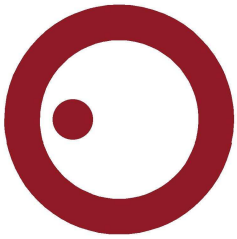

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Master in Data Science

INFLUENCE OF PARENTING STYLES AND HORMONAL LEVELS IN THE DEVELOPMENT OF NARCISSISM: A META-ANALYSIS

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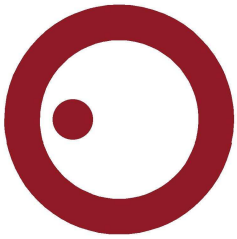

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ARIANA ISABEL NOGUEIRA DOS REIS

Project Report under the supervision of Professor Rui Santos from the School of Technology and Management of the Polytechnic Institute of Leiria, and Professor João Paulo Martins from the School of Health of the Polytechnic Institute of Porto.

Leiria, September of 2024

ORIGINALITY AND COPYRIGHT

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Finally, an acknowledgment to the authors of the primary studies included in this meta-analysis for their foundational contributions. Their dedicated research efforts made this synthesis possible and significantly enriched the scope of the work.

A B S T R A C T

This meta-analysis explores the influence of parenting styles and hormone levels on the effect of narcissistic traits. The review focuses on the four parenting styles identified by Baumrind – authoritative, authoritarian, permissive, and neglectful – highlighting how each contributes to either fostering or mitigating narcissistic tendencies. Authoritarian parenting, marked by strict rules and limited emotional warmth, and permissive parenting, characterized by leniency and lack of boundaries, are linked to the development of inflated self-images and entitlement. Meanwhile, neglectful parenting, with its emotional detachment and lack of guidance, often leaves children struggling with controlling their emotions, coping effectively, and facing difficulties in maintaining and nurturing social relationships. Authoritative parenting characterized by developing a close, nurturing relationship with the children drives them confident, responsible, and able to self-regulate. The analysis also explores the role of testosterone and cortisol levels on narcissistic behaviors through traits like dominance, aggression, and stress responses. By integrating both environmental and biological perspectives, this meta-analysis provides a comprehensive understanding of how parenting and hormonal factors together influence the emergence of narcissism.

Keywords: cortisol, education, meta-analysis, narcissism, parental, systematic review, testosterone.

RESUMO

Esta meta-análise explora a influência dos estilos parentais e dos níveis hormonais no desenvolvimento de traços narcisistas. A revisão centra-se nos quatro estilos parentais identificados por Baumrind – democrático, autoritário, permissivo e negligente – destacando como cada um contribui para incitar ou mitigar tendências narcisistas. A parentalidade autoritária, marcada por regras rígidas e pouca afectividade, e a parentalidade permissiva, caracterizada pela leniência e pela falta de limites, estão associadas ao desenvolvimento de uma autoimagem inflamada e de um senso de direito exacerbado. Por outro lado, a parentalidade negligente, com ausência de envolvimento emocional e falta de orientação, frequentemente deixa as crianças com dificuldades em controlar as emoções, lidar eficazmente com os desafios, manter e nutrir relações. Enquanto a parentalidade democrática, caracterizada por uma relação próxima e afetuosa com as crianças, promove confiança, responsabilidade e capacidade de auto-regulação. A análise também explora o papel dos níveis de testosterona e cortisol nos comportamentos narcisistas, particularmente em traços como dominância, agressão e respostas ao stress. Ao integrar tanto fatores sociais quanto biológicos, esta meta-análise oferece uma compreensão abrangente de como a educação parental e os fatores hormonais, em conjunto, podem influenciar o desenvolvimento do narcisismo.

Palavras-chave: cortisol, educação, meta-análise, narcisismo, parentalidade, revisão sistemática, testosterona.

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LIST OF ABBREVIATIONS AND ACRONYMS

ADP-IV	DSM-IV Assessment of Personality Disorders Questionnaire.
CAQ	California Adult Q-Sort.
CI	Confidence Intervals.
CNS	Childhood Narcissism Scale.
DSM	Diagnostic and Statistical Manual of Mental Disorders.
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders – 4th Edition.
DSM-IV-TR	Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision.
DTDD	Dark Triad Dirty Dozen Scale.
FFM	Five-factor model.
FFNI-SF	Five-Factor Narcissism Inventory – Short Form.
HSNS	Hypersensitive Narcissism Scale.
NOS	Newcastle-Ottawa Scale.
NPI	Narcissism Personality Inventory.
NPQ	Narcissistic Personality Questionnaire.
PDQ-4+	Personality Diagnostic Questionnaire – 4th Edition Plus.

PNI	Pathological Narcissism Inventory.
PRISMA	Preferred Reporting Items for Systematic Reviews and Network Meta-Analyses.
SCID	Structured Clinical Interview for DSM-IV Personality Disorders.
SD3	Short Dark Triad.
SD4	Short Dark Tetrad.
SINS	Single Item Narcissism Scale.
YSQ-SF	Young Schema Questionnaire – Short Form.

REPORT

1

INTRODUCTION

In contemporary Western societies, a significant surge in narcissistic tendencies has been observed, a phenomenon often dubbed the "narcissism epidemic" (Vater et al., 2018). This escalation is evidenced by empirical data revealing a stark increase in self-centric attitudes, particularly among adolescents. For instance, the endorsement rate for statements such as "I am an important person" rose from 12% in 1963 to 77-80% in 1992 (Vater et al., 2018). This trend permeates various aspects of culture, including the lyrical content of contemporary songs and the thematic focus of popular television shows, which increasingly prioritize individual fame and self-promotion (Vater et al., 2018).

Jean Twenge and her team investigated the observed increase in narcissistic tendencies by examining generational changes. The study, carried out in 2008, analyzed 85 cohorts of participants who completed the Narcissistic Personality Inventory (NPI) scale between 1979 and 2006. The results revealed a 30% increase in narcissism levels among US university students during this period (Shaw, 2021). If this trajectory continues, as many scholars speculate, the path toward heightened narcissism appears inevitable (Shaw, 2021).

The rise in narcissism prevalence underscores the importance of understanding its origins, whether influenced solely by education or also by physiological characteristics. Such understanding can inform treatment adaptations and potentially shift paradigms.

The initial objective of this project was to verify whether there is a correlation between parental education, brain physiology, and the development of narcissistic traits. However, after reviewing the available literature for brain physiology, it was observed that there is a lack of consistent and comparable measures between the studies, which makes it unfeasible to continue with a meta-analysis. This limitation highlights a significant gap in the field and opens avenues for future research to explore the intricate relationship between brain function and narcissism. Given this constraint, the project shifted toward investigating the role of hormones, specifically testosterone and cortisol levels, in understanding narcissistic traits.

Given the aim to explore the relationship between narcissism and two distinct areas – parental education and testosterone and cortisol levels – this project includes two separate systematic reviews and meta-analyses, each following the same methodology. Thus, some chapters are divided into two sub-groups, each addressing a different area.

Chapter 2 provides a brief introduction to the topics addressed, covering the concept of narcissism and its types, the various forms of parenting considered, and the roles of testosterone and cortisol in the body. The subsequent chapter discusses the study methodology that follows Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which remains consistent across both meta-analyses. Chapter 4 presents the results, followed by a discussion in Chapter 5 and a conclusion in Chapter 6.

2

UNDERSTANDING NARCISSISM: FROM PERSONALITY TRAITS TO PARENTING AND HORMONAL INFLUENCES

This chapter presents a broad review of the literature on Narcissistic Personality Disorder, with a focus on its two main forms: grandiose and vulnerable narcissism. In addition, the chapter examines the assorted scales used to assess narcissistic traits, as well as the connections between narcissism, parental education, and the testosterone and cortisol levels.

2.1 NARCISSISTIC PERSONALITY DISORDER

Speaking of narcissism almost automatically brings us to Narcissus, a figure from Greek mythology known for falling in love with his own reflection in a pond, which ultimately led to his death. The etymology of the word possibly derives from the Greek $\nu\alpha\rho\kappa\eta$ (narke), meaning "sleep, numbness". The concept was taken up and refined by psychodynamic theorists, who considered that narcissism functioned as a self-regulatory mechanism as well as a personality disposition (as cited Jauk and Kanske, 2021). In the third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM), it was included for the first time as a personality disorder being defined by the American Psychiatric Association as "a pervasive pattern of grandiosity (in fantasy or behavior), need for admiration, and lack of empathy, beginning by early adulthood and present in a variety of contexts".

Individuals with Narcissistic Personality Disorder are highly sensitive to criticism or defeat due to their fragile self-esteem. Even though they may not display it outwardly, criticism can affect them deeply, leaving them feeling humiliated, empty, and degraded. Their reactions may range from disdain and rage to defiant counterattacks. These experiences often result in social withdrawal or a façade of humility, concealing their underlying grandiosity. Their interpersonal relationships suffer significantly due to entitlement issues, a constant need for admiration, and a lack of consideration for others' feelings (American Psychiatric Association, 2013).

Beneath their superficially smooth and socially adaptive behavior lies deep-seated dysfunction in their internal relations with others. They often oscillate between intense ambitions, grandiose fantasies, and feelings of inferiority, relying heavily on external validation to maintain their self-worth. Despite an outward display of confidence and success, they are plagued by chronic feelings of boredom, emptiness, and dissatisfaction with life. Their constant search for admiration and gratification stems from deep-rooted desires for brilliance, wealth, power, and beauty, often paired with an inability to genuinely love or empathize with others (O. Kernberg, 2004).

These individuals struggle with a lack of empathetic understanding, exhibiting exploitative and even ruthless behavior, driven by conscious or unconscious envy. Their persistent dissatisfaction, combined with their envy of others, can result in heightened defenses and further isolation. Although their ambition and confidence may lead to temporary successes, their inability to handle criticism and defeat often undermines their performance, leading to low vocational functioning, depression, and social withdrawal. Periods of grandiosity may be interspersed with hypomanic moods, adding to the instability of their emotional and professional lives (American Psychiatric Association, 2013; O. Kernberg, 2004).

2.1.1 *Grandiose and Vulnerable Narcissism*

As mentioned by Jauk and Kanske (2021), emerging consensus suggests that narcissism is multifaceted, with distinct expressions. Grandiose and vulnerable narcissism are recognized as separate yet related manifestations, characterized by either self-assured dominance or self-conscious withdrawal. Despite differences, both entail feelings of self-importance and entitlement.

Narcissism is a multidimensional construct, with grandiose and vulnerable forms distinguished by persistent feelings of importance and grandiosity, alongside a desire for admiration and antagonistic traits. Although the term “narcissism” commonly evokes notions of exaggerated self-worth, superiority, entitlement, and arrogance, this definition closely aligns with the definition of grandiose narcissism. This personality trait encompasses entitlement, extroversion, socially dominant behavior, self-assurance, immodesty, exhibitionism, manipulation, and aggression. While vulnerable narcissism is associated with distrustful, hostile interpersonal styles driven by negative emotionality and problematic attachment that tends towards depressive symptoms and social withdrawal, with less emphasis on grandiose fantasies.

Pathological grandiose or vulnerable narcissism may be diagnosed when these traits are pronounced. Both overlap in their use of antagonistic interpersonal strategies but differ in specific traits and behavioral tendencies (Clemens et al., 2022; Jauk and Kanske, 2021; J. Miller et al., 2012; Rawn et al., 2023).

2.1.2 *Narcissism Scales*

With the advancement of studies on narcissism, methods for assessing personality also emerged. The first known assessments were developed by Raskin and Hall, consisting of versions with 80 and 54 items, respectively. The shorter version, **Narcissistic Personality Inventory-40 (NPI-40)**, was subjected to three different studies by the same authors in 1988, and it is the version that is most used and examined in many studies to date (Statistics Solutions, 2024). However, short versions were perceived after NPI-40, such as NPI-16 and NPI-34.

The NPI-40 is composed of three subscales, each capturing different facets of narcissism:

- Entitlement/Exploitativeness: This subscale is often considered the most indicative of narcissistic personality pathology. It is related to lower self-esteem and extraversion, higher mood variability, and neuroticism. Additionally, it is associated with both grandiose and vulnerable narcissism, as well as narcissistic personality disorder (Gentile et al., 2013).
- Leadership/Authority: This subscale is a more specific marker of grandiose narcissism, associated with higher self-esteem, extraversion, and lower neuroticism. It indicates a tendency to seek and enjoy positions of leadership and authority (Gentile et al., 2013).
- Grandiose Exhibitionism: Like the Leadership/Authority subscale, this is also a marker of grandiose narcissism. It is associated with higher self-esteem, extraversion, and lower neuroticism. It reflects the need to be the center of attention and to receive admiration from others (Gentile et al., 2013).

Several assessments are commonly used to measure narcissistic personality traits in psychological research. Alongside the widely recognized NPI-40, the **Pathological Narcissism Inventory (PNI)**, developed by Pincus et al. in 2009, is a 52-item self-report measure that assesses both vulnerable and grandiose narcissism traits. The PNI is divided into four subscales for vulnerable narcissism (Contingent Self-Esteem, Hiding the Self, Devaluing, and Entitlement Rage) and three subscales for

grandiose narcissism (Self-Sacrificing Self-Enhancement, Grandiose Fantasies, and Exploitativeness) (Gentile et al., 2013).

The **Hypersensitive Narcissism Scale (HSNS)**, created by Hendin and Cheek in 1997, is a 10-item self-report measure specifically designed to assess vulnerable narcissism (Gentile et al., 2013).

The **California Adult Q-Sort (CAQ)** is a set of statements used in observer and self-report assessments of personality. It comprises 100 items that have been utilized to assess various personality traits, including narcissism. The CAQ-13 is a measure of narcissism-based CAQ, which consists of 13 items selected to represent it. These items were identified by experts and subjected to factor analysis, resulting in three subscales: Grandiose, Vulnerable, and Autonomy (Cramer, 2015; Lanning and Sherman, 2017).

The **Childhood Narcissism Scale (CNS)** is a unidimensional measure consisting of 10 items designed to assess narcissistic traits in children. The scale evaluates the degree to which children endorse grandiose and entitled self-perceptions (Brummelman, 2015; Coppola, 2020; Eberly-Lewis, 2018).

The **Dark Triad Dirty Dozen Scale (DTDD)** is a 12-item measure used to assess the Dark Triad traits: narcissism, machiavellianism, and psychopathy. Each of these three dimensions is evaluated with four specific items (Guoa, 2021; Tajmirriyahi, 2021; Yendell, 2022).

The **DSM-IV Assessment of Personality Disorders Questionnaire (ADP-IV)** is a self-report instrument comprising 94 items, representing the 80 criteria of the 10 DSM-IV personality disorders and the 14 research criteria of the depressive and passive-aggressive personality disorders (Hengartner, 2013).

The **Five-Factor Narcissism Inventory – Short Form (FFNI-SF)** is a 60-item self-report questionnaire designed to assess narcissism through the lens of the five-factor model (FFM) of personality. The FFNI-SF assesses both vulnerable and grandiose narcissism across 15 subscales, each representing a maladaptive variant of an FFM trait. Additionally, it considers three dimensions derived from factor analysis: antagonism, neuroticism, and agentic extraversion (Şar, 2021).

The **Narcissistic Personality Questionnaire (NPQ)** developed by Zhou et al. (2009) is a 34-item self-report instrument that assesses three dimensions: desire for power, sense of superiority, and self-appreciation (Li, 2023).

The **Personality Diagnostic Questionnaire – 4th Edition Plus (PDQ-4+)** is the most recent version of the PDQ. Each version corresponds to the different

editions of the DSM since 1980. The PDQ-4+ consists of 99-item true/false questions and assesses ten DSM-IV-TR personality disorders and two provisional personality disorders (Batool, 2017; Cohen, 2014; PsycNet, 2024a).

The **Short Dark Triad (SD3)** and the **Short Dark Tetrad (SD4)** are 27-item and 28-item, respectively, self-report questionnaires designed to measure individuals' dark personality traits. The SD4 addresses all four dark personality traits (subclinical narcissism, machiavellianism, subclinical psychopathy, and sadism), whereas the SD3 focuses on only the first three (Babakr and Fatahi, 2023; Ferencz, 2022; Ren, 2022).

The **Single Item Narcissism Scale (SINS)** is an one-item measure that assesses grandiose and vulnerable aspects of non-clinical narcissism. Participants respond on a seven-point scale (1 = "Not very true of me" to 7 = "Very true of me"): "To what extent do you agree with this statement: I am a narcissist. (Note: The word "narcissist" means egotistical, self-focused, and vain.)." (PsycNet, 2024b; Wang, 2022)

The **Structured Clinical Interview for DSM-IV Personality Disorders (SCID)** is a widely used semi-structured interview designed to diagnose personality disorders according to DSM-IV criteria. It includes 94 main yes/no questions that address enduring patterns of inner experience and behavior deviating from cultural expectations, affecting cognition, affectivity, interpersonal functioning, and impulse control (Glasofer et al., 2015; Ochojska, 2021).

The **Young Schema Questionnaire – Short Form (YSQ-SF)** is a 75-item adaptation of the original 205-item Young Schema Questionnaire. The short form includes 5 items from each of the 15 original scales, selected based on their strong factor loadings. The 15 subscales assess various schemas, such as abandonment, mistrust/abuse, and emotional deprivation. In the study under analysis, narcissism was specifically assessed using the 5-item grandiosity subscale from the YSQ-SF, which measures beliefs of superiority and entitlement to special treatment (Calvete, 2015; PsycNet, 2024c).

2.2 NARCISSISM AND PARENTAL EDUCATION

Parenting education is widely recognized as an influential factor in the development of a child's personality traits. As mentioned by Imamoglu (2020) and O. Kernberg (2004), overly permissive, intrusive, cold, or strict parenting styles — particularly

when parents appear functional but are emotionally indifferent or subtly aggressive — can play a significant role in the development of narcissistic traits, including pathological narcissism. Similarly, Young et al. (2003) propose that childhood experiences such as loneliness, poor boundaries, manipulation, and conditional approval contribute to the development of a narcissistic personality, often resulting in a lack of genuine love and empathy in these individuals during their early years.

In the investigation of the impact of parental education on child development, Baumrind (1971) identified four parenting styles, each offering a perspective on the socialization processes that shape children's personalities. These parenting styles, among the most widely accepted by scholars, are authoritarian, authoritative, permissive, and neglectful styles.

Authoritarian parenting is characterized by shaping and controlling the child's behavior according to strict standards, emphasizing obedience without explanation, and often relying on punitive measures to enforce compliance (Cramer, 2015). This approach can restrain the child's development of personal competence, as it discourages the recognition and expression of their thoughts and feelings, leading to a reliance on external approval to maintain a constructed self-image (A. Miller, 1981; Winnicott, 1965). Children raised in authoritarian households may exhibit higher levels of aggression, struggle with decision-making, and have poor self-esteem due to the lack of nurturing and flexibility from their parents. Additionally, strict rules can lead to rebellion or an inflated sense of self-importance if the child is praised for compliance. However, this sense of specialness is fragile, as it depends on the continued admiration of others (Cramer, 2015; Sanvictores and Mendez, 2024).

In contrast, **authoritative parenting** sets clear behavioral standards but uses reasoning and explanation to guide the child, balancing assertiveness with respect for the child's perspective and rights. Discipline in this style is more supportive than punitive (Cramer, 2015). This approach is responsive to the child's needs, fostering autonomy, competent skill-building, and self-regulation (George and Solomon, 1989; Pomerantz and Thompson, 1981). By maintaining clear expectations and simultaneously respecting the child's individuality, authoritative parenting promotes a strong sense of self-confidence and self-esteem, reducing the likelihood of narcissistic traits developing (Cramer, 2015).

Permissive parenting is characterized by leniency and affection, often struggling to enforce discipline and not requiring the child to display mature behavior (Cramer, 2015). While this approach meets the child's needs and affirms their worth, it can foster impulsivity, selfishness, and a lack of self-regulation. Although children raised

by permissive parents may develop some level of self-esteem and social skills, they often become demanding and expect their needs to be met without effort. This lack of boundaries may result in compensatory behaviors, where the child inflates their self-image and ignores others who do not satisfy their desires, behaviors commonly associated with narcissism (George and Solomon, 1989; P. F. Kernberg et al., 2000; Sanvictores and Mendez, 2024).

On the other hand, **neglectful parenting** expects the child to manage problems independently, offers little support, and encourages the child to take responsibility for their own life, often neglecting to provide guidance or assistance (Cramer, 2015). Children may develop resilience and self-sufficiency out of necessity, rather than through positive development. This lack of involvement can leave the child feeling incompetent and vulnerable, as they do not receive the support needed to build essential skills and emotional regulation. As a result, they often struggle with controlling their emotions, coping effectively, and facing difficulties in maintaining and nurturing social relationships. Eventually, the child's ability to develop a strong sense of self is compromised, leading to further challenges in navigating setbacks (P. F. Kernberg et al., 2000; Sanvictores and Mendez, 2024).

The different parenting styles can significantly influence the development of narcissistic traits in children. Understanding these dynamics is essential for both researchers and practitioners aiming to address the root causes of narcissism and to promote healthier personality development.

2.3 NARCISSISM, TESTOSTERONE, AND CORTISOL LEVELS

The investigation of the biological foundations of personality traits, particularly narcissism, has garnered significant attention in psychological and physiological research. Among the various factors that have been studied, the roles of testosterone and cortisol stand out due to their influence on behavior, stress responses, and social interactions (Sapolsky, 2004).

Testosterone is a steroid hormone primarily produced in the testicles in males, and in smaller amounts in the ovaries in females. It's well-known for its role in the development of male secondary sexual characteristics. Beyond its physiological effects, testosterone is associated with various psychological and behavioral traits, particularly those related to dominance and social status (South, 2023; Zajenkowski, 2023). High levels of testosterone have been linked to increased dominance traits often observed in narcissistic individuals. Narcissists are highly concerned with

their social standing, motivated to feel superior to others, and when their ego is threatened, such as through negative feedback, they often respond with aggression, which can be driven by heightened levels of testosterone (Pfattheicher, 2016).

On the other hand, cortisol is produced by the adrenal glands, and it plays a crucial role in the body's response to stress, particularly when there is a perceived significant threat to the self. It helps regulate various physiological processes, including metabolism, immune response, and stress management (South, 2023). In the context of personality, cortisol's relationship with stress and anxiety is particularly relevant. Narcissists, particularly those exhibiting vulnerable narcissism, often display heightened sensitivity to stress and criticism. High cortisol levels are associated with difficulties in emotional regulation, which can exacerbate narcissistic traits such as hypersensitivity to perceived slights and emotional volatility (Edelstein, 2010; Pfattheicher, 2016; South, 2023).

A comprehensive understanding of how testosterone and cortisol influence narcissistic traits is essential for advancing the knowledge of the biological foundations of personality. By examining the interplay between these hormones and narcissistic behaviors, researchers can gain a more profound understanding of the underlying mechanisms that drive both the grandiose and vulnerable aspects of narcissism. This knowledge could have practical implications for the development of more targeted interventions for the management of maladaptive conduct linked with narcissistic personality traits.

3

METHODOLOGY

These systematic reviews and meta-analyses were performed following the PRISMA guidelines. Both studies were registered in PROSPERO (an international prospective register for systematic review protocols) under the registrations CRD42024512999 and CRD42024516395, and included a prespecified protocol.

To ensure the integrity of the data extraction process, a systematic approach was employed. Two independent reviewers screened the eligibility of studies based on their titles and abstracts. Articles passing this initial screening underwent full-text review. Extracted data included title, authors, publication year, narcissism scale, information for effect measure computation, and risk of bias assessment.

In line with the systematic selection process, specific inclusion criteria were applied to ensure consistency across the studies analyzed. Eligible studies needed to feature participants who had completed a validated narcissism scale, thus guaranteeing reliable measurement of narcissistic traits. Both genders were included, except in studies examining testosterone, where this criterion was not enforced due to the hormone's predominance in males. Participants were required to be at least six years old, a threshold informed by developmental psychology theories, such as those proposed by Jean Piaget and Erik Erikson, which suggest that personality traits and self-concept begin to emerge more distinctly around this age. Additionally, studies had to report at least one relevant outcome measure, be published in English or Portuguese, and have a publication date no earlier than 2000, ensuring the inclusion of contemporary research.

A first search for articles was carried out on PubMed and Scopus on 2nd January 2024, using Boolean operators and the following search terms: "narcissism", "education", "parental", "brain", "physiological", and "cognitive" (cf. Appendix A). After screening the titles and abstracts, 2723 articles were excluded. Out of 108 qualified studies, 28 did not provide quantitative data, 38 were outside of scope, 3 the full version of the article could not be retrieved, and 1 was not written in English or Portuguese. A total of 38 studies examining the relationship between parental education and narcissism were included in the final analysis, cf. Figures 1 and 2.

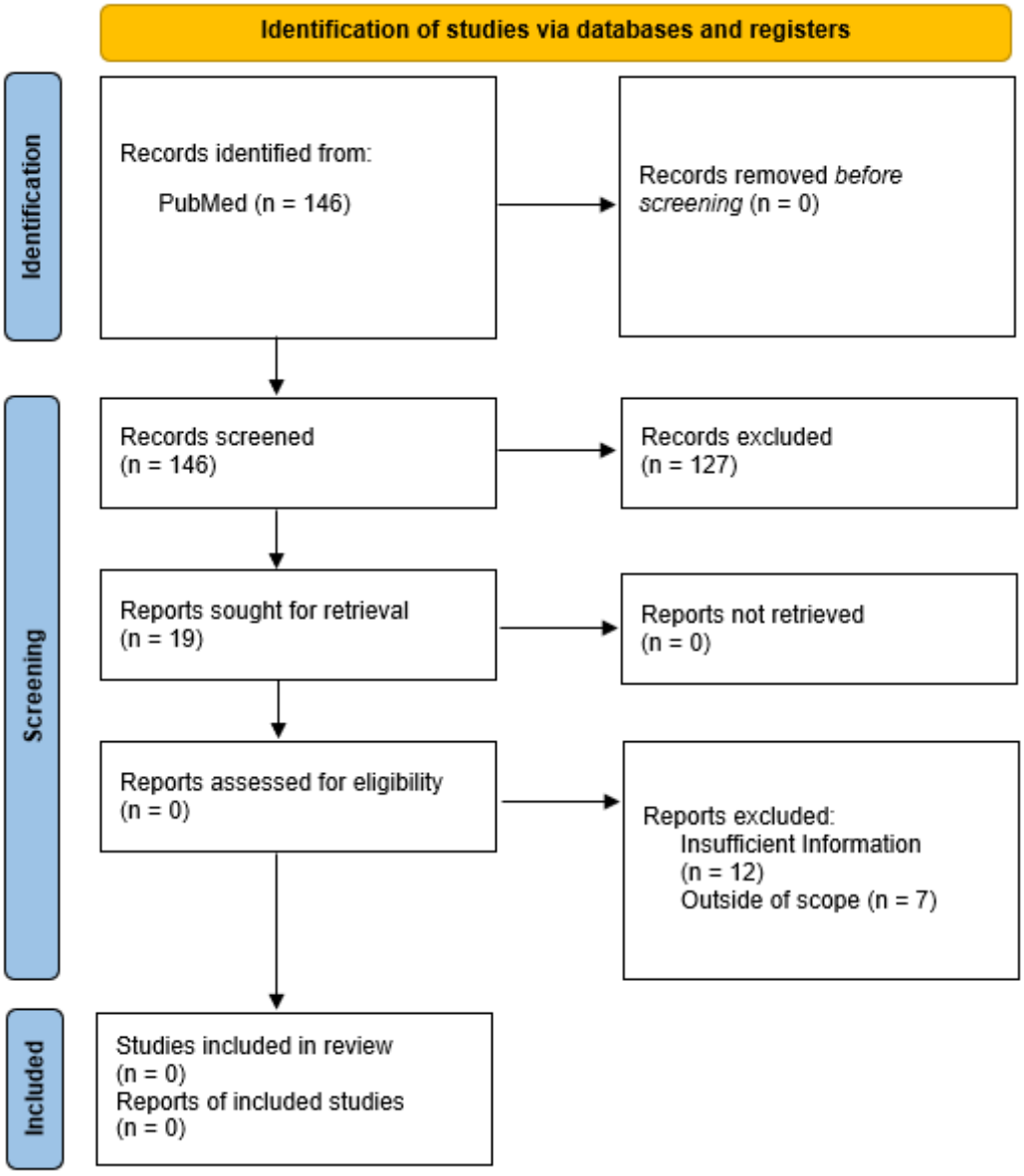

Figure 1: PRISMA 2020 flow diagram – Neurological studies

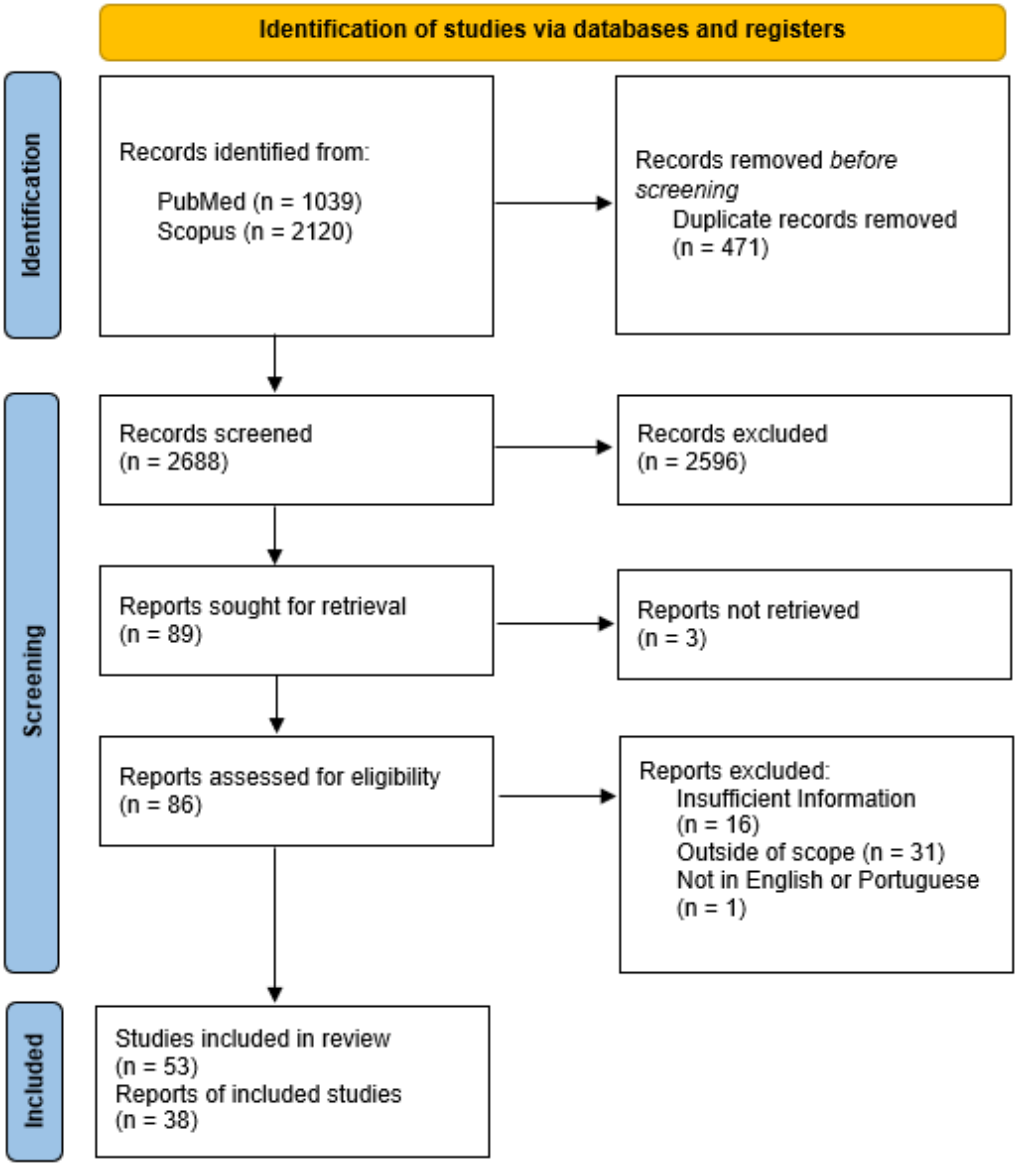

Figure 2: PRISMA 2020 flow diagram – Parental Education studies

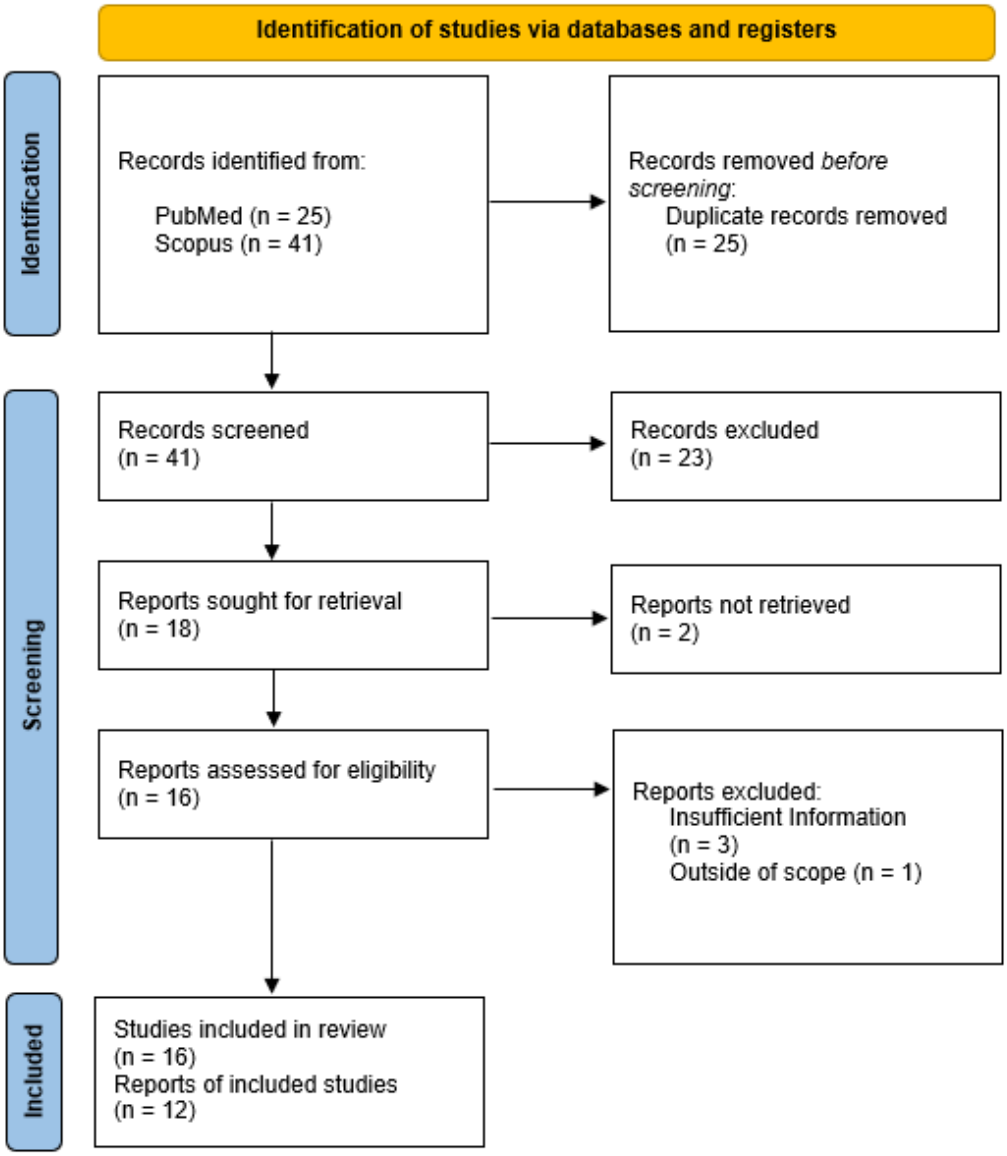

Figure 3: PRISMA 2020 flow diagram – Testosterone and Cortisol Levels studies

After analyzing and selecting the articles, it was determined that proceeding with the meta-analysis of studies investigating the relationship between the brain physiology and narcissism would not be feasible. This is due to the lack of comparable measures across the available literature, making their study challenging. Given this limitation, the focus shifted towards the study of the relation between narcissism and two hormones: testosterone and cortisol. Consequently, a second search was conducted on Scopus and PubMed, in February of 2024, using the terms "narcissism", "testosterone", and "cortisol". This yielded 66 articles, of which 25 were eliminated due to duplication. Following a review of titles and abstracts, a total of 18 articles were selected. Among these, 3 were excluded for lacking quantitative data, 1 was deemed outside the scope of the study, and 2 were not retrieved, cf. Figure 3.

Tables 1 and 2 summarize all the studies included in the final analysis, and details about the two search strategies are listed in the Appendix A.

The studies addressing parental education analyze various characteristics such as overprotection, rejection, and corporal punishment, among others. Consequently, these characteristics were associated with established parenting styles – authoritative, authoritarian, neglectful, and permissive, as detailed in Section 2.2. In situations where multiple characteristics were identified for a single parental style, a 90% confidence interval for the correlation was calculated. If there was an overlap within the confidence intervals, an average was taken; otherwise, the characteristics were excluded.

Additionally, specific terminology was employed to clarify the study. Therefore, the term "parenting" and "parents" refers to the influence of both parents, while "maternal" or "mother" corresponds to the mother's role, and "paternal" or "father" relates to the father's influence. The term "overall" was used when discussing narcissism without distinguishing between its subtypes, while "grandiose" and "vulnerable" specifically denote grandiose and vulnerable narcissism, respectively.

3.1 STATISTICAL ANALYSIS

In these meta-analyses, the effect measures considered were partial and zero-order correlations. Partial correlations were preferred over zero-order correlations, as they measure the strength of a relationship between two variables while controlling for the effect of one or more other variables, thereby providing a more accurate representation of the relationships under investigation.

For data synthesis, statistical heterogeneity was assessed using the I^2 statistic, between 25 and 75% indicating moderate heterogeneity and above 75% indicating high heterogeneity. The models were selected based on the I^2 statistic, with a fixed-effects model being used if the value was less than 25% and a random-effects model being used otherwise. Data analysis was conducted using R statistical software and metacor package (Laliberté, 2019; R Core Team, 2024).

During the analysis, confidence intervals (CI) were reported at the 95% level, and hypothesis tests were conducted with a significance level of 5%.

Publication bias, if present, was assessed using funnel plots, Egger's test, and the trim and fill method. Subgroup analyses were planned in case of significant heterogeneity, focusing on predefined criteria such as age, gender, and narcissism scale. These analyses aim to identify potential moderating factors influencing the observed effects (Brilhante, 2017; Hansen et al., 2022; Shim and Kim, 2019).

It's noteworthy that a minimum criterion has been set for the analysis, as it's necessary to have a minimum number of studies that provide a sufficient basis for reliable statistical analysis and meaningful conclusions. Therefore, in cases where fewer than three studies were available, the analysis was not carried out.

3.2 QUALITY ANALYSIS

The included studies were evaluated for risk of bias using established critical appraisal tools. Two researchers independently assessed each study, with any discrepancies resolved by a third researcher. The Newcastle-Ottawa Scale (NOS) were used to evaluate methodological quality, with studies scoring at least 8 out of 10 points considered high quality. The original scale was modified to accommodate the particular circumstances under examination in this analysis. The scales employed and their respective adaptations are detailed in the Appendices D and E, while the individual study scores are presented in Tables 1 and 2.

To assess the sensitivity of the conclusions, in cases that included studies scored less than eight on the NOS, two analyses were performed: one including all studies regardless of NOS score and another including only those scoring eight or higher, comparing the results accordingly.

Table 1: Parental Education Studies Characteristics
Narc. Scale: Narcissism Scale; **G**: Grandiose Narcissism; **V**: Vulnerable Narcissism.

Study	Country	Sample Size	Female %	Mean Age	Narc. Scale	NOS
Batool, 2017	Pakistan	100	87		PDQ	7
Brummelman, 2015	Netherlands	565	54	9.6	CNS	10
Cater, 2011		330	83.9	21.6	PNI	8
					PNI-V	8
Cohen, 2014	USA	231	54.5	39.3	PDQ 4+	8
Coppola, 2020	Italy	519	52.4	9.7	CNS	9
Cramer, 2015	USA	85	50.6	23	CAQ-13	9
					CAQ-13-V	9
Cramer, 2011	USA	102		23	CAQ	8
Eberly-Lewis, 2018	USA	460	58.5		CNS	10
Farzand, 2021	Cyprus	628	45.4		NPI-40	10
Ferencz, 2022		111	58.6	15.9	SD3	9
Green, 2020	UK	176	100		PNI-52-G	8
					PNI-52-V	8
		152	0		PNI-52-G	8
					PNI-52-V	8
Guo, 2021	China	559	68.2	21.2	DTDD	9
Horton, 2006	USA	214	59.3	15.4	NPI-40	9
Horton, 2014	USA	145	32,4	19.6	NPI-40	9
Huxley, 2016	Australian	442	68.1	25.6	PNI-52	9
					PNI-52-V	9
Imamoglu, 2020	Turkey	508	53.3	31.2	PNI	9
					PNI-V	9
Kealy, 2021	UK	334	79.9	20.3	HSNS	9
Khorshidtalab, 2023	Iran	278			NPI-16	8
Lan, 2021	China	681	59	15.6	SD3-D	9
					SD3-I	9

Continued on next page

Table 1: Parental Education Studies Characteristics

Study	Country	Sample Size	Female %	Mean Age	Narc. Scale	NOS
Li, 2023	China	1173	53.7	14.8	NPQ	10
Li, 2020	China	1533	55.1	15.3	SD3	9
Lin, 2023	Taiwan	285	70.5	20.1	NPI-40	9
Liu, 2021	China	530	82.3	18.8	DTDD	8
Lyons, 2013	UAE	70	100	19.7	NPI-40	8
	UK	78		21		
Maxwell, 2014	USA	599	76,5	22,3	PNI-52	9
McGinley, 2022	USA	155	66.7	19.3	PNI-28	8
					PNI-28-V	8
Mechanic, 2015		300	14.3	16.6	PNI	8
					PNI-V	8
Nguyen, 2020	USA	263	90	45	NPI-40	8
Ochojska, 2021		387	70.8	22.8	SCID	9
Otway, 2006	UK	119	50	28.8	NPI-40	9
					HSNS	9
Ren, 2022	China	1035	57.5	22.5	SD4	10
Şar, 2021	Turkey	422	79.6	20.1	FFNI-SF	9
					FFNI-SF-V	9
Segrin, 2013	USA	653	69.5	20	PNI-52	10
Tajmirriyahi, 2021	Iran	262	23.2	22.8	DTDD	9
Wang, 2022	China	4172	48	16.4	SINS	9
Winner, 2018		380	78.9	20.1	PNI	9
					PNI-V	9
Yendell, 2022	Germany	1060	49		DDS	9
Zarbiv, 2022	Israel	689	79	24.6	PNI-28	9
					PNI-28-V	9

Table 2: Testosterone and Cortisol Studies Characteristics

Study	Country	Sample Size	Female %	Mean Age	Narcissism Scale	NOS
Borráz-León, 2023	USA	47	63.8	24.3	NPI-40	9
					HSNS	9
Czarna, 2022	Polon	68	0	23.2	NPI-34	8
Czarna, 2022	Polon	84	0	23.1	DTDD	8
Dane, 2017	Canada	25	0	23.2	NPI-40	7
Edelstein, 2010	USA	90	51	20.6	NPI-40	8
Lobbestael, 2014	USA	100	0	19.5	NPI-37	7
					HSNS	7
Noser, 2018	Germany	109	0	50.9	DDS	8
Noser, 2017	Germany	109	0	50.9	DDS	8
Pfattheicher, 2016	Germany	129	0	21.9	SD3	8
South, 2023	Australian	268	49.3	25.2	SD3	9
Stoppelbein, 2013	USA	158	100	9.7	APSD	8
Wardecker, 2018	USA	366	48.2	19.2	NPI-40	9
Zajenkowski, 2023	Poland	283	0	22.8	NPI-34	8
					HSNS	8

4

RESULTS

This chapter provides an overview of the findings, organized according to parental education and testosterone and cortisol levels. The statistical analyses, relevant trends, and significant patterns observed during the study are presented in detail, forming the basis for the discussion and conclusions that will be presented in the following chapters.

4.1 NARCISSISM AND PARENTAL EDUCATION

A total of 11, 13, 9, and 6 studies were found relating overall narcissism to parenting styles authoritative, authoritarian, neglectful, and permissive, respectively. Figures 4 to 7 present forest plots summarizing the findings. In all cases, the results revealed significant heterogeneity for the authoritative, authoritarian, and negligent education (authoritative: $Q(6530) = 85.37$, $p < 0.0001$; authoritarian: $Q(6987) = 73.60$, $p < 0.0001$; negligent: $Q(3978) = 82.64$, $p < 0.0001$). Results also showed that the magnitudes of heterogeneity were large for these three parenting styles (authoritative: $I^2 = 88.3\%$; authoritarian: $I^2 = 83.7\%$; negligent: $I^2 = 90.3\%$). Only results for the permissive style showed moderate heterogeneity ($Q(2319) = 7.28$, $p = 0.2005$, $I^2 = 31.3\%$).

Given this heterogeneity in all instances, the overall estimates were calculated using a random-effects model. The highest correlations were observed for the permissive (0.15, CI 95% [0.10; 0.21]) and authoritarian (0.15, CI 95% [0.09; 0.21]) styles, followed by neglectful (0.10, CI 95% [0.01; 0.19]), and authoritative (0.08, CI 95% [0.00; 0.15]) styles.

Upon examination of the forest plots, it becomes evident that the confidence intervals intersect, thereby rendering it plausible to suggest that the correlation values are equal. Concerning all parenting styles, a significant, albeit weak, correlation with narcissism is observed, with an estimated range between 0.08 and 0.15.

Funnel plots, the trim-and-fill method, and Egger's test for funnel plot asymmetry were employed to investigate the potential for publication bias. As illustrated in

Appendix D (Figures 31, 39, 45, and 49), the funnel plots for permissive and authoritarian parenting styles exhibit symmetrical patterns. However, the plots for authoritative and neglectful styles reveal potential missing studies, with two and four studies respectively.

Despite these observations, the p-values from the Egger's tests for funnel plot asymmetry are substantially higher than 0.05 (authoritative: $p = 0.5533$; authoritarian: $p = 0.7727$; negligent: $p = 0.2736$; permissive: $p = 0.9582$), indicating that the results of the meta-analyses are not significantly affected by publication bias.

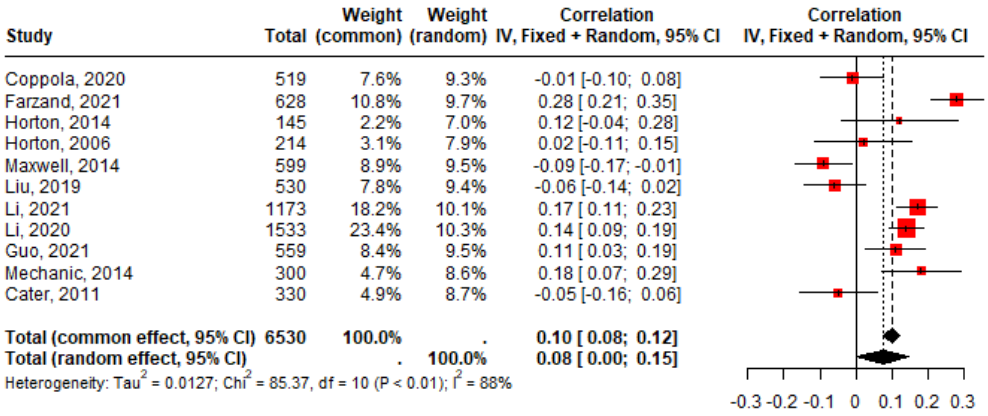

Figure 4: Forest Graphic Authoritative Parenting Overall Narcissism

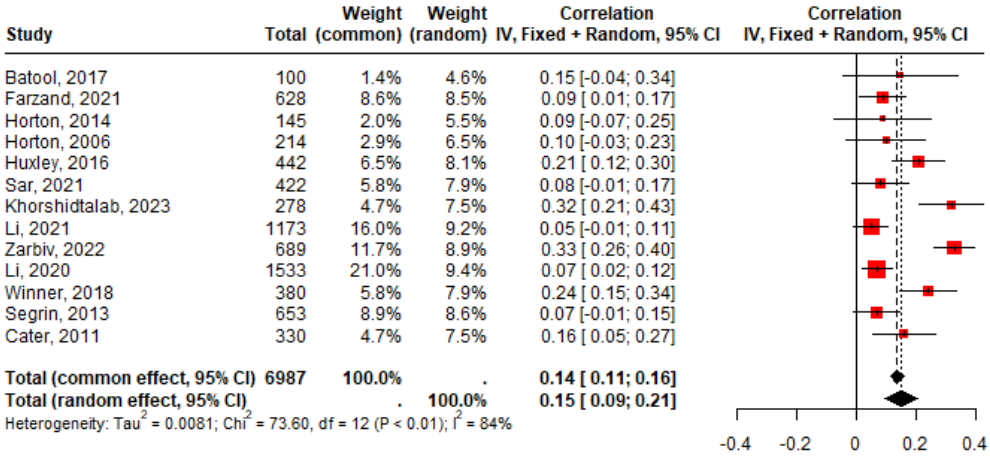

Figure 5: Forest Graphic Authoritarian Parenting Overall Narcissism

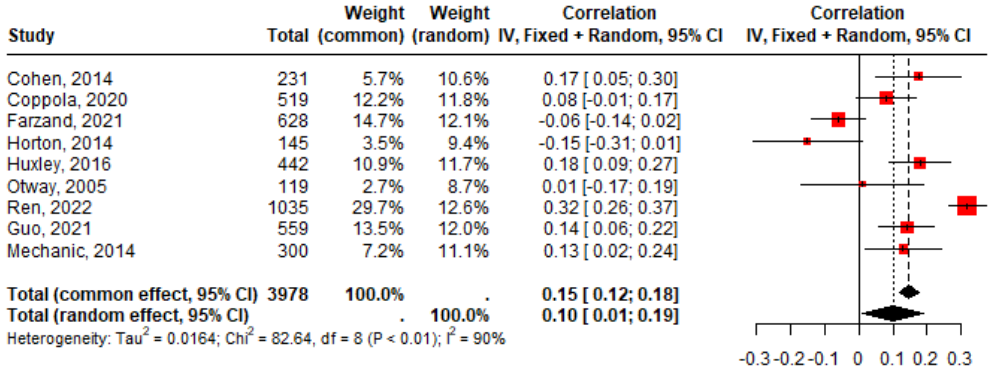

Figure 6: Forest Graphic Neglectful Parenting Overall Narcissism

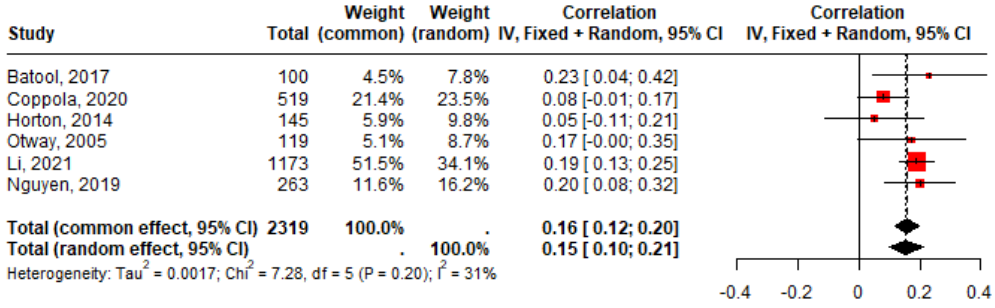

Figure 7: Forest Graphic Permissive Parenting Overall Narcissism

In the analysis examining the relationship between authoritarian and permissive parenting and overall narcissism, a study was identified with a NOS score below eight. Therefore, a second analysis was performed, excluding this lower-quality study, to assess the robustness of the findings, cf. Figures 8 and 9. In this secondary analysis (authoritarian: 0.15, CI 95% [0.0919; 0.2102]; permissive: 0.15, CI 95% [0.0853; 0.2082]), the conclusions remained consistent with the primary analysis, indicating that the lower-quality study did not significantly influence the overall results. This reinforces the reliability of the conclusions drawn from the full dataset, as the observed results were not contingent on the exclusion of studies with potential methodological limitations.

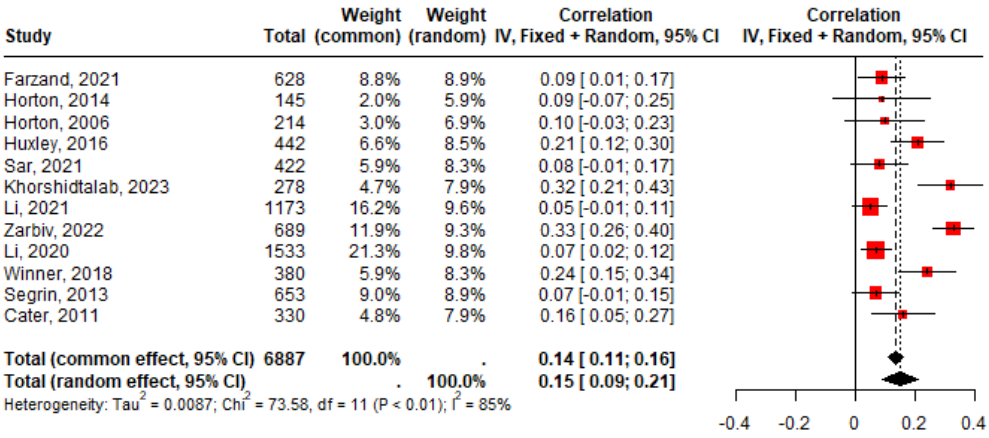

Figure 8: Forest Graphic Authoritarian Parenting Overall Narcissism – with NOS score studies higher or equal to 8

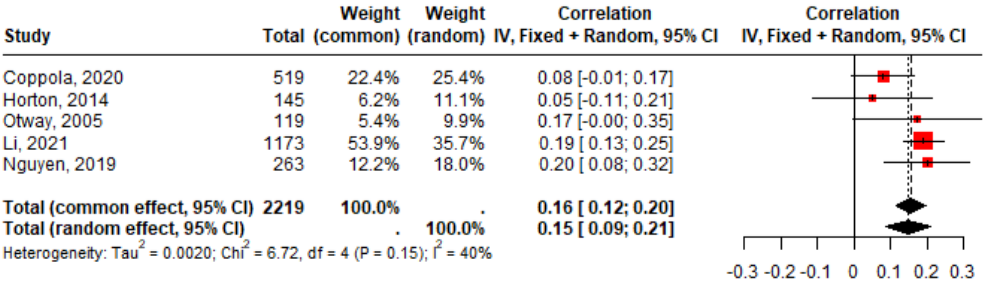

Figure 9: Forest Graphic Permissive Parenting Overall Narcissism – with NOS score studies higher or equal to 8

4.1.1 *Narcissism and Authoritative Education*

Focused on maternal and paternal education, a total of 11 studies were identified for each, examining the correlation between the authoritative parenting style and overall narcissism. Figures 10 and 11 present forest plots summarizing the findings. A significant heterogeneity was evident for both maternal and paternal education (mother: $Q(4670) = 64.41$, $p < 0.0001$, $I^2 = 84.5\%$; father: $Q(4670) = 580.97$, $p < 0.0001$, $I^2 = 98.3\%$).

Consequently, a random-effects model was used to analyze the correlation. Observing the forest plots, the confidence intervals for the correlations between overall narcissism and both maternal and paternal authoritative parenting overlap with zero, suggesting that these correlations are not statistically significant (mother: 0.01, 95% CI [-0.0764; 0.1061]; father: -0.05, 95% CI [-0.2322; 0.1415]).

Although funnel plots identify two missing studies for both maternal and paternal influences (Figures 32 and 33), the p-values from the regression tests for funnel plot asymmetry remain well above the 0.05 threshold (maternal: $p = 0.3003$; paternal: $p = 0.9498$). This suggests that publication bias is not significantly affecting the results of these meta-analyses.

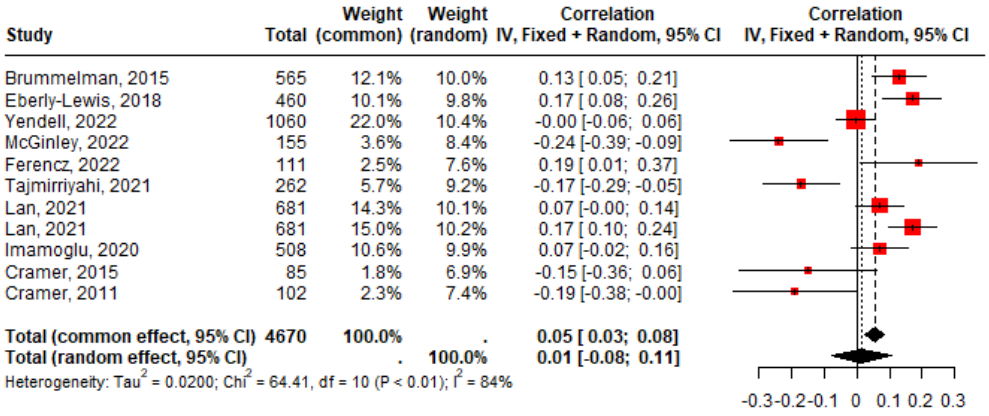

Figure 10: Forest Graphic Authoritative Mother Overall Narcissism

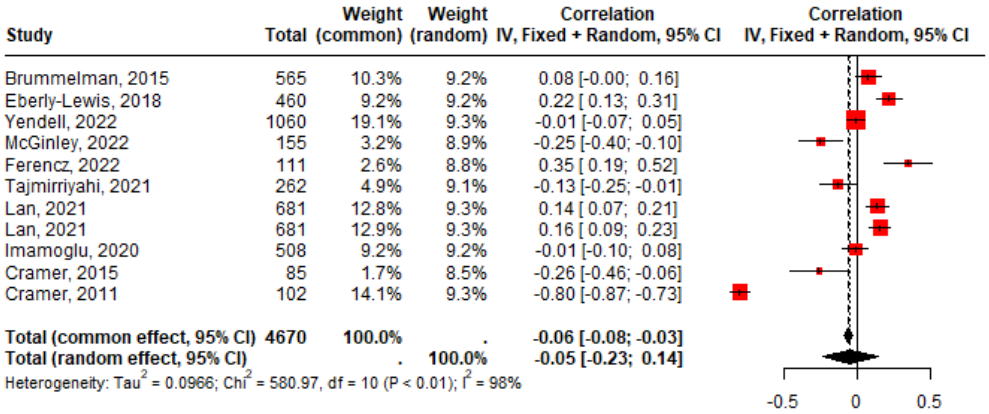

Figure 11: Forest Graphic Authoritative Father Overall Narcissism

Regarding grandiose narcissism, five studies each were identified examining the correlation between maternal and paternal authoritative parenting, cf. Figures 12 and 13. Upon further analysis, significant heterogeneity was found in these studies. Specifically, the studies focusing on maternal authoritative parenting reveal high heterogeneity ($Q(761) = 31.85$, $p < 0.0001$, $I^2 = 87.4\%$), whereas studies focusing on paternal authoritative parenting show moderate heterogeneity ($Q(761) = 9.32$, $p < 0.0001$, $I^2 = 57.1\%$).

In the context of vulnerable narcissism, three studies examined overall authoritative parenting, while five studies each focused on maternal and paternal authoritative

parenting. Forest plots summarizing the findings are shown in Figures 14 to 16. Once again, the heterogeneity remains significant for both maternal (Q(1076) = 25.04, $p < 0.0001$, $I^2 = 84\%$) and overall authoritative parenting (Q(1076) = 11.20, $p = 0.0037$, $I^2 = 82.1\%$), while paternal authoritative parenting shows moderate heterogeneity (Q(1076) = 6.64, $p = 0.1564$, $I^2 = 39.7\%$).

A closer examination of these specific types of narcissism reveals different patterns in the data. It is noteworthy that while maternal authoritative parenting shows no significant correlation with grandiose narcissism, paternal authoritative parenting exhibits a negative correlation, suggesting the potential for an inverse relationship (mother: -0.06, CI 95% [-0.2510; 0.1329]; father: -0.15, CI 95% [-0.2603; -0.0434]).

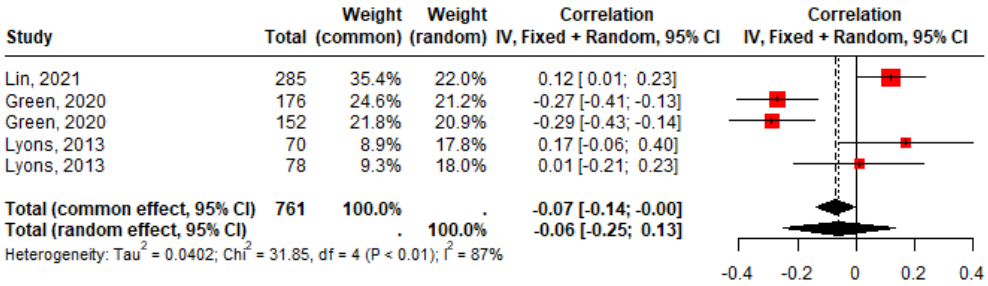

Figure 12: Forest Graphic Authoritative Mother Grandiose Narcissism

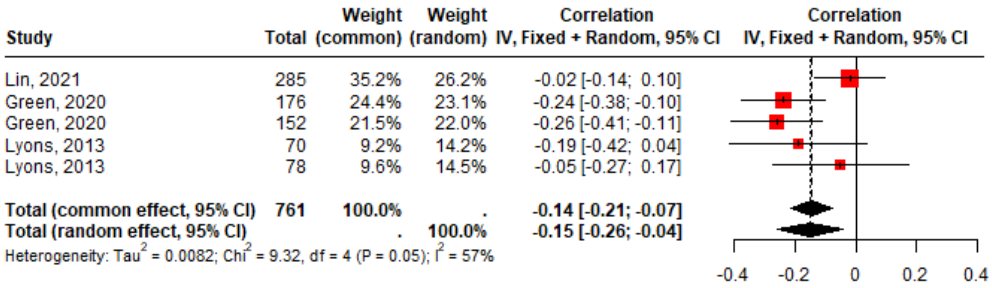

Figure 13: Forest Graphic Authoritative Father Grandiose Narcissism

For vulnerable narcissism, although the intervals indicate that there is no statistically significant correlation with authoritative parenting (-0.11, CI 95% [-0.2529; 0.0360]), when looking for maternal and paternal influences (mother: -0.28, CI 95% [-0.4046; -0.1521]; father: -0.21, CI 95% [-0.2931; -0.1316]), the negative correlations observed imply that authoritative parenting may be inversely related to vulnerable narcissism.

Funnel plots reveal symmetrical patterns for the analyses of both grandiose (mother and father) and vulnerable narcissism (overall parenting), cf. Figures 34, 35, and 36. However, for maternal and paternal influences on vulnerable narcissism, the

plots indicate two missing studies each, cf. Figures 37 and 38. Despite these findings, there is no evidence of publication bias in the analyses according to p-values from the Egger's tests for funnel plot asymmetry, well above 0.05 (grandiose narcissism: mother: $p = 0.724$, father: $p = 0.9242$; vulnerable narcissism: parenting: $p = 0.4534$, mother: $p = 0.4423$, father: $p = 0.7393$), suggesting that the meta-analysis results are not significantly affected by publication bias.

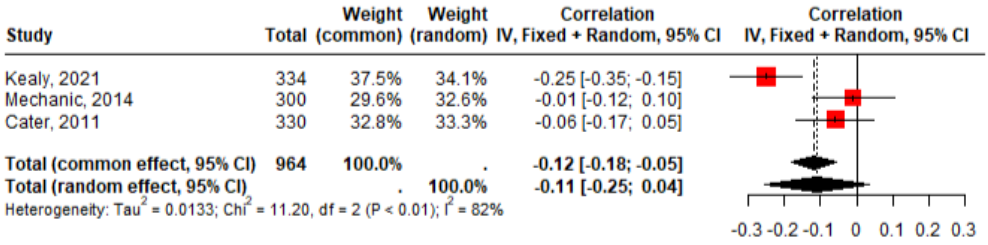

Figure 14: Forest Graphic Authoritative Parenting Vulnerable Narcissism

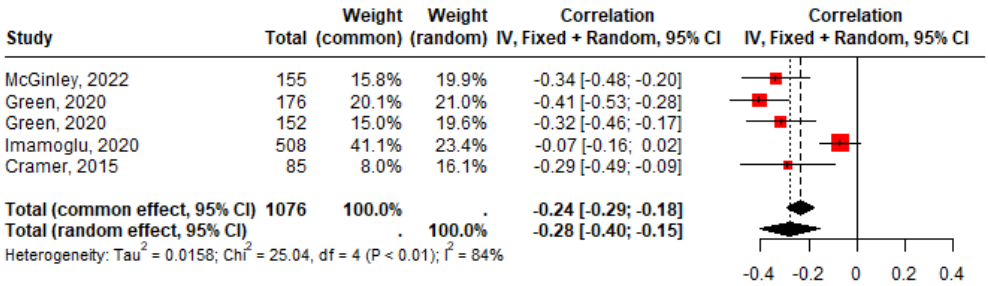

Figure 15: Forest Graphic Authoritative Mother Vulnerable Narcissism

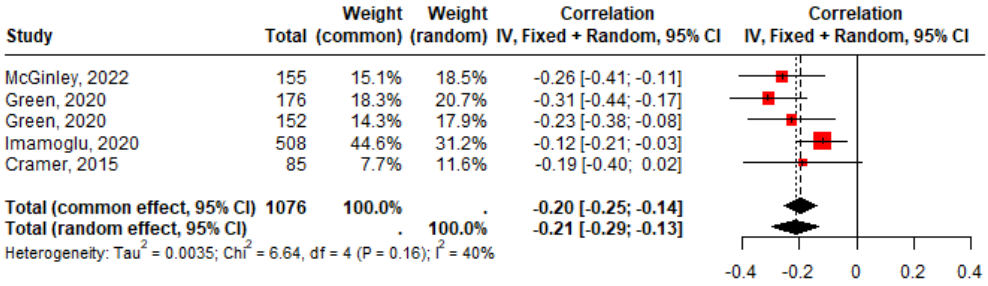

Figure 16: Forest Graphic Authoritative Father Vulnerable Narcissism

4.1.2 *Narcissism and Authoritarian Education*

A total of 11 studies were used to examine the relationship between overall narcissism and both authoritarian maternal and paternal parenting styles. Furthermore,

five studies each investigated the correlation between vulnerable narcissism and authoritarian parenting styles, including maternal and paternal influences. Figures 17 to 21 present a summary of the findings in the form of forest plots.

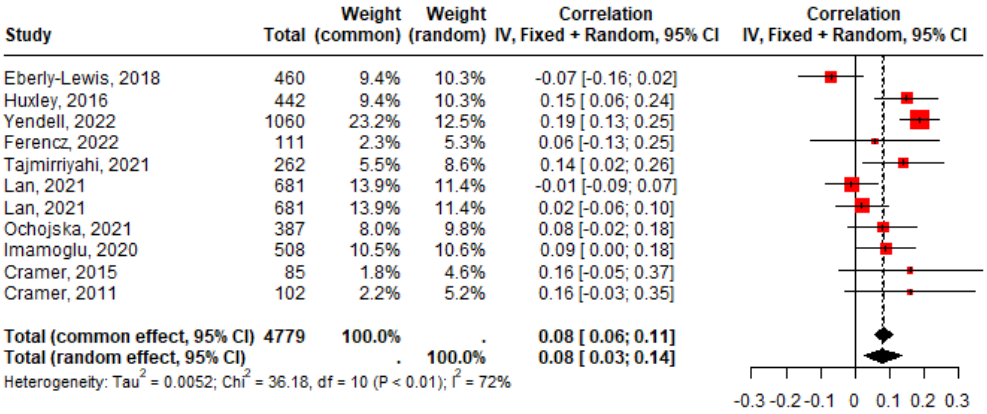

Figure 17: Forest Graphic Authoritarian Mother Overall Narcissism

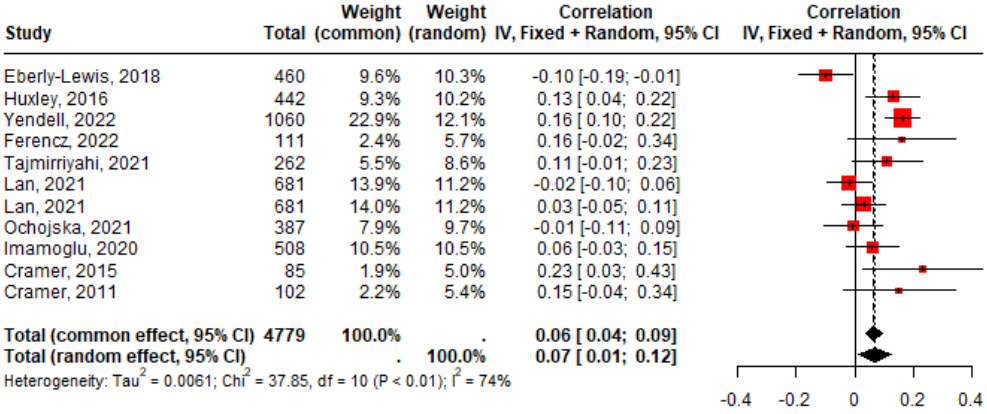

Figure 18: Forest Graphic Authoritarian Father Overall Narcissism

Despite the observed heterogeneity in studies analyzing the correlation between authoritarian parenting style and overall narcissism, this heterogeneity revealed to be not significant when focusing on maternal and paternal education (mother: $Q(4779) = 36.18$, $p < 0.0001$; father: $Q(4779) = 37.85$, $p < 0.0001$) and in relation to vulnerable narcissism (parents: $Q(2263) = 10.61$, $p = 0.0313$; mother: $Q(1363) = 3.79$, $p = 0.4354$; father: $Q(1363) = 3.93$, $p = 0.4150$).

Results also showed that the magnitudes of heterogeneity were not large when considering overall narcissism and mother education ($I^2 = 72.4\%$) or father education ($I^2 = 73.6\%$), and when considering only vulnerable narcissism (parents: $I^2 = 62.3\%$; mother: $I^2 = 0\%$; father: $I^2 = 0\%$). Therefore, a random-effects model was used to analyze the correlation between overall narcissism and mother and father education,

as well as vulnerable narcissism and overall parenting. For the correlation between vulnerable narcissism and both mother and father influences, a fixed effects (common-effects) model was used.

The forest plot analysis clearly indicates a positive correlation between authoritarian parenting style and narcissism, with no difference between maternal and paternal education (mother: 0.08, CI 95% [0.0271; 0.1352]; father: 0.07, CI 95% [0.0107; 0.1247]), cf. Figures 17 and 18.

When comparing overall narcissism with vulnerable narcissism, it is observed that the I^2 value decreases, indicating greater homogeneity of the data that point us to an even stronger correlation (0.22, CI 95% [0.1524; 0.2800]), again with no difference between maternal and paternal education (mother: 0.26, CI 95% [0.2070; 0.3062]; father: 0.26, CI 95% [0.2079; 0.3070]), cf. Figures 19 to 21.

Although the funnel plots identify missing studies for the analyses of mother and father influences on overall narcissism, and for the analyses of overall parenting with vulnerable narcissism (cf. Appendix D, Figures 40 to 44), there is no evidence of publication bias with observed regression test p-values substantially higher than 0.05 (mother: $p = 0.8892$; father: $p = 0.6535$), vulnerable narcissism (parents: $p = 0.5602$; mother: $p = 0.8658$; father: $p = 0.8546$).

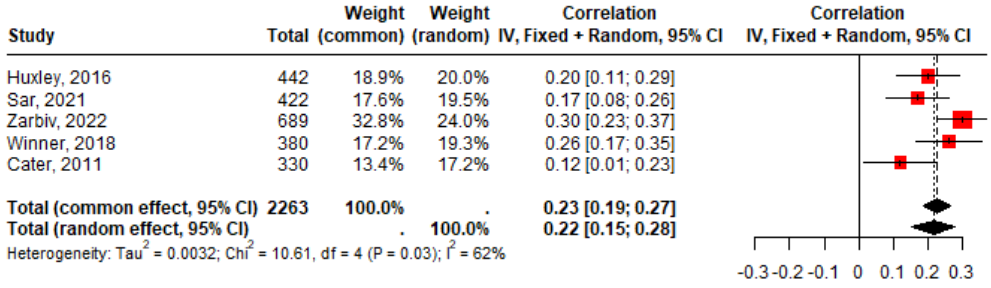

Figure 19: Forest Graphic Authoritarian Parenting Vulnerable Narcissism

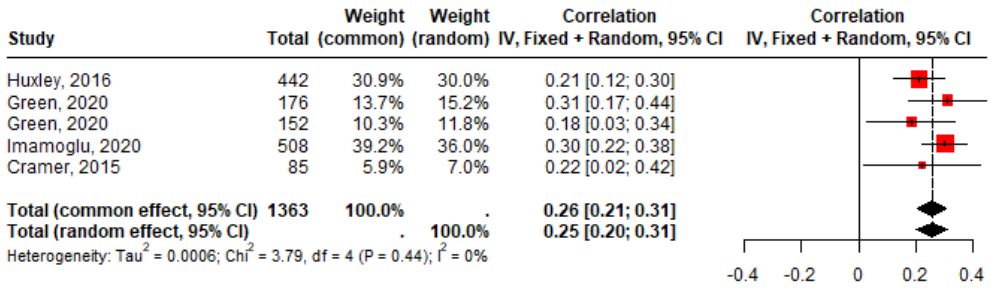

Figure 20: Forest Graphic Authoritarian Mother Vulnerable Narcissism

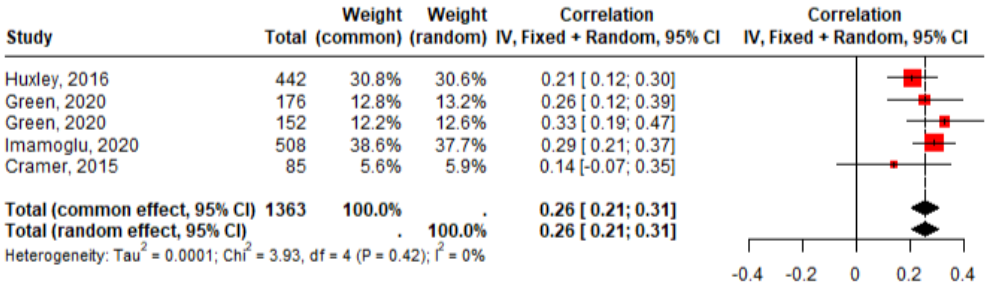

Figure 21: Forest Graphic Authoritarian Father Vulnerable Narcissism

4.1.3 *Narcissism and Neglectful Education*

In the context of the neglectful parenting style, a total of 5 studies investigated the relationship between maternal education and overall narcissism, while 6 studies focused on paternal influences. Additionally, 3 studies examined the correlation between neglectful parenting and vulnerable narcissism. Forest plots summarizing these findings are presented in Figures 22 to 24.

A more granular analysis distinguishing between maternal and paternal influences reveals persistent heterogeneity in studies focusing on maternal influences. Conversely, studies examining paternal influences display greater homogeneity (mother: $Q(1193) = 21.03$, $p = 0.0003$, $I^2 = 81\%$; father: $Q(5365) = 12.47$, $p = 0.0289$, $I^2 = 59.9\%$), with no evidence of publication bias (mother: $p = 0.4241$; father: $p = 0.9341$). The funnel plots summarizing these findings are presented in Figures 46 and 47.

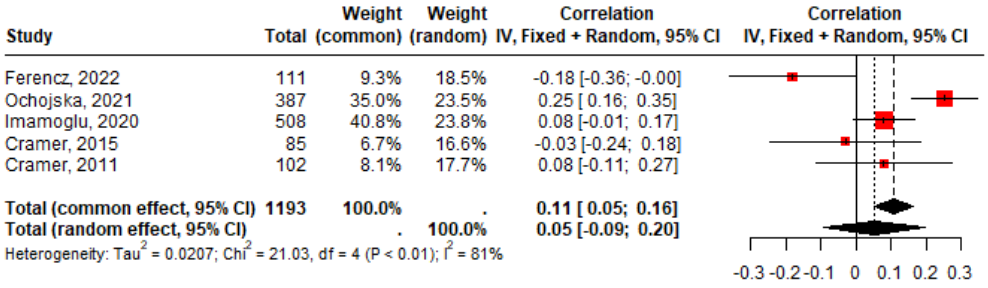

Figure 22: Forest Graphic Neglectful Mother Overall Narcissism

Analyzing the correlations, it is evident that for overall narcissism, the confidence intervals of the three estimates – overall parenting, maternal and paternal parenting – overlap, and the correlation with maternal education crosses zero, indicating a lack of significant correlation (0.05, CI 95% [-0.0901; 0.1980]). In contrast, a significant

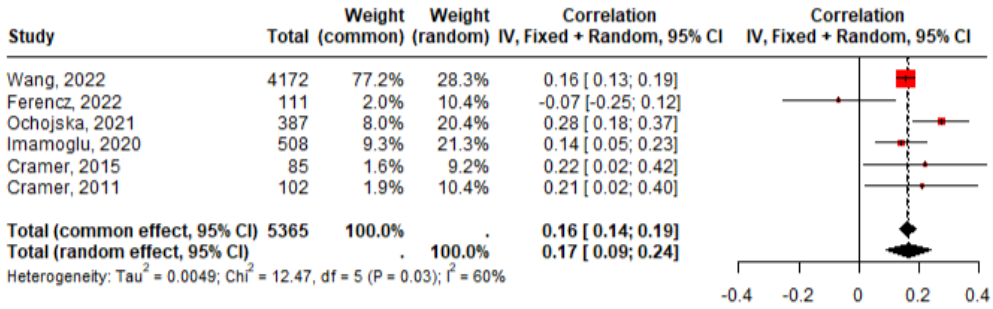

Figure 23: Forest Graphic Neglectful Father Overall Narcissism

correlation is observed with paternal education (0.17, CI 95% [0.0910; 0.2400]), as Figures 22 and 23 reveal.

When comparing the studies of negligent parenting style with overall narcissism and with vulnerable narcissism, a notable reduction in the I^2 value is observed (vulnerable narcissism: $I^2 = 0\%$), indicating increased data homogeneity, cf. Figure 24.

The comparison between the correlations of the negligent parenting style with overall narcissism and vulnerable narcissism reveals that the relationship persists, with the correlation for vulnerable narcissism (0.17, CI 95% [0.11; 0.24]) having a higher estimate than that observed with overall narcissism (0.10, CI 95% [0.01; 0.19]). This raises the question of whether the negligent parenting style may not significantly influence grandiose narcissism, which could explain the high heterogeneity and weak correlations observed with overall narcissism.

Similar to the findings for overall narcissism, the funnel plots for vulnerable narcissism, as shown in Figure 48, also identify missing studies. However, the *p*-value from the Egger's tests for funnel plot asymmetry is above the 0.05 threshold, indicating no significant evidence of publication bias. This suggests that the correlation between negligent parenting and vulnerable narcissism is stronger than that with overall narcissism.

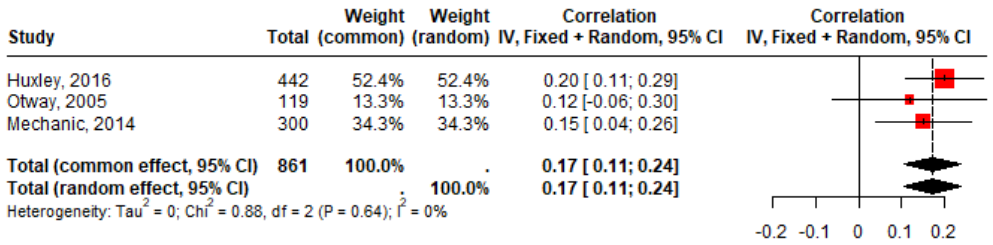

Figure 24: Forest Graphic Neglectful Parenting Vulnerable Narcissism

4.1.4 *Narcissism and Permissive Education*

A total of three studies were identified examining the correlation between permissive parenting styles, both maternal and paternal, and overall narcissism. In contrast to other parenting styles, when the analysis of the permissive parenting style is narrowed down to distinguish between maternal and paternal influences, an increase in the I^2 value is observed, indicating greater heterogeneity in studies focusing on paternal influences (mother: $Q(752) = 4.57$, $p = 0.1016$, $I^2 = 56.3\%$; father: $Q(725) = 16.14$, $p = 0.0003$, $I^2 = 87.6\%$). Due to the high heterogeneity, a random-effects model was applied to better estimate the effect sizes.

Upon examining the correlations, it becomes evident that there is no significant correlation between permissive parenting, whether maternal or paternal, and narcissism (mother: -0.08, CI 95% [-0.2145; 0.0533]; father: -0.04, CI 95% [-0.2764; 0.1886]), as Figures 25 and 26 reveal.

Additionally, there is no evidence of publication bias. Although the funnel plots identified missing studies (cf. Appendix D, Figures 50 and 51), the p-value from Egger's test for funnel plot asymmetry is above the 0.05 threshold (mother: $p = 0.57$; father: $p = 0.2734$), suggesting no significant bias. The results observed in the funnel plots may also be attributed to the small number of studies analyzed, specifically three.

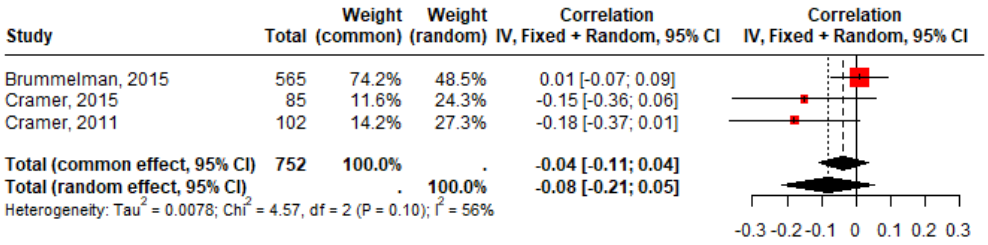

Figure 25: Forest Graphic Permissive Mother Overall Narcissism

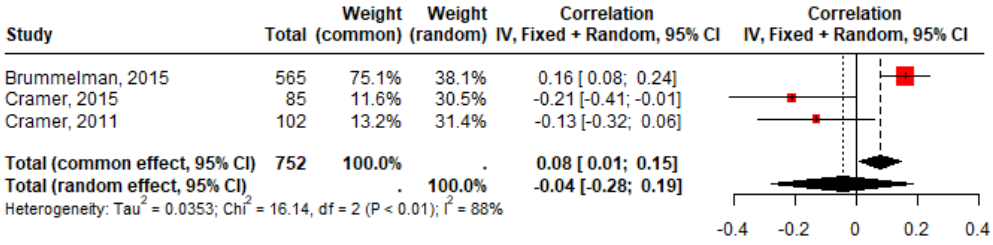

Figure 26: Forest Graphic Permissive Father Overall Narcissism

4.2 NARCISSISM AND TESTOSTERONE AND CORTISOL LEVELS

For analysis of the correlation between overall narcissism and testosterone and cortisol, it was used a total of 9 and 7 studies, respectively. The results are presented in forest plots in Figures 27 and 28.

The analysis of the relationship between overall narcissism and hormone levels revealed heterogeneity for both testosterone and cortisol levels. Specifically, the heterogeneity for testosterone levels was substantial ($I^2 = 40\%$), suggesting that observed variability in testosterone studies is not solely due to chance ($Q(1175) = 13.33$, $p = 0.1009$). In comparison, cortisol levels showed higher heterogeneity ($I^2 = 62.7\%$) and indicated a more pronounced degree of variability that is not associated with random effects, $Q(1083) = 16.06$, $p = 0.0134$.

Regarding the correlation, the confidence interval for testosterone levels indicates a statistically significant positive relationship with overall narcissism (0.10, CI 95% [0.0254; 0.1707]), thereby underscoring a meaningful association between these variables. In contrast, no significant correlation was observed between cortisol levels and narcissism, (0.01, CI 95% [-0.0975; 0.1252]).

The funnel plots for testosterone and cortisol levels in relation to overall narcissism, as illustrated in Appendix E (Figures 52 and 53), identify missing studies, two and one, respectively. However, the p-values for the publication bias tests are well above the conventional threshold (testosterone: $p = 0.4288$; cortisol: $p = 0.4781$), indicating no evidence of publication bias.

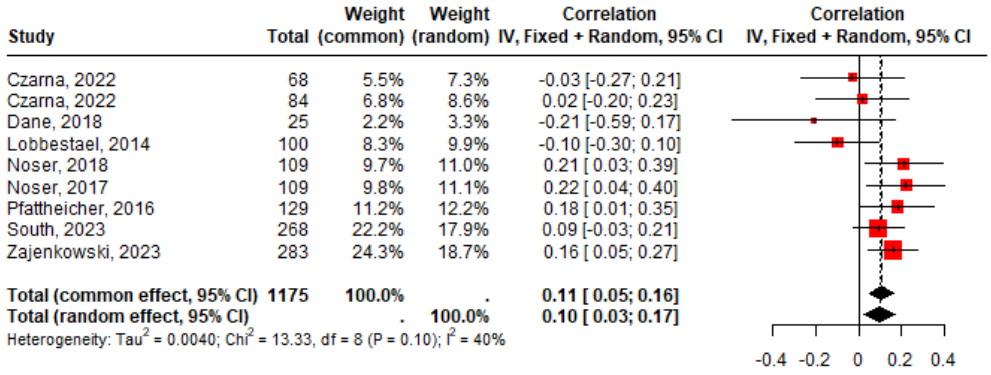

Figure 27: Forest Graphic Testosterone Overall Narcissism

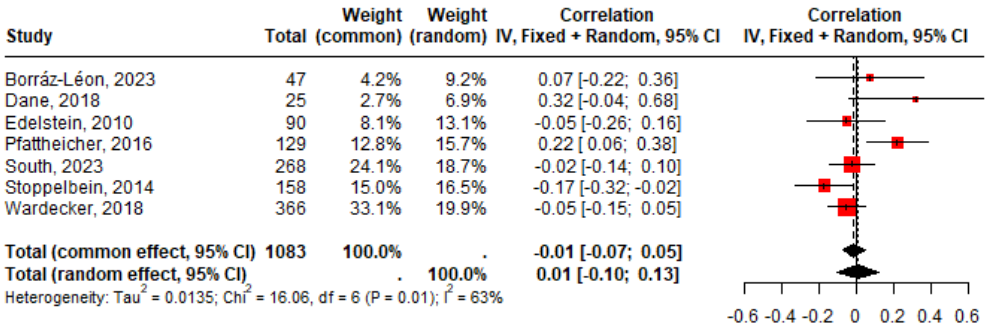

Figure 28: Forest Graphic Cortisol Overall Narcissism

Similar to what happened with the studies that analyzed the relationship between authoritarian and permissive parenting styles and overall narcissism, the studies on the correlation between overall narcissism and testosterone and cortisol levels also yielded two and one study with NOS scores of less than 8, respectively.

When the studies with NOS scores lower than eight were excluded, the conclusions remained unchanged (testosterone: 0.13, CI 95% [0.0752; 0.1938]; cortisol: -0.01, CI 95% [-0.1169; 0.0976]). The results are presented in forest plots in Figures 29 and 30.

This consistency emphasizes the robustness of the results, indicating that the relationships observed between overall narcissism and hormone levels were not significantly affected by the inclusion of studies with lower methodological quality. Therefore, the aforementioned general conclusions remain valid.

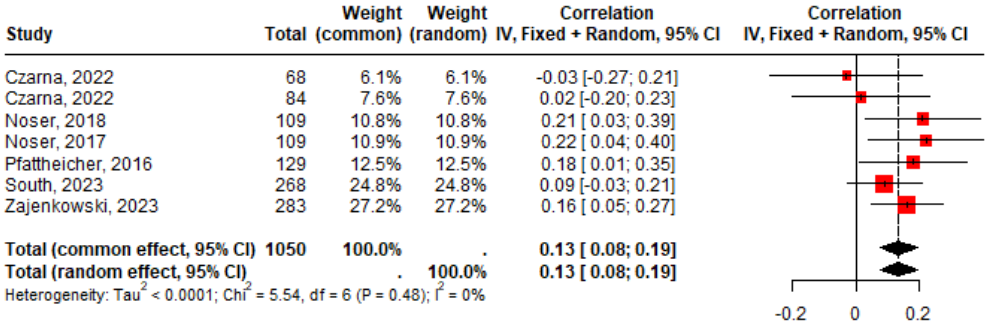

Figure 29: Forest Graphic Testosterone Overall Narcissism – with NOS score studies higher or equal to 8

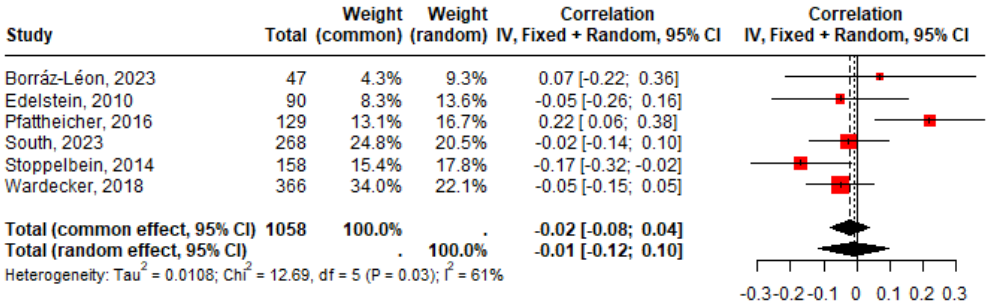

Figure 30: Forest Graphic Cortisol Overall Narcissism – with NOS score studies higher or equal to 8

5

DISCUSSION

In this section, the discussion will focus on the key findings related to the influence of parental education and hormone levels on narcissism.

5.1 NARCISSISM AND PARENTAL EDUCATION

The results of this meta-analysis provide nuanced insights into the relationship between various parenting styles and the development of narcissistic traits, highlighting both the complexity of these relationships and the differential impacts of maternal and paternal influences.

Although the analysis reveals a significant correlation between overall narcissism and all four parenting styles, these correlations are weak, with estimates ranging between 0.08 and 0.15. At a preliminary analysis of the results between overall narcissism and each one of the parental styles, the overlapping confidence intervals observed in the forest plots indicate that the correlation values among the different parenting styles are comparable, thereby emphasizing the modest influence that parenting styles exert on the development of narcissistic traits (Kohut, 1971; Kohut, 1977; Millon et al., 2004).

A closer examination of authoritative parenting reveals a more complex picture. The confidence intervals for the correlations between overall narcissism and both maternal and paternal authoritative parenting indicate no statistically significant association, suggesting that authoritative parenting, often characterized by a balanced approach of warmth and control, may not have a direct or strong influence on the emergence of narcissistic traits in children. However, when considering specific types of narcissism, such as grandiose and vulnerable narcissism, distinct patterns emerge. Notably, paternal authoritative parenting exhibits a negative correlation with grandiose narcissism, hinting at a potential inverse relationship. In contrast, maternal authoritative parenting shows no significant correlation, which may indicate that fathers may play a unique role in mitigating grandiose narcissistic tendencies through authoritative parenting.

Similarly, for vulnerable narcissism, although the overall correlations with authoritative parenting are not statistically significant, both maternal and paternal authoritative parenting exhibit negative correlations. These findings imply that authoritative parenting, particularly from mothers, may be inversely related to the development of vulnerable narcissism, suggesting a potential protective effect against this subtype of narcissism.

In contrast, the analysis of authoritarian parenting consistently reveals a significant and positive correlation with narcissism. This relationship persists regardless of whether the influence is maternal or paternal, with similar correlation estimates observed. Furthermore, the correlation between authoritarian parenting and vulnerable narcissism appears even higher, which reinforces the notion that an authoritarian parenting style, characterized by strict discipline and low warmth, is more strongly associated with the development of narcissistic traits, particularly vulnerable narcissism (O. Kernberg, 2004; Millon et al., 2004; Zeigler-Hill et al., 2008) .

The examination of negligent parenting further supports the persistence of the relationship between this style and narcissism, particularly vulnerable narcissism. The higher correlation estimates for vulnerable narcissism compared to overall narcissism suggest that a neglectful parenting approach may have a more pronounced effect on the development of vulnerable narcissistic traits, potentially due to the lack of emotional support and guidance (Kohut, 1971; Kohut, 1977).

In contrast, the analysis of permissive parenting reveals no significant correlation with narcissism, whether maternal or paternal. The confidence intervals for maternal and paternal permissive parenting indicate the absence of a meaningful association, which suggests that this style may not significantly contribute to the development of narcissistic traits in children.

5.2 NARCISSISM AND TESTOSTERONE AND CORTISOL LEVELS

Regarding hormone levels, a statistically significant positive correlation between testosterone and overall narcissism suggests a meaningful relationship between heightened testosterone levels and the expression of narcissistic traits. This finding aligns with prior research linking testosterone to dominant, aggressive, and self-enhancing behaviors, all of which are associated with narcissism (Dreher et al., 2016; Mazur and Booth, 1998).

In contrast, cortisol levels did not exhibit a significant correlation with narcissism, as indicated by confidence intervals overlapping with zero. The lack of association between cortisol and narcissism may reflect the complex and context-dependent nature of cortisol's role in personality and stress regulation.

5.3 LIMITATIONS

These meta-analyses, while providing valuable insights, were subject to some limitations that need to be acknowledged. One of the primary challenges was the heterogeneity observed across studies, coupled with the lack of sufficient data on grandiose and vulnerable narcissism, which highlights the limitations of the current evidence.

It also would be valuable to conduct more studies examining maternal and paternal influences to understand the distinct roles that each parent may play in the development of narcissistic characteristics.

It is noteworthy that there were not enough studies to analyze the impact of the hormones – testosterone, and cortisol – on vulnerable and grandiose narcissism specifically. This limitation is particularly relevant, as the lack of correlation between cortisol and overall narcissism could differ when examining vulnerable narcissism, where stress-related processes may play a more prominent role.

Similarly, further exploration of testosterone's effects on different types of narcissism would have been valuable, as its influence may deviate across the distinct narcissistic dimensions. These gaps underscore the need for more targeted research on the differential effects of hormone levels on different forms of narcissism.

Addressing these gaps is crucial for a more nuanced understanding of how biological and environmental factors interact in the development of narcissistic traits.

6

CONCLUSION

In summary, this meta-analysis reveals a significant, though weak, correlation between parenting styles and narcissistic traits, with notable differences observed between maternal and paternal influences.

Authoritative parenting shows no significant relationship with overall narcissism, but paternal authoritative parenting is negatively correlated with grandiose narcissism, suggesting fathers may help mitigate these traits. In contrast, both maternal and paternal authoritative parenting exhibit negative correlations with vulnerable narcissism, indicating a potential protective effect. Authoritarian and neglectful parenting are more strongly associated with vulnerable narcissism, reinforcing the detrimental impact of low warmth and emotional neglect. Finally, permissive parenting shows no significant correlation with narcissism, indicating that a lack of discipline does not contribute notably to the development of narcissistic traits.

Additionally, a significant positive correlation between testosterone levels and overall narcissism underscores the potential role of hormonal factors in the expression of narcissistic behaviors, particularly traits related to dominance and aggression. In contrast, cortisol levels indicated no significant correlation with narcissism, suggesting a more complex or context-dependent relationship that may deviate across different forms of narcissism.

Despite the limitations of heterogeneity and insufficient data, the findings offer valuable insights into the interplay between parenting styles, hormonal levels, and narcissistic traits, providing directions for future theoretical models and clinical interventions.

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APPENDIXES

A

APPENDIX A – SEARCH STRATEGY

First search:

(narcis*) AND (brain OR physiological)

(narcis*) AND (cognitive OR parent* OR educat*)

Second search:

(narcis*) AND (testost* OR cortisol)

B

APPENDIX B – ADAPTED NEWCASTLE-OTTAWA SCALE FOR PARENTAL EDUCATION STUDIES

NEWCASTLE-OTTAWA QUALITY ASSESSMENT SCALE (adapted for meta-analysis studies)

Selection: (Maximum 5 stars)

1. Representativeness of the sample:
    - Truly representative of the average in the target population. * (all subjects or random sampling)
    - Somewhat representative of the average in the target population. * (non-random sampling)
    - Selected group of users.
    - No description of the sampling strategy.
2. Sample size:
    - Justified and satisfactory. *
    - Not justified.
3. Non-respondents:
    - Comparability between respondents and non-respondents characteristics is established, and the response rate is satisfactory. *
    - The response rate is unsatisfactory, or the comparability between respondents and non respondents is unsatisfactory.
    - No description of the response rate or the characteristics of the responders and the non-responders.
4. Ascertainment of the exposure (risk factor):
    - Validated measurement tool. **
    - Non-validated measurement tool, but the tool is available or described.*
    - No description of the measurement tool.

Comparability: (Maximum 2 stars)

1. The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled.
    - The study controls for two or more factors. **
    - The study control for one factor. *

Outcome: (Maximum 3 stars)

1. Assessment of the outcome:
    - Validated measurement tool. **
    - Non-validated measurement tool, but the tool is available or described.*
    - No description of the measurement tool.
2. Statistical test:
    - The statistical test used to analyze the data is clearly described and appropriate, and the measurement of the association is presented, including confidence intervals and the probability level (p-value). *
    - The statistical test is not appropriate, not described or incomplete.

C

APPENDIX C – ADAPTED NEWCASTLE-OTTAWA SCALE FOR TESTOSTERONE AND CORTISOL LEVELS STUDIES

NEWCASTLE-OTTAWA QUALITY ASSESSMENT SCALE (adapted for meta-analysis studies)

Selection: (Maximum 5 stars)

1. Representativeness of the sample:
    - Truly representative of the average in the target population. * (all subjects or random sampling)
    - Somewhat representative of the average in the target population. * (non-random sampling)
    - Selected group of users.
    - No description of the sampling strategy.
2. Sample size:
    - Justified and satisfactory. *
    - Not justified.
3. Non-respondents:
    - Comparability between respondents and non-respondents characteristics is established, and the response rate is satisfactory. *
    - The response rate is unsatisfactory, or the comparability between respondents and non respondents is unsatisfactory.
    - No description of the response rate or the characteristics of the responders and the non-responders.
4. Ascertainment of the exposure (risk factor):
    - Validated measurement tool. **
    - Non-validated measurement tool, but the tool is available or described.*
    - No description of the measurement tool.

Comparability: (Maximum 2 stars)

1. The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled.
    - The study controls for the most important factor (medication). *
    - The study control for any additional factor. *

Outcome: (Maximum 3 stars)

1. Assessment of the outcome:
    - Independent blind assessment. *
    - Sample collection at the same time of day. *
    - No description.
2. Statistical test:
    - The statistical test used to analyze the data is clearly described and appropriate, and the measurement of the association is presented, including confidence intervals and the probability level (p-value). *
    - The statistical test is not appropriate, not described or incomplete.

D

APPENDIX D – FUNNEL GRAPHICS FOR PARENTAL EDUCATION STUDIES

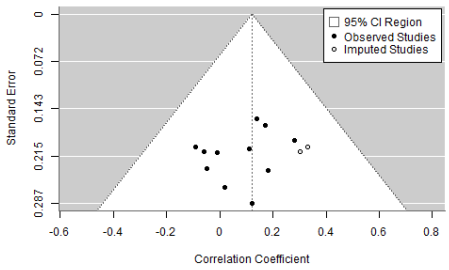

Figure 31: Authoritative Parenting Overall

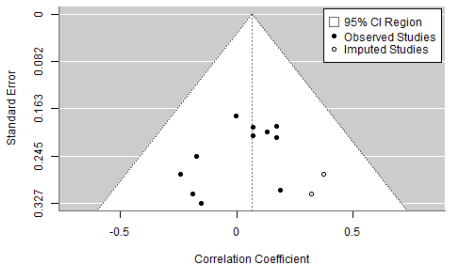

Figure 32: Authoritative Mother Overall

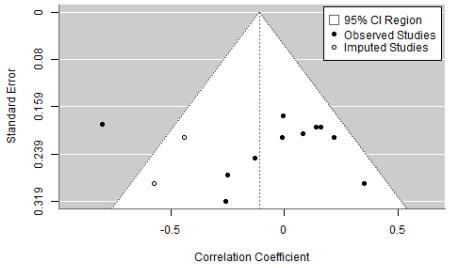

Figure 33: Authoritative Father Overall

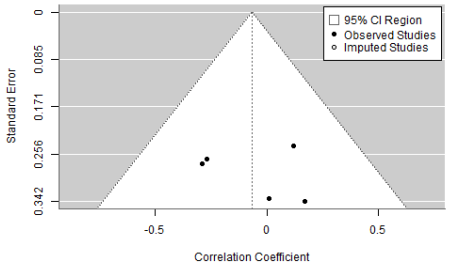

Figure 34: Authoritative Mother Grandiose

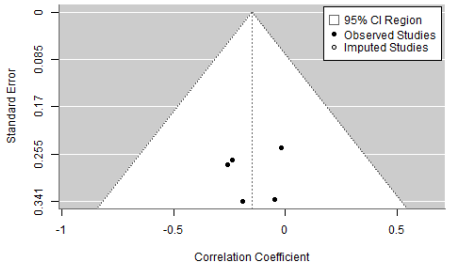

Figure 35: Authoritative Father Grandiose

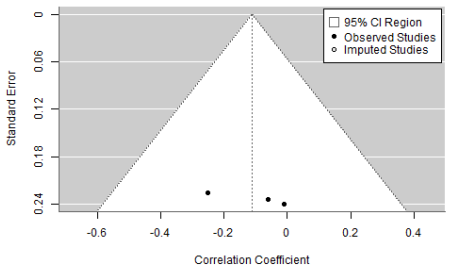

Figure 36: Authoritative Parenting Vulnerable

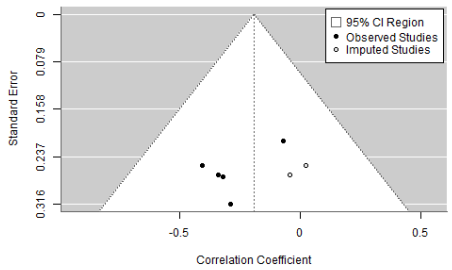

Figure 37: Authoritative Mother Vulnerable

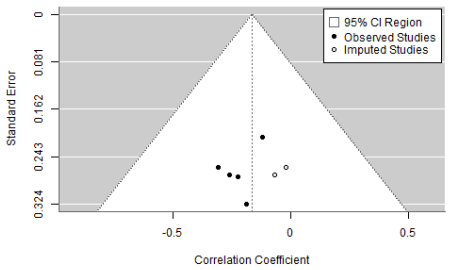

Figure 38: Authoritative Father Vulnerable

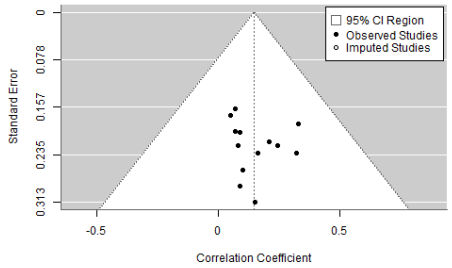

Figure 39: Authoritarian Parenting Overall

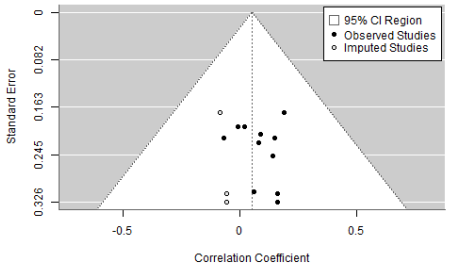

Figure 40: Authoritarian Mother Overall

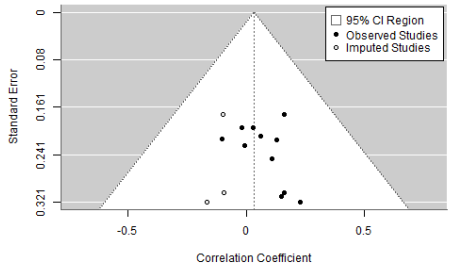

Figure 41: Authoritarian Father Overall

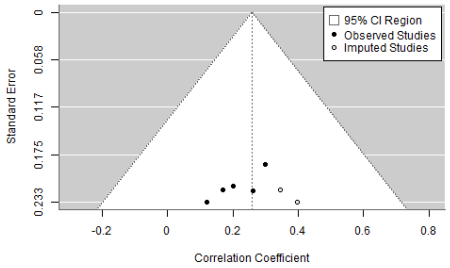

Figure 42: Authoritarian Parenting Vulnerable

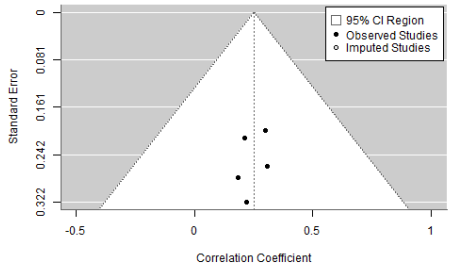

Figure 43: Authoritarian Mother Vulnerable

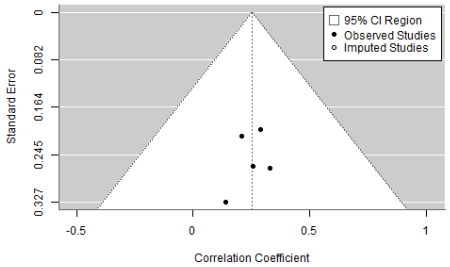

Figure 44: Authoritarian Father Vulnerable

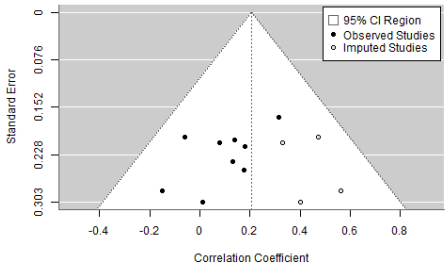

Figure 45: Neglectful Parenting Overall

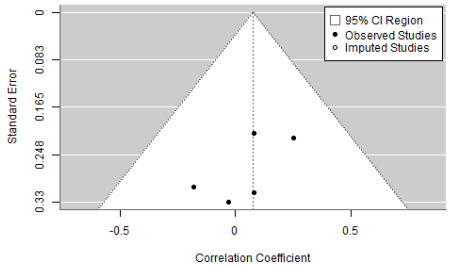

Figure 46: Neglectful Mother Overall

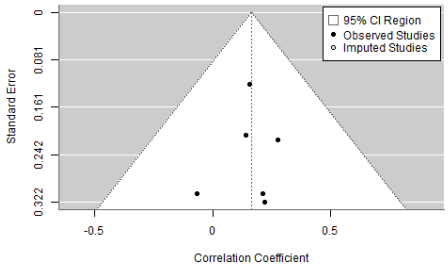

Figure 47: Neglectful Father Overall

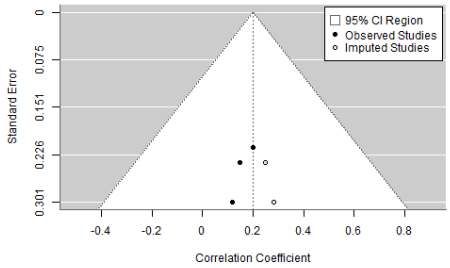

Figure 48: Neglectful Parenting Vulnerable

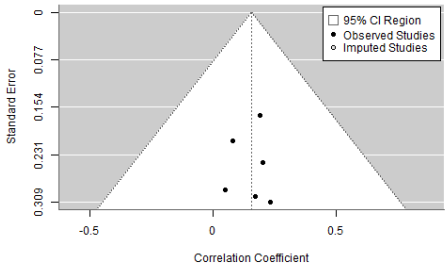

Figure 49: Permissive Parenting Overall

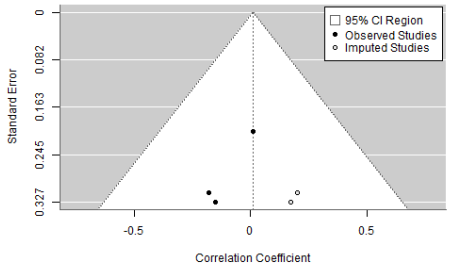

Figure 50: Permissive Mother Overall

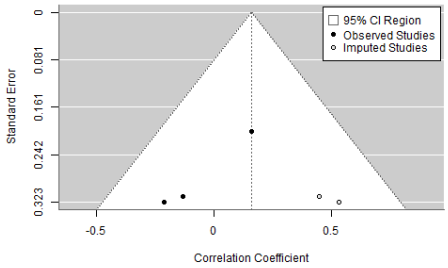

Figure 51: Permissive Father Overall

E

APPENDIX E – FUNNEL GRAPHICS FOR TESTOSTERONE AND CORTISOL LEVELS STUDIES

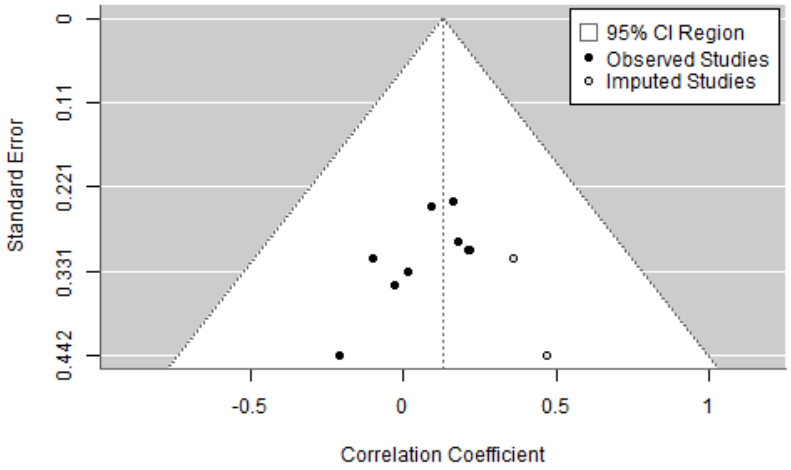

Figure 52: Funnel Graphic Testosterone Levels Overall Narcissism

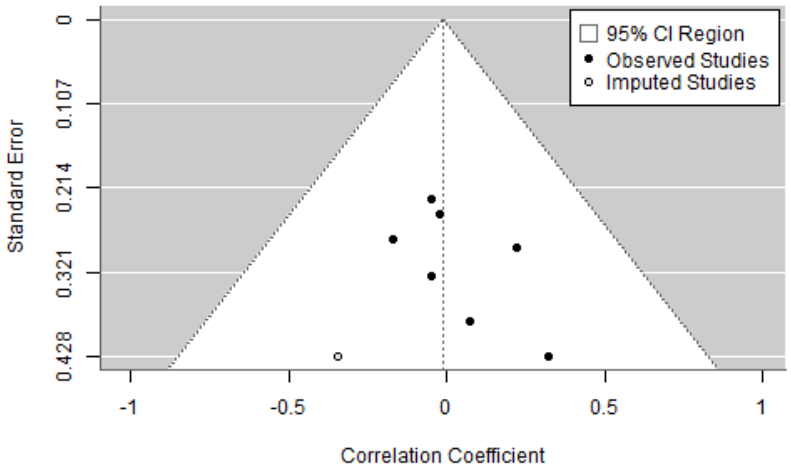

Figure 53: Funnel Graphic Cortisol Levels Overall Narcissism