all parents was 10.17 ± 3.48 years, with the experimental group averaging 10.19 ± 3.52 years and the control group 10.13 ± 3.41 years. An independent *t*-test also showed no significant difference in children's ages [t (19) = 1.19; $P > 0.05$]. Descriptive statistics for internalized stigma and quality of life variables for both groups at pre-test, post-test, and follow-up are detailed in Table 2.

The normality test for all variables indicated significance levels greater than 0.05, confirming the assumption of normal distribution. Multicollinearity analysis showed no significant linear correlation between internalized stigma and quality of life at the 0.05 level, validating the absence of multicollinearity. Levene’s test for homogeneity of variances across pre-test, post-test, and follow-up stages revealed non-significant F-values ($P > 0.05$) for all variables, upholding this assumption.

To evaluate the hypothesis that the psychosocial intervention improves internalized stigma and quality of life in parents of children with ASD, ANCOVA was conducted, with results detailed in Table 3.

Results from Table 3 and the F-statistic indicate that internalized stigma levels significantly improved in the experimental group after intervention sessions compared to the control group, with 27% of the variance attributed to the intervention ($P < 0.001$). Additionally, quality of life subscales showed significant associations: 23%, 16%, 43%, and 23% of the variance in psychological health, social relationships, environment, and general quality of life, respectively, were linked to the psychosocial intervention, while physical health showed no significant change ($P > 0.05$).

Assumptions for repeated measures ANOVA were validated, with no outliers and normal distribution indicated by the Shapiro-Wilk test ($P > 0.05$). Mauchly’s Sphericity assumption was unmet, necessitating Greenhouse-Geisser correction. Repeated measures ANOVA was utilized to compare internalized stigma and quality of life across groups and time points, as detailed in Table 4.

The results in Table 4 indicate significant differences in mean internalized stigma and overall Quality of Life

Table 2. Descriptive Statistics of Internalized Stigma and Quality of Life for the Experimental and Control Groups at Pre-test, Post-test, and Follow-up [a,b]

Variables	Experimental Group	Control Group	K-S
Stigma			
IS			
Pre-test	53.33 ± 63.33	47.24 ± 67.67	0.06
Post-test	50.93 ± 58.73	47.22 ± 68.80	0.07
Follow-up	47.69 ± 53.60	47.42 ± 69.60	0.07
Quality of life			
Phy H			
Pre-test	2.597 ± 16.20	2.23 ± 14.87	0.09
Post-test	10.26 ± 21.67	8.15 ± 20.60	0.20
Follow-up	9.99 ± 21.07	7.78 ± 19.93	0.20
Psych H			
Pre-test	3.20 ± 14.33	2.49 ± 12.33	0.11
Post-test	2.69 ± 18.33	1.76 ± 15.40	0.05
Follow-up	2.81 ± 17.80	2.15 ± 15.07	0.06
SR			
Pre-test	1.10 ± 6.27	1.18 ± 6.40	0.05
Post-test	3.14 ± 11.80	1.75 ± 9.07	0.06
Follow-up	3.20 ± 11.13	1.44 ± 8.47	0.05
Env			
Pre-test	5.44 ± 25.07	1.71 ± 27.27	0.15
Post-test	8.77 ± 23.40	1.14 ± 28.13	0.20
Follow-up	8.61 ± 22.60	1.36 ± 28.07	0.05
GQOL			
Pre-test	1.39 ± 4.93	0.64 ± 4.47	0.05
Post-test	1.45 ± 5.60	0.83 ± 4.40	0.06
Follow-up	1.64 ± 5.40	0.83 ± 4.40	0.06

Abbreviations: M, mean; SD, standard deviation; K-S, Kolmogorov-Smirnov; IS, internalized stigma; Phy H, physical health; Psych H, psychological health; SR, social relationships; Env, environment; GQOL, general quality of life.

[a] Values are expressed as mean ± SD.

[b] The mean difference is significant at the 0.05 level.

scores between the experimental and control groups at pre-test, post-test, and follow-up stages ($P < 0.001$). Effect sizes suggest that 61% and 12% of the variance in internalized stigma and overall quality of life in the experimental group, respectively, are attributable to the psychosocial intervention. Notably, only the social relationships subscale showed significant differences ($P < 0.05$), with 15% of its variance linked to the intervention. Other subscales, including physical health, psychological health, and environment, did not exhibit significant differences ($P > 0.05$).

A Bonferroni post-hoc test was conducted to further analyze group effects across time points (Appendix 1 in the Supplementary File). Appendix 1 revealed significant differences in internalized stigma and quality of life between groups, except for the environment domain and general quality of life.

5. Discussion

This study aimed to assess the effectiveness of psychosocial interventions on internalized stigma and quality of life among parents of children with ASD. The findings revealed a significant reduction in internalized stigma among parents participating in the interventions. This supports previous research by Lodder et al. (12), which suggested that psychosocial interventions enhance resilience against stigma, thereby improving mental health and decreasing internalized stigma among caregivers of children with autism. Such interventions foster cognitive and behavioral changes, allowing individuals to replace irrational beliefs with realistic ones, leading to a decrease in maladaptive behaviors and an increase in self-efficacy. This mechanism empowers parents to

Table 3. Results of Analysis of Covariance Examining Differences Between the Experimental and Control Groups Regarding Internalized Stigma and Quality of Life

Variables	MS	F-Statistic	P-Value	Effect Size
Stigma				
IS				
Pre-test	31859.734	63.836	< 0.001	0.703
Group	4862.695	9.743	0.004	0.265
Quality of life				
Phy H				
Pre-test	63.139	0.287	0.401	0.026
Group	24.873	0.287	0.597	0.011
Psych H				
Pre-test	63.139	0.729	0.401	0.026
Group	39.95	8.19	0.01	0.233
SR				
Pre-test	7.726	0.623	0.437	0.023
Group	61.180	4.936	0.035	0.155
Env				
Pre-test	640.698	17.933	< 0.001	0.399
Group	43.343	1.213	0.280	0.043
GQOL				
Pre-test	23.658	41.101	< 0 .001	0.604
Group	4.604	8.00	0.009	0.229

Abbreviations: MS, mean of squares; IS, internalized stigma; Phy H, physical health; Psych H, psychological health; SR, social relationships; Env, environment; GQOL, general quality of life.

Table 4. Results of Repeated Measures ANOVA for Comparing Mean Internalized Stigma and Quality of Life (and Its Subscales) Between the Experimental and Control Groups at Pre-test, Post-test, and Follow-up

Variables	SS	df	MS	F-Statistic	P-Value	Effect Size	Power of Test
IS							
Time	7055.289	2	114.54	19.57	< 0.001	0.41	1
Time × group	510.47	2	255.23	43.61	< 0.001	0.61	1
Phy H							
Time	564.29	1.01	557.57	8.82	0.01	0.24	0.96
Time × group	0.29	1.01	0.29	0.005	0.95	< 0.001	0.05
Psych H							
Time	222.82	1.18	188.18	34.75	< 0.001	0.55	1
Time × group	3.62	1.18	3.06	0.57	0.49	0.02	0.14
SR							
Time	292.29	1.12	260.26	35.65	< 0.001	0.56	1
Time × group	40.16	1.12	35.76	4.90	0.03	0.15	0.78
Env							
Time	10.42	1.05	9.94	0.44	0.52	0.02	0.12
Time × group	44.07	1.05	42.02	1.88	0.18	0.06	0.37
GQOL							
Time	1.40	2	0.7	2.59	0.08	0.09	0.49
Time × group	2.16	2	1.08	3.99	0.02	0.12	0.69

Abbreviations: SS, sum of squares; df, degree of freedom; MS, mean of squares; Phy H, physical health; Psych H, psychological health; SR, social relationships; Env, environment; GQOL, general quality of life.

adopt more effective coping strategies for stigma-related challenges (17).

Participants developed skills to identify stigma-reinforcing situations, seek support, and better understand their child's needs, which improved their self-perception and acceptance (18). Ultimately, these interventions enabled parents to manage stigma more effectively by modifying their perspectives and enhancing their psychosocial capacities.

The second research finding revealed that overall quality of life scores for parents of children with ASD improved following psychosocial intervention. This aligns with findings from several studies (19-21), which suggest that psychosocial interventions enhance parents' adaptive coping mechanisms, thereby reducing emotional distress (22). Increased parental engagement in these interventions correlates with improved quality of life, as evidenced by a systematic review highlighting better outcomes for parents involved in psychosocial programs for children with ASD (23).

While the observed effect size in this study was modest, several factors warrant consideration. The statistical method employed compared pre- and post-intervention changes between experimental and control groups, a conservative approach that minimizes bias compared to methods solely comparing post-intervention scores. Additionally, limitations on the number of intervention sessions made large effect sizes unrealistic. Parents reported enhanced well-being and understanding of their circumstances post-intervention, consistent with findings from Merriman et al. (24) and Moghtader et al. (25), which demonstrated improvements in psychological health, social relationships, and environment subscales. However, changes in physical health did not reach statistical significance, mirroring previous research outcomes.

The current study found that psychosocial interventions significantly enhance the psychological health of parents with children diagnosed with ASD, aligning with existing literature (26, 27). Contrarily, one research (28) indicated that mothers experiencing higher levels of internalized stigma reported increased anxiety and depression, thereby worsening their psychological well-being. Given the rising prevalence of ASD, parents face escalating challenges in various domains, highlighting the potential value of psychosocial interventions in improving their mental health and resilience (29). These interventions may bolster capacities and coping strategies while fostering supportive relationships, ultimately influencing parent-child dynamics and safeguarding the child's future psychological health (17).

The current study found that participation in psychosocial intervention sessions significantly improved the social relationships of the experimental group compared to the control group, consistent with prior research (26, 30). However, the findings contrast with one study (31), which indicated that while initial improvements in social relationships occur, challenges in mothers' social environments persist long-term. This suggests that while psychosocial interventions improve parents' social skills and coping strategies, structural issues — such as insufficient support and societal stigma — may impede lasting change. Comprehensive interventions addressing these barriers could enhance long-term effectiveness.

The next finding showed that the environment domain of quality of life for parents significantly improved after participation in intervention sessions. This finding aligns with some studies (32, 33). In low- and middle-income countries like Iran, 44% of autism interventions are parent/caregiver mediated, primarily targeting children aged 2 - 10, which positively affects developmental trajectories. Meta-analyses show small but significant improvements in parent-child interactions, and evidence suggests greater benefits for parents, including reduced stress and enhanced competence (33).

The findings of this study revealed that psychosocial interventions did not lead to significant improvements in the physical health impacting the quality of life of mothers with children diagnosed with ASD, consistent with previous research (24-26). Shafiee and Mohajerani (30) similarly noted that while psychosocial training enhanced mental health, physical health remained unchanged. This limited effect may stem from the long-term difficulties of caregiving for children with ASD, alongside parenting-related stress. The lack of significant impact of the psychosocial intervention on physical health may be attributed to two factors: (1) The long-term challenges of caring for a child with ASD, and (2) parenting-related stress.

The reported findings suggest that challenges related to the physical health and well-being of parents may arise due to limited access to environmental, social, and economic resources. Consequently, it is not surprising that participation in a psychosocial intervention program might yield highly variable access to these resources (30). A key limitation of this study is the use of non-randomized sampling and a relatively small sample size, which may limit the generalizability of the findings. Additionally, the study did not evaluate potential adverse effects or harms associated with participation, an important consideration for future research.

Several confounding variables — such as parental education level, socioeconomic status, and the number of children — were not accounted for, potentially influencing the outcomes. Moreover, the absence of stratification based on factors like the severity of internalized stigma, children's symptom severity, and family stress levels further restricts the applicability of the results, as these variables were not assessed. To build on these findings, future studies should employ larger, randomized samples and incorporate relevant mediating and confounding factors. Doing so would enhance the accuracy, robustness, and external validity of the results.

5.1. Conclusions

Based on the findings obtained, it can be concluded that stigma can impart significant psychological and social costs to individuals with ASD, as well as to their families and communities. It appears that increasing support for caregivers and parents of children with autism may enable them to employ more effective coping strategies when faced with stigma, thereby improving their ability to manage these challenges. Given that psychosocial interventions have been shown to enhance the internalized stigma, quality of life, psychological well-being, and social relationships of parents who have children with autism, it seems essential to implement empowerment programs for these parents. Such programs could facilitate a better response to the challenges associated with autism, allowing parents to adopt more adaptive strategies for establishing social relationships and receiving environmental support.

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Supplementary Material

Supplementary material(s) is available here [To read supplementary materials, please refer to the journal website and open PDF/HTML].

Footnotes

Authors' Contribution: Conceptualization: F. G. D., M. P. T., and M. V.; Methodology: F. G. D., M. P. T., and M. V.; Validation: F. G. D., M. P. T., and M. V.; Analysis: F. G. D., M. P. T., and M. V.; Investigation: F. G. D., Writhing-original draft: F. G. D. and M. P. T.; References: F. G. D. and M. P. T.; Writing-review and editing: F. G. D. and M. P. T.; Supervision: M. P. T. and M. V.

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