WEP Warwick Evans Publishing

Transactions on Materials, Biotechnology and Life Sciences
ISSN: 2960-1932, eISSN: 2960-2319 | Volume 1
FBB 2023

Biological reasons for the phenomenon of eating disorders are more prevalent in the female population

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Abstract. Eating disorders, characterized by irregular eating habits and distress concerning body image, have emerged as a significant global health challenge. With a specific focus on gender disparities, this paper explores the complex interplay of biological, environmental, and psychological factors contributing to the prevalence of eating disorders like anorexia nervosa, bulimia nervosa, and binge-eating disorder. The paper delves into evolutionary theories, arguing that historically ingrained reproductive strategies may predispose females to higher sensitivity toward body image, thus making them more susceptible to eating disorders. Additionally, the paper examines the strong correlation between affective disorders such as anxiety and depression, and the onset of eating disorders, drawing upon neurobiological mechanisms involving the hypothalamus and extended amygdala. We also investigate the role of dopamine and pleasure derived from eating, highlighting experimental findings that suggest females may experience more sustained pleasure from eating behaviors, potentially leading to higher susceptibility to eating disorders. The paper concludes by urging the need for gender-tailored therapeutic interventions and calls for a paradigm shift in societal attitudes to mitigate the risk and stigma associated with these disorders. Furthermore, it emphasizes the necessity for a multidisciplinary approach in both understanding and treating eating disorders, given their multifaceted etiology and impact on individual and public health.

Keywords: Neuron science; Eating disorder; Gender differences; Prevalence.

1. Introduction

Eating disorders, typified by erratic eating habits and pronounced distress regarding body weight or appearance, have rapidly escalated into a critical global health challenge. This gamut of disorders encompasses anorexia nervosa, bulimia nervosa, and binge-eating disorder. Beyond the conspicuous physical health ramifications, these disorders exert a profound influence on the emotional and psychological well-being of those afflicted. Alarmingly, there has been a marked uptick in the incidence of eating disorders, particularly among adolescents and young adults. This surge has elicited concerted attention from clinicians, policymakers, and global media. The heightened scrutiny is a testament to the intricate interplay between these disorders, individual health, and broader societal implications. Addressing eating disorders transcends mere symptomatology; it mandates a deep-seated understanding and intervention at sociocultural determinants underpinning their genesis and perpetuation. The gravity of this issue, underscored by potential fatal outcomes and a labyrinthine matrix of causative factors, necessitates immediate and comprehensive action.

Emerging hypotheses postulate innate biological disparities in brain structures across genders. Notably, evidence suggests that females possess a more prominent corpus callosum (Grabowska, 2016). Such differences engender uncertainties regarding the universal applicability and efficacy of therapeutic interventions across diverse gender groups. For instance, an NCBI study indicated protracted treatment durations for male patients and a higher propensity for medication use among females (Orlando et al., 2020). Such divergences potentially stem from intrinsic biological variances between genders. To tailor more precise therapeutic modalities catering to gender-specific needs, it becomes imperative to delve deeper into the etiological factors of these disorders. A pertinent query in this realm is the overrepresentation of females in eating disorder demographics.

Prior to delving into the core discussion, it is pivotal to elucidate a clear taxonomy of eating disorders to forestall potential misconceptions. Eating disorders, characterized by their alarmingly high mortality rates, are bracketed into three primary categories: anorexia, bulimia, and binge disorders. Anorexia manifests as self-imposed severe caloric restriction, culminating in undernutrition or even organ malfunction. Bulimia is characterized by episodes of overconsumption followed by compensatory behaviors, while binge disorders amalgamate symptoms of both aforementioned disorders. The severity of eating disorders can cascade into grave physiological complications, including gastrointestinal and renal pathologies, and immunosuppression (National Eating Disorders Association, 2018). This discourse will, however, confine itself to biological gender disparities influencing eating disorders, thereby excluding considerations of intersex and other non-binary gender identities.

Comprehensive data synthesis from myriad studies unequivocally indicates a higher predilection for eating disorders among females. Drawing from Biological Psychiatry, the lifetime risk for anorexia stands at 0.3% for males and 0.9% for females (Hudson et al., 2006). This observation is further corroborated by researchers Stice and Bohen, who delineated a 0.9%-2.0% risk in females, starkly contrasted with a mere 0.1%-0.3% in males. For bulimia, the risk spans 1.1%-4.6% for females, juxtaposed against 0.1%-0.5% for males. Binge eating disorder exhibits a prevalence of 0.2%-3.5% in females and 0.9%-2.0% in males (Stice & Bohon, 2012).

The disproportionate prevalence of eating disorders in females remains a conundrum, with a plethora of postulated hypotheses spanning environmental influences, intrinsic biological determinants, and potential intersections with other psychiatric disorders.

2. Environmental Factors, Brain Structures, and the Prevalence of Eating Disorders

Research has consistently explored the intricate interplay between brain structures, environmental pressures, and behavioral outcomes. A particularly intriguing hypothesis focuses on the evolutionary divergence of brain structures between males and females due to environmental pressures, specifically the imperative of survival. This divergence might account for the observed discrepancies in beauty standards and self-perception between the genders. Over time, females may have evolved to be more attuned to their physical appearance as a survival and reproductive strategy, which, in modern contexts, could contribute to the higher incidence of eating disorders among them. Blodgett Salafia (2015) delves into this theory, suggesting that the societal pressures combined with an innate drive might result in heightened self-awareness about appearance among females, subsequently leading to the disorders in question.

Yarosh (2019) provides a comprehensive overview of gender-specific reproductive strategies, shedding light on the underlying biological imperatives that drive behavior. Females, historically and prehistorically, have been inclined to select partners based on their perceived ability to provide and protect, a trait which would ensure the propagation of their genes. This inherent preference might have led to inter-female competition, with physical attractiveness becoming a significant parameter. Consequently, attractiveness became not just a means to secure a suitable partner, but also a way to gain additional resources. This theory is further bolstered by empirical observations that females exhibit a heightened sensitivity to beauty cues, both in themselves and in their same-sex peers, as compared to males. While this sensitivity has evolutionary roots, its manifestation in today's society, rife with beauty standards and ideals, might predispose many females to developing eating disorders.

3. The Correlation Between Anxiety/Depression Disorders and Eating Disorders: A Multifaceted Examination

The relationship between mental health conditions, specifically anxiety and depression, and the prevalence of eating disorders has garnered considerable attention in recent medical and psychological research. A plethora of studies has underscored a compelling correlation between these

conditions, suggesting that the presence of anxiety or depression could serve as a precursor or exacerbating factor for the development of eating disorders.

A comprehensive study featured in the NCBI encompassed a diverse demographic of 10,000 participants, spanning ages from 18 to 80, with a significant portion over the age of 40. The findings of this research were revelatory, illustrating a pronounced correlation between the manifestations of anxiety and the onset of eating disorders. Furthermore, the study underscored an intriguing relationship between the sensations of hunger and heightened anxiety levels. When delving deeper into the neurological underpinnings of these findings, it was observed that certain regions of the brain, including the hypothalamus and extended amygdala, become notably activated during episodes of hunger and anxiety. Another layer to this complex relationship was the release of neuropeptides during hunger, which appeared to modulate anxiety levels, suggesting a deeply intertwined relationship between these phenomena (Hussenoeder, 2021).

In another exploration published by MDPI, the focus shifted to a younger demographic, specifically female adults and teenagers. Within this study's confines, a substantial percentage of participants showcased behaviors and tendencies commonly associated with eating disorders. These included a profound fear of weight gain, regular instances of vomiting, and extreme dietary and exercise regimens. Alarmingly, within this group, 18.4% were concurrently diagnosed with anxiety and depression, manifesting traits like profound low self-esteem, perfectionistic tendencies, and frequent mood dysregulations (Sander, 2021).

Further insights from ACAMH revealed an unsettling trend: children who exhibited latent anxiety markers at a tender age of 10 had a substantially elevated risk of grappling with eating disorders by the age of 14 (Schaumberg, 2018).

A comparative study disseminated via the Wiley Online Library provided another dimension to this discourse. Here, two groups of female participants were juxtaposed: one with diagnosed anxiety disorders, including conditions like OCD and social phobia, and another without any such disorders. The findings were startling. Within the group diagnosed with anxiety disorders, a substantial percentage displayed behaviors symptomatic of eating disorders. In contrast, the group devoid of anxiety disorders had a significantly lower percentage of participants reporting such behaviors (Garcia, 2020).

Adding another layer to this intricate tapestry, data collated by NIC posits that females typically manifest a higher predisposition to anxiety disorders compared to their male counterparts. Such disorders include panic disorders, agoraphobia, social anxiety disorder, and specific phobias. This heightened susceptibility might offer some insights into the more pronounced prevalence of eating disorders among females (McLean, 2011).

Delving into the biological intricacies that might render females more prone to anxiety disorders, several theories emerge. One prominent theory revolves around the hormonal oscillations that females undergo, especially during their reproductive years. Regular physiological transitions, epitomized by menstrual and estrous cycles, lead to fluctuations in ovarian hormones. A standout in this context is estrogen, which some studies suggest might accentuate emotional vulnerability, predisposing females to anxiety disorders. This is further substantiated by research correlating estradiol concentrations with changes in the hippocampal grey matter volume, offering a potential rationale for females' heightened anxiety susceptibility (Kundakovic & Rocks, 2022).

Simultaneously, other scientific discourses propose that structures within the female brain, specifically the 5-HTTLPR in the right amygdala, might be instrumental in determining anxiety propensities. Studies have indicated that subclinical anxiety is invariably linked to an augmented right amygdala volume in females (Cerasa, 2014). This neurological predisposition is further compounded by findings suggesting that females, on a neural level, might have a more pronounced reaction to negative stimuli, especially within regions like the dorso-medial frontal cortex and right amygdala.

Such heightened neural reactions could potentially elucidate the increased incidence of anxiety disorders among females (Lungu, 2015).

Lastly, the role of genetics and epigenetics cannot be understated. Research has shown that there's a significant correlation between gender and SLC6A4 methylation levels. Typically, females exhibit elevated levels of SLC6A4 methylation compared to males. This genetic distinction might shed light on the narrative that, under specific conditions, females might be more psychologically vulnerable, rendering them more susceptible to conditions like depression (Dukal, 2015).

In summation, the nexus between anxiety, depression, and eating disorders is undeniably multifaceted. As research continues to unveil the myriad factors at play, it becomes imperative to approach both understanding and interventions with a holistic perspective.

4. Dopamine, Pleasure from Eating, and the Onset of Eating Disorders

While the correlation between anxiety and depression with eating disorders has been studied extensively, another crucial facet that warrants attention is the pleasure derived from eating and its associated dopamine production. Dopamine, often termed the "feel good" neurotransmitter, plays a pivotal role in our brain's reward system. When released in significant amounts, it induces feelings of joy and relaxation, influencing our behavior and choices.

Recent research has posited dopamine as a significant contributor to the onset of specific eating disorders, notably binge eating disorder and anorexia nervosa. For individuals with binge eating disorder, the dopamine released during eating episodes offers a reprieve from feelings of guilt and emotional turbulence, exacerbating the cycle of overconsumption. Conversely, individuals with anorexia nervosa find their dopamine rewards in a different set of behaviors. The act of losing weight and consuming minimal food, often culminating in purging behaviors or an outright refusal to eat, triggers dopamine production in these individuals, reinforcing their harmful patterns (Botticelli, 2020).

An intriguing dimension to this narrative is the gender disparity in the pleasure derived from eating. Experimental findings have highlighted that females are more susceptible to experiencing pleasure from eating behaviors. A study published by NIH in 2021 observed that, in trials, 79.28% of females identified eating as a rewarding behavior, in stark contrast to 69.34% of males.

Delving deeper into the gender-based nuances, Aston C. Cornwall's work provides a comprehensive analysis. According to Cornwall, females tend to experience consistent, frequent, yet relatively smaller rewards during eating episodes. Males, on the other hand, lean towards larger but less consistent and short-lived rewards. The human psyche typically exhibits a preference for consistent, albeit smaller, rewards, suggesting that females might derive more sustained pleasure from their eating behaviors. This heightened sensitivity and prolonged pleasure could make females more susceptible to developing food addictions, potentially serving as a precursor to eating disorders (Cornwell, 2018).

In conclusion, the intricate relationship between dopamine, pleasure from eating, and the subsequent susceptibility to eating disorders offers a fresh lens through which we can understand and address these conditions. As research continues to unfold the many layers of this complex issue, it underscores the need for multi-pronged therapeutic interventions.

5. Discussion

The differential prevalence of eating disorders across genders, as alluded to in preceding sections, is a topic of burgeoning academic interest. At the heart of this discourse lies an intriguing proposition: the evolutionary reproductive strategies adopted by distinct sexes might play a pivotal role in shaping cognitive and emotional responses. Historically and sociobiologically, females have been subjected to multifarious environmental pressures, compelling them to prioritize physical aesthetics as a means

of securing optimal genetic progeny and superior socioeconomic stability. Such pressures, over successive generations, could ostensibly lead to neurobiological modifications, rendering females more susceptible to anxiety-related disorders, particularly those rooted in body image perceptions. This heightened susceptibility could, in turn, predispose females to eating disorders.

However, a salient question arises: can environmental and societal restructuring modulate these biologically entrenched susceptibilities? For instance, if sociocultural narratives were recalibrated to emphasize female professional achievements and intellectual prowess over physical aesthetics, could it engender a shift in neurocognitive processing, thereby attenuating the risk of eating disorders? Should such environmental interventions prove efficacious, they could herald a paradigmatic shift in therapeutic strategies, potentially reducing female mortality rates associated with eating disorders and refining therapeutic interventions.

Additionally, a plethora of empirical studies underscore a robust positive correlation between affective disorders (namely anxiety and depression) and eating disorders. This confluence of disorders suggests that the neurobiological underpinnings of anxiety and depression might serve as catalysts for the onset or exacerbation of eating disorders. From a clinical perspective, this intersectionality warrants a proactive approach wherein individuals diagnosed with affective disorders are concurrently evaluated for eating disorder risk. Interventions might encompass pharmacological prophylaxis or dietary recommendations that eschew substances with high addictive quotients, such as sugars and lipids. Given that these substances are implicated in augmented dopamine production, leading to heightened pleasure sensations, their intake could potentiate the risk of eating disorders.

Yet, as we navigate the clinical and neurobiological terrains, the sociocultural dimensions cannot be overlooked. Individuals diagnosed with eating disorders often grapple with societal stigmatization, rooted in misconceptions that equate these disorders with volitional deficits, laziness, or diminished cognitive capacities. Historically, such disorders have been erroneously deemed as predominantly female-centric afflictions, thereby adding layers of gendered misconceptions. Such entrenched stigmas can act as formidable deterrents, discouraging affected individuals, particularly males, from seeking therapeutic interventions. Consequently, extant epidemiological data on gender-specific prevalence might be skewed, underscoring the need for more nuanced research methodologies that account for potential underreporting.

Furthermore, recent neuroscientific investigations have unequivocally delineated gender-specific differences in both brain and body morphologies. Such differences underscore the imperative for gender-tailored therapeutic interventions, be it pharmacological or psychotherapeutic. While certain disorders might exhibit pronounced prevalence in specific demographic cohorts, it is academically and clinically myopic to dismiss potential occurrences in other demographics. For instance, while breast cancer predominantly affects females, males are not immune. Hence, it is incumbent upon the academic and clinical communities to broaden their investigative purview, ensuring that even minority populations, often overshadowed by statistical prevalences, receive optimal attention and care, especially when the disorders in question carry significant morbidity or mortality risks.

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