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The mediating role of parent stress in the relationship between children's emotion dysregulation and ADHD risk: a pilot study

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Abstract

Despite the well-known link between earlier children's emotional dysregulation and their high risk of developing later ADHD symptoms, few studies investigated the relationships between positive and negative emotion dysregulation, on the one hand, and ADHD symptoms, on the other one, via parent stress. This pilot study aimed to investigate the mediating role of parental stress on the relationship between children's positive and negative emotion dysregulation and ADHD risk indices. A sample of 62 children (Female = 38.2%; M = 65.90 months; SD = 3.8) was rated by one of their parents (i.e., mothers), using the subscales of the Italian Temperament Questionnaire (QUIT; i.e., positive and negative emotionality) and the subscales of Conners' Parent Rating Scale-Revised (CPRS; i.e., hyperactivity and inattentions deficit). Furthermore, parents reported their stress levels by completing the Parenting Stress Index—Short Form (PSI-SF) self-report. Findings show the mediating role of parental stress on the relationship between negative emotion dysregulation and both measures of ADHD symptoms (hyperactivity/impulsivity and inattention deficit).

Highlights

- Child's negative emotion dysregulation and ADHD symptoms are connected.
- Parent stress mediates the relationships between children's negative emotion dysregulation and hyperactivity/impulsivity symptoms.
- Parent stress mediates the relationships between children's negative emotion dysregulation and inattention deficit.

Keywords Emotion dysregulation, ADHD · Hyperactivity · Inattention · Parent stress

Introduction

Emotion regulation (ER) comprises behaviors, skills, and strategies, whether conscious or unconscious, automatic or effortful, that serve to modulate, inhibit, and enhance emotional experiences and expressions (Calkins & Hill, 2007, p. 229). Moreover, ER encompasses emotional reactivity to internal and external stimuli (Gross, 2013), bringing together reactive and control dimensions. Thus, ER is a multi-component process characterized by long development during the first twenty years of an individual's life and the role played by socialization processes occurring in the developmental environment (e.g., Beauchaine, 2015). For some children, the development of ER can encounter difficulties, both due to organic and environmental factors, to the point of emotion dysregulation.

According to Beauchaine, emotion dysregulation is a pattern of emotional experiences or expressions that are

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experienced either too intensely or too enduringly to be adaptive (Beauchaine, 2015, p. 876). Emotion dysregulation (ED) refers to children's difficulty managing positive emotions (PE) and negative emotions (NE) (e.g., Nigg, 2022; Vogel et al., 2022). PE dysregulation refers to the excessive and context-inappropriate expression of positive emotions, such as hyperexcitability, strong desires, and wills, that may lead to impulsive actions. In this case, scholars agree to speak of emotional exuberance (e.g., Beauchaine, 2015; Ravi et al., 2022; Vogel et al., 2019). In contrast, NE dysregulation refers to expressions of irritability, anger, or discontent. In both cases, children react to specific situations that elicit high-intensity negative or positive emotions. Despite being two distinct domains, the two emotional expressions, positive and negative, maintain close relationships and mutually influence each other (Zisner & Beauchaine, 2016; Usai et al., 2007). For instance, the desire to achieve a goal, if hindered or prevented by external events, can transform positive excitement into aggression and anger (Nigg, 2022; Rothbart et al., 2011).

Although extreme irritability (i.e., expression of dysregulation of negative emotions) is considered a robust factor for many negative behavioral and developmental outcomes (Vogel et al., 2019, p. 2), current evidence also shows the decisive role played by excessive levels of positive emotions. When positive emotions reach a state of exuberance, they do not constitute adaptive factors for children (e.g., Silverman et al., 2022). For instance, the high intensity of positive emotions (exuberance emotionality) at 5 years old positively correlates with anger and aggression, predicting later external behavioral problems (e.g., Deater-Deckard et al., 2010; Deveney et al., 2013; Rydell et al., 2003). Compelling evidence supports the predictive role of dysregulation of positive emotions in subsequent negative outcomes, like attention deficit and hyperactivity disorder (ADHD) (e.g., Nigg, 2022; Nigg et al., 2004, 2020; Plicta & Scheres, 2014).

Well-documented data show that children's ADHD symptoms impact parents' emotional experience with their children's care. Effectively, a child's ER affects the parent-child relationship and socialization process quality (Clark et al., 2000; Godleski et al., 2020; Rothenberg et al., 2019; Shenaar-Golan et al., 2017; for review, see Breaux et al., 2022). Parenting stress is an aversive psychological reaction to the demands of being a parent (Deater-Deckard, 1998, p. 315). Concerning parents of children with ADHD, findings support a higher risk of parental stress than parents of children without ADHD symptoms (Ben-Naim et al., 2019; Das et al., 2012; Friedrichs et al., 2012; McLaughlin & Harrison, 2006; Theule et al., 2011). They may struggle with managing their own emotions, such as frustration and irritability, resulting from the daily challenges and demands (e.g., managing impulsive behaviors, difficulty with attention and organization, and emotional reactivity) of their children with ADHD symptoms. When parents experience high stress levels, they are less accessible to their children, which may enhance their children's negative outcomes (Craig et al., 2016, 2017; Leitch et al., 2019; for a review, see Martin et al., 2019). Moreover, even though genetics and biological characteristics are central to ADHD development (Scassellati et al., 2012), research indicates that parenting may contribute to determining the developmental course of ADHD (Epstein et al., 2000; Nigg & Hinshaw, 1998; Nigg et al., 2004; for a meta-analysis, see Cheung & Theule, 2016).

The mediator role of parenting stress

Due to the literature above, a child's emotion dysregulation (both positive and negative) emerges early in development and can predict later ADHD symptoms. On the other hand, children acquire their ER through socialization in their developmental environment, which may cause ER dysregulation. More specifically, Winters (2012) supports the hypothesis that how parents react to their children's emotion dysregulation may contribute to their later ADHD symptoms. Stress may imply an emotional and behavioral response on the part of the individual to some unpleasant event, and typically, the reaction involves some degree of distress, negatively affecting the subject's subsequent behavior and functioning. According to longitudinal studies, parents' excessive responses to their children's non-cooperative behaviors may generate a vicious circle and exacerbate ADHD symptoms (Drabick et al., 2008; Nagy et al., 2018; Soleimani et al., 2020; Umemura et al., 2015). Theule et al. (2013) argued that parents of children with ADHD perceive their children as significantly more complex than parents of children with other clinical disorders. Furthermore, they stated that hyperactive/impulsive and inattentive symptoms influence parental stress. While much has been learned about parenting stress concerning children with ADHD, some questions remain to be clarified.

Aims and hypotheses

Despite the well-known link between earlier children's emotional dysregulation and their high risk of developing later ADHD symptoms, few studies investigated the relationships between positive and negative emotion dysregulation, on the one hand, and ADHD symptoms, on the other one, via parent stress. The current study investigates whether and to what extent parents' stress mediates the relationship between children's positive/negative emotionality and ADHD symptoms. Specifically, we set two hypotheses: (1) we expected that child's positive and negative emotions

dysregulation were positively associated with parents' stress and high levels of ADHD symptoms (i.e., inattention, hyperactivity/impulsivity); (2) we hypothesized that parents' stress mediates the relationship between positive and negative emotions dysregulation, on the one hand, and ADHD symptoms (i.e., inattention deficit and hyperactivity/impulsivity), on the other one.

Methods

Participants

The current study reports on 62 Italian children aged 62.1 to 69.7 months (Female = 38.2%; Mean age = 65.9 months; SD = 3.8) who were rated by one of their parents after giving consent for the research participation. All participants were recruited from public schools in Rome through public advertisements and announcements under the approval of school leaders. Children with a known diagnosis and affected by psychopathology were excluded to avoid clinic-referral selection bias. The final parents' consent rate was 60%.

Procedure

The current study was conducted in Italy in 2022, adopting a cross-sectional descriptive design. The research project was presented to the parents of two preschools in Rome's municipality through a letter of presentation during a school meeting after the authorization of the school council and the school principal. The parents who voluntarily joined the study received informed consent and all the information necessary for completing the questionnaire. Parents filled out the questionnaires with a paper-pencil approach in their own homes. Parents were assured that their responses would remain anonymous and confidential. This study was conducted under the privacy requirements following current Italian law (Law Decree DL-196/2003) and its latest versions (2013). The research project was accepted and approved by the Social and Forensic Psychology Academy (Rome) ethics committee.

Instruments

Positive and negative emotionality It is a subscale of the Italian Temperament Questionnaire (QUIT; Axia, 2002), which comprises six subscales completed by a parent who investigated their child's behavior last week. The current study used the scales of Positive Emotionality (9 items) and Negative Emotionality (9 items). Examples of each kind of affirmation are: "My child maintains a calm or smiling expression when playing with someone"; "My child heartily laughs when playing with others" (positive). "My child gets angry quickly if criticized"; "My child cries when playing"; "My child maintains a frowning or sad expression for a long time" (negative). All items are on a six-point Likert scale ranging from "almost never" (1) to "almost always" (6). Cronbach's alpha was 0.63 for the Positive Emotionality scale and 0.70 for the Negative Emotionality scale, respectively.

Hyperactivity/impulsivity and inattention subscales Two sub-scales of the Conners' Parent Rating Scale-Revised (CPRS; Conners, 1998; Italian Version by Nobili et al., 2007) were utilized. The CPRS is employed by parents to assess their children's attentional and behavioral difficulties. The Hyperactivity/Impulsivity scale comprises 9 items, while the Inattention deficit scale comprises 12 items. All items were rated on a four-point Likert scale ranging from "not true at all/never" (0) to "very much true/very often" (3). Cronbach's alpha was 0.92 for the Hyperactivity scale and 0.93 for the Inattention deficit scale.

Parenting stress index—short form The Parenting Stress Index—Short Form (PSI-SF; Abidin, 1990; It. Vers. by Guarino et al., 2016) is a self-report measure of parental stress levels across 36 items evaluating agreement or disagreement on a five-point Likert scale ranging from "strongly agree" (1) to "strongly disagree" (5). PSI-SF includes five dimensions: Defensive Response, which evaluates the degree to which the parent is trying to respond in a way that makes them seem better; Parental Stress, which examines how much stress the parent is experiencing and measures the parent's sense of competence, the stress associated with the restrictions of parenting, conflicts with the other parent, social support, and depression; Dysfunctional Parent/Child Interaction, which evaluates the quality of parent-child interactions and the degree to which the parent believes that their child meets their expectations; Difficult Child, which assesses how easy or difficult the parent perceives their child as being; and Global General Stress, which measures the stress that the parent perceives, exclusively in the role of parent. This study used the Global General Stress sub-scales ($\alpha = 0.96$).

Data analysis

The SPSS statistical software (v. 27; Statistical Product and Service Solutions, Chicago, IL, USA) was used to analyze the collected data. The means and standard deviations for all scales were calculated. The means and standard deviations for all scales were calculated to verify the relationships

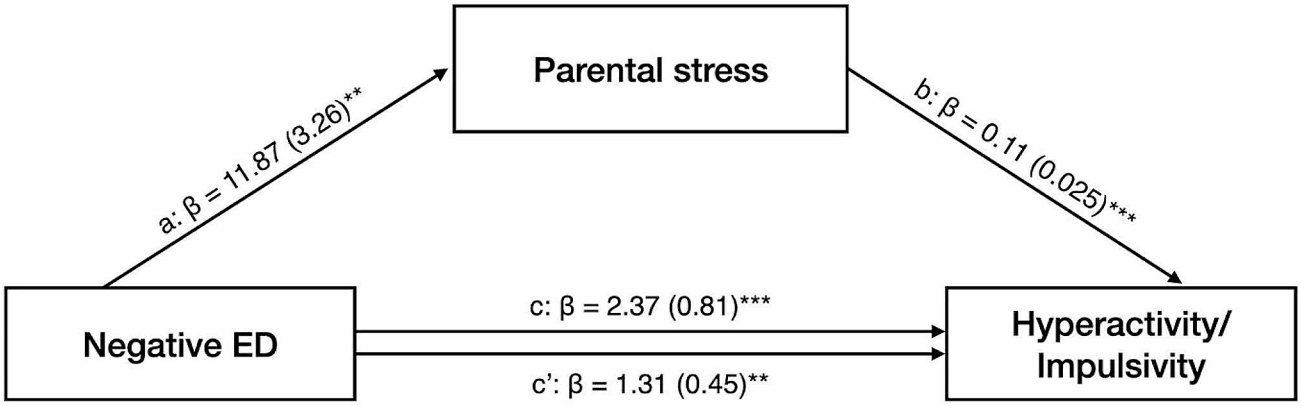

Fig. 1 The mediating role of parental stress in the relationship between negative ED and hyperactivity/impulsivity. *Note*. $^{**}p < 0.01$; $^{***}p < 0.001$; ED = Emotion dysregulation

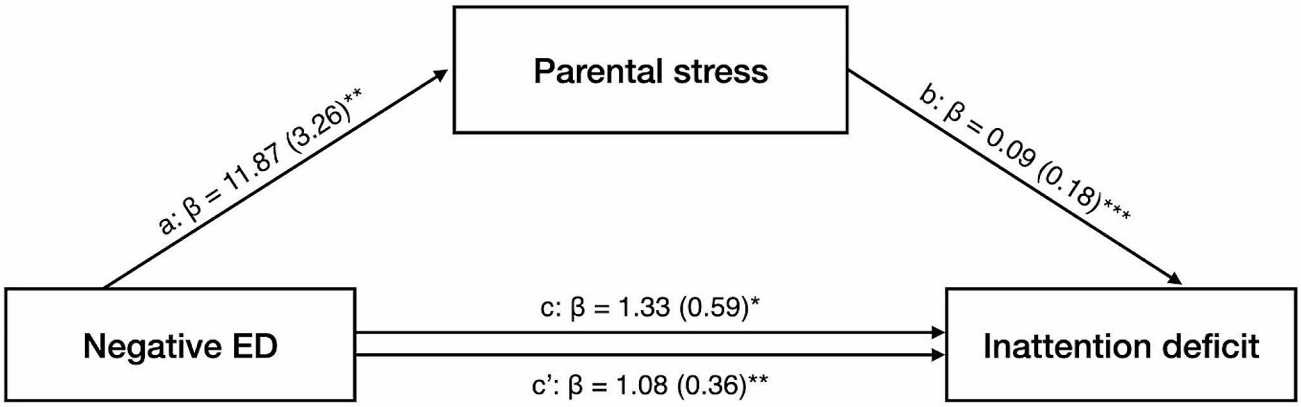

Fig. 2 The mediating role of parental stress in the relationship between negative ED and attention deficit. *Note*. $^{*}p < 0.05$; $^{**}p < 0.01$;*** $p < 0.001$; ED = Emotion dysregulation

between the study's variables, and then Pearson's correlations analysis was performed. The gender variable was treated as a dummy variable where 1 = Female and 2 = Male. Two mediation models were tested using the macro-program PROCESS 4.0 (Hayes, 2018) to evaluate the effect of parental stress. In the first, parental stress mediated the relationship between Negative emotionality and Attention deficit (Fig. 1), while in the second, parental stress mediated the relationship between Negative emotionality and Hyperactivity (Fig. 2). Specifically, in Fig. 1a represents the effect of Negative emotionality on Parental stress, (b) represents the effect of Parental stress on Attention deficit, (c) represents the total effect of Negative emotionality on Attention deficit and (c′) represents the direct effect of Negative emotionality

on Attention deficit. On the other hand, Fig. 2a represents the effect of Negative emotionality on Parental stress, (b) represents the effect of Parental stress on Hyperactivity, (c) represents the total effect of Negative emotionality on Hyperactivity, and (c′) represents the direct effect of Negative emotionality on Hyperactivity. To verify the statistical relevance of the indirect effects, the bootstrap technique for each of the 5000 resamples of bootstrapped estimates within 95% of the confidence interval (CI).

Results

Table 1 shows the descriptive statistics and correlations of the Italian Temperament Questionnaire emotion sub-scales, the Conners Comprehensive Behavior Rating Scales' ADHD indices, and the Parenting Stress Index.

Results showed a significant positive correlation between negative ED assessed by parents and their stress ($r = 0.426$; $p < 0.01$). Parents assessed a significant and positive correlation between negative emotionality with the ADHD- Inattention deficit index and the ADHD-Hyperactivity-Impulsivity index (respectively, $r = 0.265$; $p < 0.05$; $r = 0.383$; $p < 0.01$). Significant and positive correlations were found between ADHD inattention deficit assessed by parents and parental stress ($r = 0.521$; $p < 0.01$) and between ADHD-hyperactivity-impulsivity assessed by the parents and parental stress ($r = 0.450$; $p < 0.01$). Finally, no correlations have been found between positive emotion and other study variables.

Mediation analysis

The first mediation model investigates the mediating role of parental stress in the relationship between negative ED and Hyperactivity/Impulsivity. The results showed that negative ED showed a significant and positive total effect on Hyperactivity/Impulsivity (path c: $\beta = 2.37$, $p < 0.001$; LLCI = 0.86-ULCI = 3.99). Furthermore, negative ED positively affected parental stress (path a: $\beta = 11.87$, $p < 0.01$; LLCI = 28.28-ULCI = 63.37). In turn, the parental stress was positively and significantly related to Hyperactivity/Impulsivity (path b: $\beta = 0.11$, $p < 0.001$; LLCI = 0.03-ULCI = 0.14). Parental stress played a significant role in the relationship between negative ED and Hyperactivity/Impulsivity, albeit remaining significant after controlling the mediators (path c ': $\beta = 1.31$, $p < 0.01$; LLCI = -0.02-ULCI = 3.070). Therefore, a partial mediation occurred ($R^2 = 14$ F (1, 60) = 9.61, $p < 0.01$). The bootstrap procedure confirmed the statistical relevance of this indirect effect (Boot LLCI = 0.20-Boot ULCI = 0.32). The summary of the first mediation model is shown in Fig. 1.

The second mediation model investigates the mediating role of parental stress in the relationship between negative ED and Inattention deficit. The results showed that negative ED showed a significant and positive total effect on Inattention deficit (path c: $\beta = 1.33$, $p < 0.5$; LLCI = 0.075-ULCI = 2.50). Furthermore, negative ED positively affected parental stress (path a: $\beta = 11.87$, $p < 0.01$; LLCI = 5.36-ULCI = 18.40). Parental stress was positively and significantly related to Inattention deficit (path b: $\beta = 0.09$, $p < 0.001$; LLCI = 0.04-ULCI = 0.12). Parental stress played a significant role in the relationship between negative ED and Inattention deficit, albeit remaining significant after controlling the mediators (path c': $\beta = 1.08$, $p < 0.01$; LLCI = 0.07-ULCI = 2.48). Therefore, a partial mediation occurred ($R^2 = 0.10$ F (1, 60) = 4.50, $p < 0.05$). The bootstrap procedure confirmed the statistical relevance of this indirect effect (Boot LLCI = 0.05-Boot ULCI = 0.40). The summary of the second mediation model is shown in Fig. 2.

Discussion

The current pilot study investigated how parental stress mediates the relationship between children's positive/negative emotionality and ADHD symptoms. Previous studies have shown that early childhood emotional dysregulation (ED) may predict later dysfunctional problems (e.g., Beauchaine, 2015; Vogel et al., 2019). Nevertheless, while the role of negative ED is a well-known risk factor, there is a lack of investigation concerning the positive ED that may occur in childhood (e.g., Deater-Deckard et al., 2010; Deveney et al., 2013; Putnam & Stifter, 2005). Moreover, less investigated is the role of parental stress in mediating the well-known

Table 1 Descriptive statistics and correlations

Variable			*M*	*SD*	1	2	3	4	5
QUIT	**1**	Positive emotionality	4.72	0.70	1	−0.405**	−0.041	−0.049	−0.142
	2	Negative emotionality	2.59	0.74		1	**0.265***	**0.372****	**0.426****
CCBRS	**3**	Inattention deficit	3.34	3.59			1	**0.742****	**0.521****
	4	Hyperactivity/Impulsivity	5.52	4.85				1	**0.450****
PSI	**5**	General Parental stress	76.60	20.71					1

CCBRS, Conners Comprehensive Behavior Rating Scales; *M*, Mean; *PSI*, Parenting Stress Index—Short Form; *QUIT*, Italian Temperament Questionnaire; *SD*, Standard Deviation

* $p < 0.05$; ** $p < 0.01$

predictive role of early ED on later ADHD symptoms. We expected both high positive and negative emotion dysregulation (i.e., exuberance and irritability, respectively) to be positively associated with ADHD symptoms analyzed in the current study (i.e., hyperactivity/impulsivity and inattention deficit). In line with the above studies showing the negative impact of children's ED (both positive and negative) on their parents' stress levels, we further expected its mediating role in the relationship between ED and ADHD symptoms. Our results partially confirmed the two study hypotheses.

First, consistent with previous findings (e.g., Nigg, 2022), our result supports the idea that a high level of negative emotion regulation (negative ED) is positively associated with hyperactivity/impulsivity and inattention deficit. Similarly, it was expected, albeit weakly investigated, and supported by previous findings (e.g., Vogel et al., 2019), a positive association between high children's ED and their parents' stress levels. Conversely, no correlations have been found concerning positive ED and the other study variables (i.e., parent stress and ADHD symptoms). One previous study by Tsotsi et al. (2019) also confirms no correlations among parents' stress levels, positive ED, and ADHD problems, evoking the possibility that measures may differ in capturing other dimensions of children's behavior. Moreover, we consider the unexpected results a possible sign of fewer parents worrying about their children's high positive emotions as a problem cue, prompting the need for further investigations. As claimed by several scholars, when parents minimize at-risk children's emotional manifestations (e.g., exuberance), they may inappropriately respond to children's emotional socialization process needs (e.g., Morey & Gentzler, 2017; Saarni & Weber, 1999; Sallquist et al., 2009).

Although not the primary focus of this study, it is worth noting, as suggested in the literature, how strong positive emotional states can exacerbate anger and aggressive behavior, particularly in individuals with ADHD. Children with ADHD often struggle with emotional regulation, experiencing intense and fluctuating emotions. While positive emotions typically enhance mood and well-being, they can amplify emotional dysregulation in children with ADHD, making it challenging to manage negative emotions such as anger. Consequently, there is a tendency for a rapid escalation from positive states to anger and aggression (Barkley, 2010; Shaw et al., 2014). ADHD is characterized by impulsivity and difficulties in inhibiting behavioral responses. Positive emotional states can further intensify impulsivity, prompting individuals to act on their emotions without considering the consequences. This impulsivity, combined with heightened reactivity, often manifests as anger and aggressive outbursts, particularly in frustrating situations (Shaw et al., 2014).

Moreover, children with ADHD frequently experience chronic stress due to the challenges associated with their condition. While positive emotional states may temporarily alleviate this stress, the underlying difficulties persist unresolved. Consequently, children may resort to explosive outbursts of anger and aggression as a coping mechanism for dealing with accumulated stressors (Yang et al., 2017). Second, our findings support the mediating role of parental stress in the relationship between children's negative ED and ADHD symptoms (both for hyperactivity/impulsivity and inattention deficit). While the direct effect of negative ED on ADHD symptoms aligns with previous studies (see, for example, Nigg et al., 2004, 2020), our findings add new perspectives by addressing the mediating role of parenting stress. Parental stress can elicit dysfunctional parental behaviors and a mutual increase in problem behavior in children with ADHD (e.g., Barroso et al., 2018; Corcoran et al., 2017; Leitch et al., 2019; Miranda et al., 2015; Wiener et al., 2016). Parental stress has been a predictor of behavioral disorders and externalizing problems in children (Benzies et al., 2004; Heller et al., 1996). Specifically, aggression and poor parental coping strategies may lead to increased symptoms of hyperactivity in children with ADHD (Woodward et al., 1998).

The literature demonstrates how children's ED, as part of temperament traits, has a clear effect on the characteristics of impulsivity/hyperactivity and inattention and how the family context can contribute to ADHD symptoms (Nigg, 2022; Shiner & Caspi, 2003; Van Beveren et al., 2019). On the other hand, a child with difficult temperament traits (i.e., negative ED) can pose a challenge for parents and increase parenting stress levels (Ben-Naim et al., 2019; Das et al., 2012; Friedrichs et al., 2012; McLaughlin & Harrison, 2006; Theule, 2010).

Our findings align with the work of Coplan et al. (2003), suggesting that infant temperament (comprising emotion dysregulation) could influence parental stress and the child's adaptation to their life contexts. An infant with a more challenging temperament, such as being highly active or exhibiting intense reactions, can increase parental stress levels. Dealing with a challenging infant temperament can be demanding for parents, requiring more effort and energy to meet the child's needs and manage their behavior, leading to feelings of frustration, exhaustion, and stress, especially without adequate support or coping strategies.

Moreover, the interaction between infant ED and parental stress can create a reciprocal relationship. High parental stress can impact the parent-child relationship, influencing the child's development and ability to adapt to life contexts. Parents experiencing high stress levels may be unable to provide the nurturing and supportive environment crucial for a child's healthy development.

Finally, it is important to note that while infant temperament can impact parental stress and a child's adaptation, it is not the sole determinant. Factors such as parenting style, social support, family dynamics, and the broader socio-cultural context also play significant roles in shaping both parental stress and the child's adaptation to their life contexts. Future research should consider a wider range of variables involved in the relationship between a child's emotional dysregulation and ADHD symptoms. In this context, parents' pressure can also have a significant impact on a child's emotional adjustment and development, leading to increased stress, anxiety, and depression in the child (Quach et al., 2015). Prolonged parental pressure can also negatively affect the parent-child relationship, causing strain and reducing communication and trust between parents and children (Barnett et al., 2003).

Consequently, promoting emotional well-being in children and preventing attention deficit and hyperactivity disorder (ADHD) requires a combination of proactive strategies, environmental considerations, and supportive parenting practices. One important aspect of supportive parenting is being responsive to a child's needs, which involves promptly and consistently attending to them and creating a secure emotional base. This parenting style has been linked to improved emotional regulation and lower rates of behavioral problems (Landry et al., 2006; Sonuga-Barke et al., 2002). Additionally, teaching children emotional regulation skills is vital for their cognitive and social development. Programs that teach strategies for regulating emotions, such as mindfulness and cognitive-behavioral techniques, have been found to effectively reduce emotional and behavioral difficulties (Waldemar et al., 2016). Parents also play a crucial role in modeling healthy emotional expression. Children learn from observing how their caregivers handle stress and express emotions. By modeling healthy coping strategies, parents can positively influence a child's emotional adjustment (Lincoln et al., 2017). Encouraging play and creativity as outlets for emotional expression is also beneficial and helps build resilience (Russ & Fiorelli, 2010).

Limitations and future research

The study is subjected to several limitations that may impact the robustness and generalizability of its findings. The study employs a cross-sectional design, meaning data is collected at a single point in time. As a result, establishing a causal relationship between children's emotional adjustment difficulties and ADHD risk becomes challenging. The design does not allow differentiation between whether emotional adjustment difficulties lead to ADHD risk or vice versa. The inability to infer causality limits the study's ability to make definitive statements about the temporal sequence of events. Future research could benefit from adopting a longitudinal design to understand the relationship better, for example, involving tracking participants over an extended period, allowing for the observation of changes and the establishment of temporal relationships between emotional adjustment difficulties and ADHD risk.

The current study also relies on a relatively small sample size, which has implications for the generalizability of the results. Findings derived from a small sample may not accurately represent the broader population, introducing potential biases. Furthermore, future investigations should prioritize increasing the sample size to enhance the research's reliability and external validity. A larger and more diverse sample would provide a more accurate reflection of the population, thereby improving the generalizability of the study's conclusions. The study focuses exclusively on the mediating effect of parental pressure on the relationship between children's emotional adjustment difficulties and ADHD. It overlooks other potential contributing factors, such as family environment and social support, which could also play significant roles. Effectively, capturing the complexity of the relationship between emotional adjustment difficulties and ADHD should be addressed by future research scopes.

Similarly, researchers can provide a more holistic understanding of the various influences on these conditions by including a more comprehensive set of potential factors, such as family dynamics and social support systems. Overall, this study highlighted the crucial role of parents' stress in addressing interventions and training for a family engaged in challenges like ADHD symptoms. Therefore, in a holistic view, family networks can be protective factors throughout life.

Conclusion

Although emotional dysregulation is present in other developmental psychopathologies, recent studies confirm that it is a key dimension in the case of ADHD (e.g., Nigg, 2020, 2022). It is alarming that ADHD is among the most common childhood psychopathologies and one of the earliest to manifest in child development. Studies have shown that ADHD is associated with a high long-term risk of psychological problems in adulthood, with at least 50% of children with ADHD at risk of developing mental disorders later in life (e.g., Treur et al., 2021; Nigg, 2022). Furthermore, evidence supports the risk of children's negative ED and increasing ADHD symptoms through their parents' stress levels. These pieces of evidence drive researchers to increasingly focus on interventions to support and promote effective parenting styles. Our findings may contribute to opening new early interventions focused on parent-child interactions and their

coping strategies toward their children's high emotional reactivity, which, in turn, may represent high at-risk development of later ADHD symptoms. Intervention programs aimed at enhancing emotion regulation skills, stress management, and improving parent-child communication can be beneficial for both parents and children in managing the challenges associated with ADHD.

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Data availability Data can request directly to the corresponding author or the first author.

Declarations

Ethical approval All procedures performed in studies involving human participants followed the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards and were approved by and were approved by the ethic committee of Social and Forensic Psychology Academy (Rome).

Informed consent Informed consent was obtained from all individual participants included in the study.

Conflict of interest The authors declare that they have no conflict of interest.

References

Axia, G. (2002). *QUIT– Questionari Italiani del Temperamento*. Erickson.

Barkley, R. A. (2010). Why emotional impulsiveness should be a central feature of ADHD. *The ADHD Report*, *18*(4), 1–5.

Barnett, D., Clements, M., Kaplan-Estrin, M., & Fialka, J. (2003). Building new dreams: Supporting parents' adaptation to their child with special needs. *Infants & Young Children*, *16*(3), 184–200.

Barroso, N. E., Mendez, L., Graziano, P. A., & Bagner, D. M. (2018). Parenting stress through the lens of different clinical groups: A systematic review & meta-analysis. *Journal of Abnormal Child Psychology*, *46*(3), 449–461.

Beauchaine, T. P. (2015). Future directions in emotion dysregulation and youth psychopathology. *Journal of Clinical Child & Adolescent Psychology*, *44*(5), 875–896.

Ben-Naim, S., Gill, N., Laslo-Roth, R., & Einav, M. (2019). Parental stress and parental self-efficacy as mediators of the association between children's ADHD and marital satisfaction. *Journal of Attention Disorders*, *23*(5), 506–516.

Benzies, K. M., Harrison, M. J., & Magill-Evans, J. (2004). Parenting stress, marital quality, and child behavior problems at age 7 years. *Public Health Nursing*, *21*(2), 111–121.

Breaux, R., Lewis, J., Cash, A. R., Shroff, D. M., Burkhouse, K. L., & Kujawa, A. (2022). Parent emotion socialization and positive emotions in child and adolescent clinical samples: A systematic review and call to action. *Clinical Child and Family Psychology Review*, 1–18.

Calkins, S. D., & Hill, A. (2007). Caregiver influences on emerging emotion regulation. *Handbook of Emotion Regulation*, *229248*.

Cheung, K., & Theule, J. (2016). Parental psychopathology in families of children with ADHD: A meta-analysis. *Journal of Child and Family Studies*, *25*(12), 3451–3461.

Clark, L. A., Kochanska, G., & Ready, R. (2000). Mothers' personality and its interaction with child temperament as predictors of parenting behavior. *Journal of Personality and Social Psychology*, *79*(2), 274.

Conners, C. K. (1998). Conners' Parenting Rating Scale-Revised, ed. it. a cura di M. Nobile, B. Alberti, A. Zuddas. (2008). Giunti O.S.

Coplan, R. J., Bowker, A., & Cooper, S. M. (2003). Parenting daily hassles, child temperament, and social adjustment in preschool. *Early Childhood Research Quarterly*, *18*(3), 376–395.

Corcoran, J., Schildt, B., Hochbrueckner, R., & Abell, J. (2017). Parents of children with attention deficit/hyperactivity disorder: A meta-synthesis, part I. *Child and Adolescent Social Work Journal*, *34*(4), 281–335.

Craig, F., Operto, F. F., De Giacomo, A., Margari, L., Frolli, A., Conson, M.,... & Margari, F. (2016). Parenting stress among parents of children with neurodevelopmental disorders. *Psychiatry Research*, *242*, 121–129.

Craig, J. M., Piquero, A. R., Farrington, D. P., & Ttofi, M. M. (2017). A little early risk goes a long bad way: Adverse childhood experiences and life-course offending in the Cambridge study. *Journal of Criminal Justice*, *53*, 34–45.

Das, D., Cherbuin, N., Butterworth, P., Anstey, K. J., & Easteal, S. (2012). A population-based study of attention deficit/hyperactivity disorder symptoms and associated impairment in middle-aged adults. *PloS One*, 7(2), e31500.

Deater-Deckard, K. (1998). Parenting stress and child adjustment: Some old hypotheses and new questions. *Clinical Psychology: Science and Practice*, *5*(3), 314–332.

Deater-Deckard, K., Beekman, C., Wang, Z., Kim, J., Petrill, S., Thompson, L., & DeThorne, L. (2010). Approach/positive anticipation, frustration/anger, and overt aggression in childhood. *Journal of Personality*, *78*(3), 991–1010.

Deveney, C. M., Connolly, M. E., Haring, C. T., Bones, B. L., Reynolds, R. C., Kim, et al. (2013). Neural mechanisms of frustration in chronically irritable children. *American Journal of Psychiatry*, *170*(10), 1186–1194.

Drabick, D. A., Gadow, K. D., & Loney, J. (2008). Co-occurring ODD and GAD symptom groups: Source-specific syndromes and cross-informant comorbidity. *Journal of Clinical Child & Adolescent Psychology*, *37*(2), 314–326.

Epstein, J. N., Conners, C. K., Erhardt, D., Arnold, L. E., Hechtman, L., Hinshaw, S., et al. (2000). Familial aggregation of ADHD characteristics. *Journal of Abnormal Child Psychology*, *28*(6), 585–594.

Friedrichs, B., Igl, W., Larsson, H., & Larsson, J. O. (2012). Coexisting psychiatric problems and stressful life events in adults with symptoms of ADHD—a large Swedish population-based study of twins. *Journal of Attention Disorders*, *16*(1), 13–22.

Godleski, S. A., Eiden, R. D., Shisler, S., & Livingston, J. A. (2020). Parent socialization of emotion in a high-risk sample. *Developmental Psychology*, *56*(3), 489.

Gross, J. J. (Ed.). (2013). *Handbook of emotion regulation*. Guilford Publications.

Guarino, A., Laghi, F., Serantoni, G., Di Blasio, P., & Camisasca, E. (2016). Parenting Stress Index–Fourth Edition (PSI-4).

Hayes, A. F. (2018). The PROCESS Macro for SPSS and SAS version 3.0 [Computer software]. *Retrieved from afhayes.com*.

Heller, T. L., Baker, B. L., Henker, B., & Hinshaw, S. P. (1996). Externalizing behavior and cognitive functioning from preschool to first grade: Stability and predictors. *Journal of Clinical Child Psychology*, *25*(4), 376–387.

Landry, S. H., Smith, K. E., & Swank, P. R. (2006). Responsive parenting: Establishing early foundations for social, communication, and independent problem-solving skills. *Developmental Psychology*, *42*(4), 627–642.

Leitch, S., Sciberras, E., Post, B., Gerner, B., Rinehart, N., Nicholson, J. M., & Evans, S. (2019). Experience of stress in parents of children with ADHD: A qualitative study. *International journal of qualitative studies on health and well-being, 14*(1), 1690091.

Lincoln, C. R., Russell, B. S., Donohue, E. B., & Racine, L. E. (2017). Mother-child interactions and preschoolers' emotion regulation outcomes: Nurturing autonomous emotion regulation. *Journal of Child and Family Studies*, *26*, 559–573.

Martin, C. A., Papadopoulos, N., Chellew, T., Rinehart, N. J., & Sciberras, E. (2019). Associations between parenting stress, parent mental health and child sleep problems for children with ADHD and ASD: Systematic review. *Research in Developmental Disabilities*, *93*, 103463.

McLaughlin, D. P., & Harrison, C. A. (2006). Parenting practices of mothers of children with ADHD: The role of maternal and child factors. *Child and Adolescent Mental Health*, *11*(2), 82–88.

Miranda, A., Tárraga, R., Fernández, M. I., Colomer, C., & Pastor, G. (2015). Parenting stress in families of children with autism spectrum disorder and ADHD. *Exceptional Children*, *82*(1), 81–95.

Morey, J. N., & Gentzler, A. L. (2017). Parents' perceptions of and responses to children's emotions: Relations with meta-emotion philosophy and adult attachment. *Parenting*, *17*(2), 73–103.

Nagy, S. S., Sayied, N. E., Kotb, F. N., & Zaki, S. M. (2018). Relation between attention deficit hyperactivity disorder among school age children and parent's stress and sense of competence. *Minia Scientific Nursing Journal*, *4*(1), 115–123.

Nigg, J. T. (2022). Parsing ADHD with temperament traits. *Current Directions in Psychological Science*, *31*(4), 324–332.

Nigg, J. T., & Hinshaw, S. P. (1998). Parent personality traits and psychopathology associated with antisocial behaviors in childhood attention-deficit hyperactivity disorder. *Journal of Child Psychology and Psychiatry*, *39*(02), 145–159.

Nigg, J. T., Blaskey, L. G., Stawicki, J. A., & Sachek, J. (2004). Evaluating the endophenotype model of ADHD neuropsychological deficit: Results for parents and siblings of children with ADHD combined and inattentive subtypes. *Journal of Abnormal Psychology*, *113*(4), 614.

Nigg, J. T., Sibley, M. H., Thapar, A., & Karalunas, S. L. (2020). Development of ADHD: Etiology, heterogeneity, and early life course. *Annual Review of Developmental Psychology*, *2*, 559–583.

Plichta, M. M., & Scheres, A. (2014). Ventral–striatal responsiveness during reward anticipation in ADHD and its relation to trait impulsivity in the healthy population: A meta-analytic review of the fMRI literature. *Neuroscience & Biobehavioral Reviews*, *38*, 125–134.

Putnam, S. P., & Stifter, C. A. (2005). Behavioral approach–inhibition in toddlers: Prediction from infancy, positive and negative affective components, and relations with behavior problems. *Child Development*, *76*(1), 212–226.

Quach, A. S., Epstein, N. B., Riley, P. J., Falconier, M. K., & Fang, X. (2015). Effects of parental warmth and academic pressure on anxiety and depression symptoms in Chinese adolescents. *Journal of Child and Family Studies*, *24*, 106–116.

Ravi, S., Havewala, M., Kircanski, K., Brotman, M. A., Schneider, L., Degnan, K.,... & Filippi, C. (2022). Parenting and childhood irritability: Negative emotion socialization and parental control moderate the development of irritability. *Development and Psychopathology*, 1–10.

Rothbart, M. K., Sheese, B. E., Rueda, M. R., & Posner, M. I. (2011). Developing mechanisms of self-regulation in early life. *Emotion Review*, *3*(2), 207–213.

Rothenberg, W. A., Weinstein, A., Dandes, E. A., & Jent, J. F. (2019). Improving child emotion regulation: Effects of parent–child interaction-therapy and emotion socialization strategies. *Journal of Child and Family Studies*, *28*(3), 720–731.

Russ, S. W., & Fiorelli, J. A. (2010). Developmental approaches to creativity. The Cambridge handbook of creativity, 12, 233–249.

Rydell, A. M., Berlin, L., & Bohlin, G. (2003). Emotionality, emotion regulation, and adaptation among 5-to 8-year-old children. *Emotion*, *3*(1), 30.

Saarni, C., & Weber, H. (1999). Emotional displays and dissemblance in childhood: Implications for self-presentation.

Sallquist, J. V., Eisenberg, N., Spinrad, T. L., Reiser, M., Hofer, C., Zhou, Q.,... & Eggum, N. (2009). Positive and negative emotionality: Trajectories across six years and relations with social competence. *Emotion*, *9*(1), 15.

Scassellati, C., Bonvicini, C., Faraone, S. V., & Gennarelli, M. (2012). Biomarkers and attention-deficit/hyperactivity disorder: A systematic review and meta-analyses. *Journal of the American Academy of Child & Adolescent Psychiatry*, *51*(10), 1003–1019.

Shaw, P., Stringaris, A., Nigg, J., & Leibenluft, E. (2014). Emotion dysregulation in attention deficit hyperactivity disorder. *American Journal of Psychiatry*, *171*(3), 276–293.

Shenaar-Golan, V., Wald, N., & Yatzkar, U. (2017). Patterns of emotion regulation and emotion-related behaviors among parents of children with and without ADHD. *Psychiatry Research*, *258*, 494–500.

Shiner, R., & Caspi, A. (2003). Personality differences in childhood and adolescence: Measurement, development, and consequences. *Journal of Child Psychology and Psychiatry*, *44*(1), 2–32.

Silverman, M. R., Bennett, R., Feuerstahler, L., Stadterman, J., Dick, A. S., Graziano, P., & Roy, A. K. (2022). Measuring emotion dysregulation in children with attention-deficit/hyperactivity disorder: Revisiting the factor structure of the emotion regulation checklist. *Behavior Therapy*, *53*(2), 196–207.

Soleimani, R., Jalali, M. M., & Faghih, H. A. (2020). Comparing the prevalence of attention deficit hyperactivity disorder in hearing-impaired children with normal-hearing peers. *Archives de Pédiatrie*, *27*(8), 432–435.

Sonuga-Barke, E. J., Daley, D., & Thompson, M. (2002). Does maternal ADHD reduce the effectiveness of parent training for preschool children's ADHD? *Journal of the American Academy of Child & Adolescent Psychiatry*, *41*(6), 696–702.

Theule, J. (2010). *Predicting parenting stress in families of children with ADHD*. Ontario, Canada: University of Toronto.

Theule, J., Wiener, J., Rogers, M. A., & Marton, I. (2011). Predicting parenting stress in families of children with ADHD: Parent and contextual factors. *Journal of Child and Family Studies*, *20*(5), 640–647.

Theule, J., Wiener, J., Tannock, R., & Jenkins, J. M. (2013). Parenting stress in families of children with ADHD: A meta-analysis. *Journal of Emotional and Behavioral Disorders*, *21*(1), 3–17.

Treur, J. L., Demontis, D., Smith, G. D., Sallis, H., Richardson, T. G., Wiers, R. W., ... & Munafò, M. R. (2021). Investigating causality between liability to ADHD and substance use, and liability to substance use and ADHD risk, using Mendelian randomization. *Addiction Biology*, *26*(1), e12849.

Tsotsi, S., Broekman, B. F., Shek, L. P., Tan, K. H., Chong, Y. S., Chen, H.,... & Rifkin-Graboi, A. E. (2019). Maternal parenting stress, child exuberance, and preschoolers' behavior problems. *Child Development*, *90*(1), 136–146.

Umemura, T., Christopher, C., Mann, T., Jacobvitz, D., & Hazen, N. (2015). Coparenting problems with toddlers predict children's symptoms of psychological problems at age 7. *Child Psychiatry & Human Development*, *46*(6), 981–996.

Usai, M. C., Viterbori, P., & Alcetti, A. (2007). Temperamento e identificazione precoce delle difficoltà di apprendimento. *Psicologia clinica dello sviluppo*, *11*(2), 253–270.

Van Beveren, M. L., Mezulis, A., Wante, L., & Braet, C. (2019). Joint contributions of negative emotionality, positive emotionality, and effortful control on depressive symptoms in youth. *Journal of Clinical Child & Adolescent Psychology*, *48*(1), 131–142.

Vogel, A. C., Jackson, J. J., Barch, D. M., Tillman, R., & Luby, J. L. (2019). Excitability and irritability in preschoolers predicts later psychopathology: The importance of positive and negative emotion dysregulation. *Development and Psychopathology*, *31*(3), 1067–1083.

Vogel, A. C., Brotman, M. A., Roy, A. K., & Perlman, S. B. (2022). Defining positive emotion dysregulation: Integrating temperamental and clinical perspectives. *Journal of the American Academy of Child & Adolescent Psychiatry*.

Waldemar, J. O. C., Rigatti, R., Menezes, C. B., Guimarães, G., Falceto, O., & Heldt, E. (2016). Impact of a combined mindfulness and social–emotional learning program on fifth graders in a Brazilian public school setting. *Psychology & Neuroscience*, *9*(1), 79–90.

Wiener, J., Biondic, D., Grimbos, T., & Herbert, M. (2016). Parenting stress of parents of adolescents with attention-deficit hyperactivity disorder. *Journal of Abnormal Child Psychology*, *44*(3), 561–574.

Winters, K. (2012). *Parental support, control, and stress: parenting practices and beliefs of parents of children with and without ADHD* (Master's thesis, Graduate Studies).

Woodward, L., Taylor, E., & Dowdney, L. (1998). The parenting and family functioning of children with hyperactivity. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *39*(2), 161–169.

Yang, T. C., Luber, M. J., & Coffey, B. J. (2017). Impulsive aggressive behavior triggered by headaches in a child with severe attention-deficit/hyperactivity disorder. *Journal of Child and Adolescent Psychopharmacology*, *27*(6), 555–558.

Zisner, A. R., & Beauchaine, T. P. (2016). Psychophysiological methods and developmental psychopathology.