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The overlap between Binge Eating Behaviors and Polycystic Ovarian Syndrome: An etiological integrative model

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Abstract: Studies indicate that Polycystic Ovarian Syndrome (PCOS) features (e.g. insulin instability, food cravings, overproduction of androgens and menstrual irregularities) associate with increased appetite, impaired impulse control and feelings of body dissatisfaction. Counterintuitively, binge eating behaviors have been shown to reinforce PCOS symptomatology, precipitating concurrently body dissatisfaction, weight gain, insulin instability and overproduction of androgens. The present systematic literature review aspires to investigate the relationship between binge eating, in the broader context of eating disorder behaviors, and Polycystic Ovarian Syndrome (PCOS), taking into account shared characteristics between EDs (Eating Disorders) and PCOS. To address this aim the PRISMA guidelines are adopted [1]. A total of 21 studies, which investigated the presence of binge eating in PCOS populations and the presence of PCOS in EDs populations, were synthesized. Findings suggested that an increased prevalence of binge eating has been reported in women with Polycystic Ovarian Syndrome (PCOS); and that women suffering from Bulimia Nervosa (BN) and Binge Eating Disorder (BED) are more likely to display polycystic ovaries. Further research on their shared liabilities is required in order to inform more efficient prevention and treatment initiatives for individuals presenting with comorbid features.

Keywords: Binge Eating Disorder, Polycystic Ovarian Syndrome, Eating Disorders, Menstruation, Body Dissatisfaction, Menstrual irregularities.

1. INTRODUCTION

Binge eating is characterized by consuming an excessively large amount of food in a short period of time and experiencing a loss of control when these episodes occur. Binge eating constitutes a shared feature among various eating disorders (EDs) diagnoses, including Binge Eating Disorder (BED), Bulimia Nervosa (BN) and Otherwise not Specified Feeding and Eating Disorders (OSFED) [2, 3]. Binge eating has been envisaged as a debilitating [4] and a continuously expanding pathological behavior, with an estimated prevalence of 4.5% in women and 2.5% in men over the life course [5-7]. Interestingly, although individuals who present with binge eating manifestations can be of normal weight, they are more likely to be overweight, and at a proportion of about 30% obese [8, 9].

On the other hand, polycystic ovary syndrome (PCOS) is considered a rather common endocrine condition in women, being interwoven with high levels of androgens and ovulatory dysfunctions. Specifically, more than 18% of women appear to be affected by PCOS, presenting concurrently with higher insulin resistance [10], and a greater risk of being overweight and obese compared with

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healthy controls (BMI >30 RR 2.77 (95% CI 1.88 to 4.10) [11]. In that line, several studies examined eating disorder behaviors among women with PCOS. Not surprisingly, findings revealed a higher prevalence of PCOS in patients with eating disorders [12, 13], especially for disordered eating and bulimia nervosa [14-16]. Nevertheless, relevant research presents inconsistent with some studies reporting insignificant findings [17]. In addition, an increased prevalence of depression and anxiety has been associated with PCOS compared to healthy controls [18, 19]. This appears important, given the contribution of negative emotions as a key predictor of binge eating behaviors [20, 21]. Furthermore, binge eating has been positively associated with hyper-androgenism [22] and amenorrhea, which have both been in turn linked with PCOS related dysfunctions [23].

Despite the comorbidity between binge eating and PCOS presentations being acknowledged by relevant findings, the extant literature appears (to the best of the authors

knowledge) insufficient considering the interpretation of their association (e.g. direction of causality, bi-directional links). Hence, this review aspires to shed light on the co-existence of binge eating behaviors and PCOS. To achieve this goal (e.g. to summarize and expand the available evidence regarding the inter-relationship between binge eating and PCOS, taking into consideration the shared factors between the two conditions), the present work adopts an integrative theoretical conceptualization that embraces principles from metabolic, hormonal and psychological models (which have never before been combined, so as to provide a more holistic spectrum of understanding of the interrelation between binge eating and PCOS presentations). In the context of this hybrid theoretical framework, the current literature review aims to: 1.) critically review the studies that have assessed the overlap between these two conditions; 2.) illustrate/ identify the strongest etiological links between PCOS and binge eating behaviors, through the lenses of metabolic, hormonal and psychological factors shared between the two conditions and; 3.) integrate and synthesize the available findings to inform a more comprehensive etiological model explaining the overlap between PCOS and binge eating behaviors, that could in turn pave future avenues for more targeted and effective research and clinical efforts in the field.

Conceptual framework

In that line, the link between binge eating and PCOS symptoms is investigated here using an integrative approach. This approach (perspective) blends available literature considering the identified effects of metabolic, hormonal and psychological risk and protective factors of the two conditions. Specifically, in relation to metabolic factors, the role of insulin is emphasized; in relation to hormonal factors the focus is placed on the level of androgens and menstrual irregularities; while factors related to feelings of body dissatisfaction and negative emotions are highlighted as significant psychological influences. The contribution of these factors to PCOS and EDs manifestations has been (until now) separately investigated. To provide a more holistic understanding of the PCOS-EDs co-existence, relevant literature will be combined here, to introduce the theoretical framework for reviewing the extant empirical research.

Considering metabolic factors in particular, women with PCOS present with higher insulin resistance and a concurrent higher risk of being overweight compared to healthy controls [11]. Similarly, binge eating behaviors have been shown to predict excessive weight, obesity onset and insulin related imbalances [24].

Considering hormonal factors, both binge eating and PCOS have been positively associated with hyper-androgenism [22] and amenorrhea [23], with hyper-androgenism contributing in the pathogenesis of anovulation and menstrual irregularities [25]. Despite the progress in this area, the role of circulating testosterone concentrations in the etiology of binge eating behaviors and PCOS has yet to be fully elucidated [26].

Finally, in relation to psychological factors, research has revealed an increased prevalence of depression and anxiety among females presenting with PCOS compared with

controls [19]. In that context, the significant role of negative emotions as a key predictor of binge eating behaviors has been illustrated [21]. Accordingly, it is interesting to note that weight loss has been identified as a key element of treatment for PCOS [21]. This is despite PCOS females being prone to develop binge eating behaviors, which can be exacerbated by dieting [21].

Triggered by the insufficient understanding of the etiological factors that explain the comorbidity between binge eating and PCOS manifestations, the present review aims to synthesize findings considering metabolic, hormonal and psychological effects associated simultaneously to PCOS and binge eating dysfunctions. From a conceptual point of view, these three components have been considered complementary (in exacerbating and/or buffering both PCOS and binge eating behaviors) here. Therefore, they have been combined in a comprehensive theoretical manner, which attempts to explain the concurrent presence of the two examined conditions.

2. METHOD

A computer research has been conducted on Science-Direct, PubMed, Google Scholar, Utas Library, University of Melbourne Library, and the following identifying terms were applied to detect relevant sources: Polycystic Ovarian Syndrome Eating, Binge Eating Disorders, Bulimia Nervosa Polycystic, Anorexia Polycystic, BED Polycystic, binge eating PCOS, binge eating polycystic. All searches were limited to full text, peer reviewed articles, available in English, published between 1991 and 2016, which involved human participants. Studies have been selected in accordance with the following inclusion criteria (see relevant guidelines for identification and screening; [1]): (i) studying PCOS in EDs populations, (ii) studying EDs/disordered eating in PCOS populations, (iii) containing empirical data. A total of 21 studies were deemed eligible for this review (on the basis of meeting all the above criteria).

3. RESULTS

Table 1 and Table 2 provide a summary of the 21 studies reviewed in this article, including demographic information and the major findings reported in each study. Specifically, studies that have focused on the co-existence of binge eating and PCOS are presented in Table 1, while studies that have focused on the presence of PCOS in EDs populations are presented in Table 2.

Considering Table 1, a total of 14 studies have assessed eating behavior features in PCOS populations, highlighting an increased incidence of binge eating among women with PCOS [17]. Specifically, approximately 50% of women with PCOS seem to struggle with binge and comfort eating manifestations, compared to 32% of controls [34]; with a survey of 60 women with PCOS resulting to a binge eating prevalence of 23% [35]. In consensus with the above, 30% to 50% of women with PCOS appear prone to display overeating, emotional eating, eating without the feeling of hunger and EDs [36, 37]. In addition, women with PCOS appear more likely to have hyperinsulinemia and to obtain higher scores on the Binge Eating Scale (BES), which however tend to improve with a controlled diet [38, 39]. Nevertheless, one study did not

confirm the mutual presence of the two conditions, concluding that scores for dieting and overall EDs symptoms in the polycystic ovary group were not significantly higher than those for women with normal ovaries [17].

---Insert table 1 about here---

Counter intuitively, when examining the presence of PCOS symptomatology in EDs populations, 7 studies revealed an increased incidence of polycystic ovaries among women with EDs (see Table 2), with approximately 30% of the EDs samples inclining to display PCOS related dysfunctions [13, 40-42]. In that line, other studies have shown that bulimic females have higher relevant dysfunction scores among PCOS subjects [43], with McCluskey (1992) concluding that 76% of bulimic females (based on the study sample, N=34) present with polycystic or multi-follicular ovaries [44]. On that basis, one could argue that a significant proportion of the extant literature advocates the overlap between EDs and PCOS (especially binge eating related behaviors) [36, 45].

---Insert table 2 about here---

In the context of understanding the potential etiological communalities between the two conditions, the following two points need to be highlighted (considering the results of the present literature review): a) The frequent observation of PCOS features, such as obesity, menstrual imbalance, hyperandrogenism and anovulation, in populations that present with binge eating behaviors [12], which suggests an interference in the link between binge eating and PCOS phenomenologies; b) PCOS presentations associations with a higher number of psychological symptoms, including depression, anxiety, body image dissatisfaction, eating and sexual disorders, and lower sense of wellbeing [27-31]. Following that line, women with PCOS are known to have disturbed appetite regulation [32], which has been therefore argued to explain their increased risk of developing binge eating behaviors [33]. Overall, and despite the progress recorded in the field, a clearer understanding about the inter-relation/ interplay between the two conditions (PCOS and binge eating) is recommended to inform future research and clinical work.

4. DISCUSSION

Considering the etiological link between PCOS and Binge Eating Behavior dysfunctions, research reviewed here, has revealed that, metabolic [46], hormonal [47] and psychological [48] factors are relevant to both binge eating and PCOS. Therefore, these factors could be implicated in the shared etiology between the two conditions.

Considering common metabolic factors, available literature confirms that women with PCOS are more likely to suffer from insulin resistance compared to healthy women of a similar body mass index (BMI) [49]; with insulin resistance having been described as one of the “subtle symptoms” of PCOS [50]. Insulin resistance tendencies impede body cells to be stimulated by insulin, thus constituting them unable to respond to it as effectively. Delayed or ineffective responses to Insulin precipitate in turn blood sugar spikes [51]. Accordingly, a significant proportion of women with PCOS are prone to experience increased cravings and desires to eat a particular type of food, usually high in carbohydrates [52]. In that context,

researchers have postulated that food cravings play an important role in the development and maintenance of binge eating due to a combination of psychological and physiological effects [53, 54]. Specifically, high carbohydrate meals are responsible for boosting blood sugar levels, prompting the pancreas to produce more insulin to handle the excessive amounts of glucose [55]. The latter has been identified as contributing to raising serotonin levels, which are involved with fluctuations considering one’s sense of wellbeing [56]. Interestingly, the mood state, typical of insulin-resistant individuals, has been described as “tense-tiredness” [34]. On the other hand, the subsequent abrupt drop of blood sugar and serotonin levels (after the utilization/consumption of glucose) could precipitate sudden feelings of hunger and craving behaviors [57], as well as the potential reinforcement of a state of anxiety [58]. These processes can be explained by the induction of brain mitochondrial and dopaminergic dysfunctions [59].

Subsequently, the likelihood of experiencing food cravings and mood swings is elevated among women with PCOS compared to that of healthy controls [60]. Moreover, given that binge eating involves the ingestion of large quantities of carbohydrate and fat food during the episodes, a vicious cycle of mutual exacerbation of cravings, insulin resistance and binge eating could be thus precipitated and perpetuated [61].

Considering hormonal factors, a high androgenic predisposition/ biological inclination could additionally explain the shared ground between PCOS and binge eating behaviors. Androgens are well known for accounting for differences in food intake and body weight between males and females [46]. In particular, testosterone seems to be responsible for increasing food intake in males [62]. Considering how the appetite might be affected by hormone profile abnormalities, studies showed that testosterone replacement could increase meal frequency in male rodents [63]. In consensus with this finding, anti-androgenic drug therapy was found to reduce meal-related hunger in women with bulimia [40].

In line with this, androgens in females appear to play an important role in regulating insulin. In conditions of extreme insulin resistance, such as mutations of the insulin receptor and in PCOS, high insulin levels seem to stimulate theca cells in ovaries to produce more androgens [64]. Therefore, androgen excess might contribute to insulin resistance in women with PCOS, potentially setting up a vicious cycle (e.g. hyperinsulinemia might promote the production of androgens, which in turn contributes to insulin resistance) [65]. Due to high androgen levels being responsible for increasing appetite, in conjunction with insulin resistance and the subsequent frequent cravings, women with PCOS could to be more susceptible to develop a binge eating pattern [66].

Overall, research and clinical management of PCOS have primarily focused on the physiological consequences of the disorder [67]. However, as a result of the numerous physical and metabolic changes, women with PCOS may also be at high risk for psychological problems, such as depression, decreased sense of wellbeing and EDs [68, 69].

In that context, and considering potential significant psychological factors that underpin the PCOS and binge eating overlap, a significant proportion of women with PCOS present with a psychiatric disorder during their lifetime. Preliminary work undertaken by Annagur (2015) estimated the prevalence of comorbidity between PCOS and psychiatric disorders to approach 50% (based on a clinical sample of 44 women suffering from PCOS) [70]. Similarly, other work (based on a sample of 60 women with PCOS) showed an overall prevalence rate of 40% for depression, 57% for mood disorders, 12% for anxiety syndromes and 23% for BED [35]; with 60% of females with PCOS reporting painful emotions and high sense of insecurity, confusion and ambivalence, low self-esteem and anxiety. In addition, these women presented less able to tolerate frustration, often behaving impulsively [71]. Subsequently, one could assume that due to common physical consequences of PCOS, such as hirsutism, acne and weight gain, females with PCOS may tend to experience feelings of deviance from idealized cultural norms, which in turn influence self-esteem and cultivate feelings of body dissatisfaction [72]. Body dissatisfaction and the feeling of shame (in relation to one's body) might prompt dieting in order to improve physical appearance. Due to high levels of impulsivity in PCOS women, dieting could result in the development of binge eating behaviors that could further exacerbate feelings of shame and body dissatisfaction. These could increase the attempts to lose weight with intensified dieting, which in turn worsens binge eating behaviors [73].

An integrative conceptual model of binge eating and PCOS

As previously demonstrated, PCOS and binge eating show shared characteristics. Hence, a main conceptual aim of the current review is the integration of the highlighted perspectives in a model that provides a theoretical context for the understanding of the inter-relationship between PCOS and binge eating behaviors. Figure 1 outlines the suggested integrative model/ conceptualization, visualizing the etiological links between the two conditions.

----Insert figure 1 here----

Specifically, the etiological sequence between the two conditions could be briefly described as following. Excessive weight and obesity may result to insulin resistance. This leads to high blood sugar levels, which are in turn addressed by increasing the pancreatic insulin production. Moreover, high levels of insulin are responsible for boosting androgen levels. Androgens promote insulin resistance and the development of cysts on ovaries, which then excrete more androgens [74]. Due to the high level of androgens, women with PCOS may experience hirsutism, weight gain and subsequent feelings of body dissatisfaction. On the other hand, androgens increase appetite and impulsivity, making women with PCOS more vulnerable to experiencing cravings [66]. Cravings could be further intensified by dieting behaviors often adopted to improve body image and reduce feelings of body dissatisfaction [75]. The cycle of dieting-cravings (suggested here) promotes binge eating behaviors, which, besides reinforcing weight gain and feelings of body dissatisfaction [76], may generate insulin spikes and/or sudden drops. These may intensify insulin resistance, androgen production and PCOS symptomatology,

in a cycle of mutual reinforcement (e.g. bi-directionality). These factors seem to cause an exacerbation of PCOS and binge eating at the same time, making PCOS women more susceptible to engaging and maintaining a binge eating pattern compared to their healthy counterparts. In conclusion, binge eating and PCOS presentations among women appear to share similar characteristics (see Table 3) that could imply/ highlight the potential overlap between the generating mechanisms of the two conditions.

----Insert Table 3 here----

Treatment implications

Provided that PCOS appear to have a significant negative impact on women's eating behaviors, especially in relation to binge eating, early and effective management of PCOS, concurrently with emerging and/or established eating patterns, could be deemed as necessary to improve quality of life during adolescence and adulthood [77]. For this reason, screening for mental health-related issues in patients with PCOS, as well as screening for PCOS in EDs sufferers (especially those with binge eating behavior), should constitute an inherent part of the initial evaluation.

Subsequently, a proactive approach addressing the treatment of psychological co-morbidity should be preferred (provided that psychological treatments in women with PCOS are considered to have a positive effect on binge eating patterns, weight management, insulin resistance and hormonal imbalances) [78, 79]. In that context, it has been suggested that the optimum approach combines psychological and pharmacological interventions [34], with psychological treatments/strategies aimed at improving eating, body image and comorbid psychopathology. Complementarily, pharmacological and hormonal interventions should be applied to decrease androgen levels and thus to deflate PCOS symptomatology [80].

5. CONCLUSION

The present PRISMA systematic literature review reinforces the notion that binge eating behaviors and PCOS should not always be considered as distinct disorders/manifestations. (given their shared metabolic, hormonal and psychological risk factors). Therefore, further investigations on the links between PCOS and binge eating behaviors, as well as the potential mechanisms of their mutual reinforcement could be beneficial, eventuating more effective treatment modalities for both conditions.

CONFLICT OF INTEREST

The authors declare there are no competing interests. This study received no funding

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