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Sexuality in eating disorders patients: etiological factors, sexual dysfunction and identity issues.

A systematic review

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Abstract: The scientific community appears to be less interested in sexuality of eating disorders (EDs) as compared to other psychiatric or medical comorbidities. However, a clear association between sexual problems and ED psychopathology was reported from different perspectives. The overarching goal of this systematic review was to evaluate the general approach of the scientific literature toward the topic of sexuality and EDs. In particular, four different categories of research have been individuated, encompassing the role of puberty, and sexual abuse in the pathogenesis of the disorders, sexual dysfunctions, and the association between sexual orientation and EDs psychopathology. Timing of puberty with its hormonal consequences and the changes in the way persons perceive their own body represent a crucial period of life for the onset of the disorder. Sexual abuse, and especially childhood sexual abuse are well-recognized risk factors for the development of ED, determining a worse long-term outcome. Recent research overcome the approach that considers sexual activity of EDs patients, in terms of hypersexuality and dangerous sexual behaviors, considering the sexuality of EDs persons in terms of sexual desire, satisfaction, orgasm and pain. Results from this line of research are promising, and describe a clear relationship between sexual dysfunction and the core psychopathological features of EDs, such as body image disturbances. Finally, the analysis of the literature showed

an association between sexual orientation and gender dysphoria with EDs psychopathology and pathological eating behaviors, confirming the validity of research developing new models of maintaining factors of EDs related to the topic of self-identity.

Keywords: eating disorders; gender identity; puberty; sexuality; sexual abuse; sexual dysfunction; sexual orientation.

Introduction

Eating disorders (EDs) are severe psychiatric syndromes affecting especially young women. In most cases, EDs have a long lasting duration (longer than 2 years) and a chronic course [1, 2]. The two well-known diagnoses of anorexia nervosa (AN) and bulimia nervosa (BN) share a similar psychopathological core of extreme concerns about shape and weight that significantly impact the individual's self-esteem, and they are essentially differentiated by the condition of underweight (i.e. their weight must be >85% of ideal), associated with the diagnosis of AN [3]. Typical psychopathological features of EDs are represented by an intense fear of becoming fat or of gaining weight, distortion in the way in which body weight and shape are perceived, undue influence of body weight and/or shape on self-esteem. Abnormal eating behaviors include binge eating, use of inappropriate compensatory behaviors (i.e. self-induced vomiting, or abuse of laxatives, diuretics, or enemas, excessive exercise, fasting), body checking, and body avoidant behaviors.

From an epidemiological point of view, AN and BN full syndromes represent only the tip of an iceberg, with AN occurring in 0.4% of the population and BN in 1%–1.5% [3]. Indeed, the last version of the Diagnostic and Statistical Manual of Mental Disorders (DSM 5) [3] considers also the so-called other specified FED or unspecified FED, and the binge eating disorder (BED), that showed a lifetime prevalence of 0.8% and 1.6% in men and women, respectively [3]. BED is characterized by frequent and persistent overeating episodes that are accompanied by feelings

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of loss of control and marked distress, in the absence of regular compensatory behaviors.

As far as the psychopathological assessment of these syndromes, dimensional rather than categorical models seem to be more appropriate [4, 5], as suggested by two main issues: 1) the higher prevalence of subthreshold conditions, which are the most frequently encountered in clinical [6] and community [7, 8]; 2) the “instability” of the DSM diagnoses, with a substantial crossover between the different EDs categories [9, 10]. Indeed, EDs patients often move in and out of illness states over time, display a high frequency of relapse [10], and the majority of them migrate between different ED diagnoses, without a substantial psychopathological change [9–14].

The pathogenesis of EDs is multi-factorial, and it most likely results from sociocultural, psychological and biological factors [15, 16]. Considering environmental conditions, adverse early life events showed a relevant role as a predisposing factor for EDs [16]. In particular, longitudinal and cross-sectional studies reported that sexual abuse had a significant association with the disorder’s onset [16, 17]. These conditions are supposed to affect child development in behavioral, emotional, social, physical, and cognitive areas [18], increasing the risk for EDs adult psychopathology. For example, they can be associated with low self-esteem and depression, severe body image distortion [19], and deficit in emotion regulation [19]. Moreover, chronic stressful conditions occurring during childhood may damage neurobiological and neuroendocrine aspects for long time [18], leading to greater vulnerability in the development of general psychopathology and psychiatric disorders throughout life [17].

EDs patients show a high rate of comorbidity, especially with mood (including unipolar and bipolar disorder), and anxiety disorders [3]. A large number of studies has been published on this topic, suggesting a common psychopathological trait related to emotion dysregulation between these syndromes. However, considering the psychiatric comorbidities of EDs, very few studies evaluated the co-occurring sexual dysfunction, and sexuality in terms of desire, sexual satisfaction, and relationship with own body.

From a biological point of view, puberty has been one of the most frequently discussed risk periods for the development of EDs. Indeed, puberty is characterized by physical changes such as menarche and increased adiposity, which may lead to body dissatisfaction [20]. At the same time, girls or boys perceive sexual drives for the first time, and their bodies become sexual targets for other persons. Finally, the EDs literature focused a considerable attention on the issue of gender differences in terms of quantitative

and qualitative aspects of EDs presentation, as well as on the association between specific expressions of EDs psychopathology and sexual orientation, and gender identity variance.

Indeed, it is noteworthy that, despite the clear association between sexuality and EDs from different perspectives (sexual abuse, puberty as risk factors, sexual orientation), few studies attempted to clarify the nature of this relationship, and sexual dysfunction comorbidity is rarely considered a potential target of treatment or indicator of long-term outcomes of the disorders. The scientific community appeared to be less interested in sexuality of EDs as compared to other psychiatric or medical comorbidities, and the DSM 5 Workgroup considered redundant the criteria for AN of primary amenorrhea or (in postmenarche females) loss of menses for ≥ 3 consecutive months.

According to this background, the overarching goal of this systematic review was to evaluate the general approach of the scientific literature toward the topic of “sexuality and eating disorders”, and synthesize the available data from different points of view.

Methods

Time-frame

A systematic review of the literature was performed using PubMed (U.S. National Library of Medicine, 1995–October 2015) electronic database.

Inclusion criteria

According to the DSM 5 categorization for EDs [3], we used the key words “eating disorder” in combination with “sexuality”. Articles were selected according to the following inclusion criteria: original studies, articles in English, human studies effectively related with the mentioned areas of interest. Subsequently, a further research was performed combining “eating disorder” with “puberty”, “hormonal levels”, “sexual dysfunction”, “sexual abuse”, and “sexual orientation”, “gender identity”. We focused on studies reported in the past 20 years but also included commonly referenced and highly regarded older publications. Review articles and book chapters were cited to provide readers with more details and additional references.

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Conceptual structure

The structure of the present review was based on the main fields of research associated with sexuality of EDs, taking into consideration etiopathogenic factors such as puberty, role of hormones and sexual abuse, comorbidity with sexual disorders, the issue of self-identity in EDs and its association with gender identity and sexual orientation.

Results

General consideration

The results and the further classification of the first research based on the combination between “eating disorders” AND “sexuality” are reported in Figure 1. Of the 458 articles initially considered, 155 were focused on sexuality and EDs. These studies were categorized into four main categories. The first category included papers considering the relationships between puberty, hormonal factors and their role in the onset and maintenance of EDs (13.5%). The second category included those researches focused on sexual behaviors and sexual quality of life (22.5%); a large proportion of studies was related with the sexual behaviors associated with binge eating and other impulsive behaviors, while few studies were actually focused on sexual satisfaction. The third category is the most represented, including those studies considering the role of sexual abuse (especially childhood sexual abuse) in the pathogenesis of EDs (36.7%). Finally, a large number of studies deal with the complex issue of sexual orientation and EDs, followed by a smaller subcategory including the topic of gender identity and gender role, and their significance in the different expression of EDs

psychopathology (total rate: 27.0%). Secondary researches showed a rate of 24 on 235 initially included studies for “puberty”/“hormonal levels” and “eating disorders” (Table 1), 26 on 116 for “sexual dysfunction” and “eating disorders” (Table 2), 158 on 402 studies for “sexual abuse” and “eating disorders”, and finally 32 on 441 studies for “sexual orientation” and “eating disorders”, and 11 on 164 studies for “gender identity” and “eating disorders” (Table 3). The results of the present systematic review should be considered in the light of some limitation. First of all, in many studies it is not possible to distinguish between different EDs diagnoses (AN, BN, BED). Indeed, some research considered the association between symptoms or psychopathological dimensions and sexuality. Moreover, further meta-analyses articles should provide a quantitative measure of the many of the mentioned associations. Finally, the choice of the areas of interest was based also on our clinical and scientific experiences and subcategorization or further areas could be individuated in this field.

Puberty and hormonal levels

Most of the reviews focusing on the pathogenesis of EDs [16, 107] agree that puberty is a significant risk period for the development of EDs, especially in women. The relationship between puberty and EDs has been documented by different perspectives. A recent systematic review by Klump [108] examined the role of puberty as a critical period for EDs onset, taking into consideration both animal and human studies. First of all, the effect of early puberty appears to be controversial, as some studies indicated that early puberty increases the risk for EDs onset [21–25, 109, 110], while others have not found such association [34, 43, 44, 111, 112]. Moreover, the prevalence of EDs has been reported to be higher in mid-late adolescence as compared to pre-adolescence, and the pre-pubertal onset of the disorders is rare [113]. Furthermore, several studies highlighted a post-pubertal bias in onset [40, 114], and the earlier onset of the disorders reported by some epidemiological studies has been associated with an earlier puberty onset [114]. Regarding sexual maturation, it has been observed both a delay [33] and an acceleration of psychosexual development [115].

Considering possible mechanisms underlying the association between EDs onset and puberty, as observed by Klump [108], pubertal timing showed a specific association with typical EDs symptoms onset. Most of the studies reported onset of body dissatisfaction, binge eating and purging behaviors at more advanced stages of

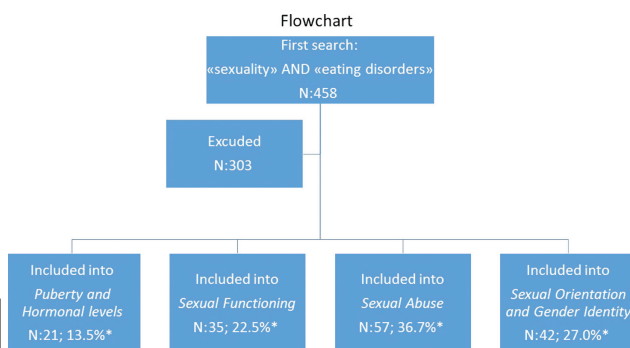


Figure 1: Flow chart for the details of the research “sexuality” and “eating disorder”.

*Percentages refer to the total number of included studies (n: 155)

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Table 1: Puberty and eating disorders.

Study	Diagnostic groups	Type of association
Wichstrom [21]	General population	
Fairburn et al. [22]	BN	
Fairburn et al. [23]	AN	
Kaltiala-Heino et al. [24]	BN	
Ruuska et al. [25]	AN, BN	
Klump et al. [26]	General population	
Cotrufo et al. [27]	General population (adolescent)	Early puberty as risk factor for EDs
Zehr et al. [28]	General population	
Day et al. [29]	General population (adolescent)	
Culbert et al. [30]		
Baker et al. [31]	General population	
McNicholas et al. [32]	General population	
Schmidt et al. [33]	AN, BN	Delays in psychosexual development
Mangweth-Matzek et al. [34]	AN, BN	Bad attitude toward menstruation; no association with early puberty
Vannucci et al. [35]	General population (8–17 years)	
Kaltiala-Heino et al. [36]	General population (14–16 years)	Early puberty as risk factor for bulimic type eating pathology
Tenconi et al. [37]	AN patients	
Tremblay and Lariviere [38]	Gen pop (adolescent)	Early puberty as risk factor for weight control behaviors
Abraham et al. [39]	General population (12–17 years)	Menarche as risk factor for the EDs
Favaro et al. [40]	AN, BN	
Striegel-Moore et al. [41]	General population	Early puberty as risk factors for body image and dieting concerns
Kaczmarek and Trambacz-Ol [42]	General population (12–18 years)	
Stice et al. [43]	General population	No association with early puberty
Ackard and Peterson [44]		

AN, Anorexia nervosa; BN, bulimia nervosa; Eds, eating disorders.

Table 2: Eating disorders and sexual dysfunction.

Study	Diagnostic groups	Correlates of sexual dysfunction
Abraham [45]	AN	Underweight
Morgan et al. [46]	AN	
Meguerditchian et al. [47]	AN	
Wiederman and Pryor [48]	AN, BN	BN better sexuality than AN
Pryor et al. [49]	AN subtypes	No difference
Wiederman et al. [50]	BN	Binge eating and impulsive sexual behaviors
Nagata et al. [51]	BN	
Nagata et al. [52]	BN	
Paul et al. [53]	AN, BN	
Kaltiala-Heino et al. [24]	BN	
Eddy et al. [54]	BN	
Culbert and Klump [55]	BN	
Ackard et al. [56]	BN	
Rodríguez et al. [57]	BN	
Morgan et al. [58]	AN, BN	Bad attitude toward sexuality
Wiederman and Pryor [59]	AN, BN	
Mangweth-Matzek et al. [34]	AN, BN	
Ruuska et al. [25]	AN, BN	
Castellini et al. [60]	BED, obese	Sexual dysfunction and body dissatisfaction
Pinheiro et al. [61]	AN, BN	
Castellini et al. [62]	AN, BN	
Folope et al. [63]	BED, obese	
Castellini et al. [64]	AN, BN	
Sarwer et al. [65]	BED bariatric	Sexual dysfunction and quality of life
Castellini et al. [66]	AN, BN	Sexual abuse, cortisol levels
Brown and Keel [67]	EDs men	Being in a relationship as a protective factor

AN, Anorexia nervosa; BN, bulimia nervosa; EDs, eating disorders.

Table 3: Eating disorders, sexual orientation and gender identity.

Study	Gender	Association between sexual orientation and EDs
Olivardia et al. [68]	Men	Non heterosexuality as risk factor for EDs
Beren et al. [69]	Men	
French et al. [70]	Men	
Carlat et al. [71]	Men	
Russell and Keel [72]	Men	
Yelland and Tiggemann [73]	Men	
Hospers and Jansen [74]	Men	
Feldman and Meyer [75]	Men	
Feldman et al. [76]	Men	
Heinberg et al. [77]	Men	
Brown and Keel [67]	Men	
Matthews et al. [78]	Men/women	
Matthews-ewald et al. [79]	Men/women	
Heffernan et al. [80]	Women	Lack of association
Moore et al. [81]	Women	
Share and Mintz [82]	Women	Non heterosexuality protective for good body image
Owens et al. [83]	Women	
Moore and Keel [81]	Women	Non heterosexuality as risk factor for body uneasiness
Duggan et al. [84]	Men	
Conner et al. [85]	Men/women	
Kaminski et al. [86]	Men	
Morgan and Arcelus [87]	Men	
Carper et al. [88]	Men	
Blashill [89]	Men	
Wiseman and Moradi [90]	Men	
Dakanalis et al. [91]	Men	
Koh and Ross [92]	Women	Higher risk in bisexual than lesbian
Austin et al. [93]	Men/women	Non heterosexuality as risk factor for purging behaviors men not for women
Legenbauer et al. [94]	Men/women	Non heterosexuality as risk factor for men; Lack of association for women
Cella et al. [95]	Men/women	
Austin et al. [96]	Men/women	Non heterosexuality as risk factor for purging behaviors
Brewster et al. [97]	Women	Bisexuality as a risk factor for EDs
Meyer et al. [98]	Men/women	Gender role and EDs
Hepp and Milos [99]	Men/women	
Duggan et al. [78]	Men	
Hepp et al. [100]	Women	
Cella et al. [101]	Men/women	
Diemer et al. [102]	Men/women	
Matthews-ewald et al. [79]	Men/women	
Vocks et al. [103]	Men/women	Higher eating psychopathology in transgender
Ålgars et al. [104]	Men/women	
Bandini et al. [105]	Men/women	
Fisher et al. [106]	Men/women	

EDs, Eating disorders.

pubertal development. In particular, it has been hypothesized that the onset of the disorder would be mediated by the body dissatisfaction due to pubertal changes (e.g. breast development, menarche, increased adiposity) [20, 113, 116]. Indeed, those who early sexually develop are thought to be at particular risk, given that they experience these physical changes earlier than their peers and may therefore experience even more body dissatisfaction than their developmentally on-time counterparts.

Apart from the developmental stage, it has been reported that EDs patients have a more negative subjective perception of menarche, pubertal body changes, and first sexual activities, as compared to healthy women [34, 117]. Indeed, ideal body image was associated with weight status and menstrual cycle phase, and negative body image was significantly associated with different phases of the menstrual cycle and increasing body weight status [42]. Moreover, Kaczmarek and Trambacz-Oleszak [42]

found that body dissatisfaction was more severe during the premenstrual phase of the menstrual cycle. These observations are similar to previous findings by Jappe and Gardner [118] and Racine et al. [119], who found that body image dissatisfaction was likely to be greater during the mid-luteal/premenstrual phases than in the follicular and ovulatory phases in a sample of adult healthy women. Teixera and colleagues [120] observed that dissatisfaction with body image peaked during the menstrual phase, with a significant increase after the premenstrual phase and a significant decrease after the menstrual phase in a sample of 44 university students.

As expected, few studies took into consideration the role of puberty in males. Klump [108] reported that the majority of them showed that early maturing boys and/or those at advanced stages of puberty had higher rates of AN, BN, and EDs symptoms, especially body dissatisfaction and weight/shape. However, there are also studies reporting that those who sexually develop later had higher rates of body dissatisfaction [121–124], and five studies found that advanced pubertal development was associated with improved body image [121, 125], enhanced self-concept [126, 127], and/or increased perceptions of physical attractiveness and/or decreased social pressures about eating [128]. However, a further support to the strong role of puberty changes in girls as a predisposing factor for ED may be represented by the female to male ratio which ranges from 4:1 [129] up to 10:1 [130]. Sex differences have been also related to a pathogenic effect of gonadal hormones [108].

As far as hormones are concerned, leptin, an adipocyte hormone important in regulating energy homeostasis, interacts with the reproductive axis with stimulatory effects at the hypothalamus and pituitary gland, and inhibitory actions at the gonads [131–139]. Leptin has been shown to play a role in important physiologic processes such as menstruation, pregnancy, and lactation [139, 140]. As a marker of nutritional status, leptin may act in concert with gonadotropins and the growth hormone axis to initiate the complex process of puberty. Conditions in which nutritional status is not adequate, such as eating disorders and exercise-induced amenorrhea, are associated with low serum leptin levels, raising the possibility that relative leptin deficiency may be at least partly responsible for the reproductive abnormalities observed in these conditions [141–144]. Leptin may act as the critical link between adipose tissue and the reproductive system, indicating whether adequate energy reserves are present for normal reproductive function [139, 145].

Although puberty is recognized as an important period of risk for the onset of eating pathology in

adolescent females, the extent to which puberty-related hormonal change accounts for elevated risk for disordered eating remains unclear [146]. For example, data from the Swedish Twin Study of Child and Adolescent Development [31] showed that pubertal development in early-to-mid adolescence was significantly associated with EDI scores and dieting in late adolescence, while no significant association was observed between pubertal development and dieting and purging in young adulthood.

In females, at least some of the unique genetic risk may be related to puberty and ovarian hormones. The heritability of disordered eating symptoms in females increases with both pubertal development and increasing levels of estradiol. Although more research is needed in order to elucidate specific mechanisms, gonadal hormones may be promising candidates for understanding sex and developmental effects and the ways in which genes exert their influence on disordered eating [30].

As far as fertility is concerned, it has been suggested that EDs are associated with fertility problems, unplanned pregnancies, negative attitudes to pregnancy and increased risk of induced abortions and miscarriages [147]. Linna et al. [147] reported that unplanned pregnancies were more common in the AN group compared with the general population, and that EDs patients more frequently experienced negative feelings upon discovering their pregnancy. Furthermore, BN patients had an increased risk of induced abortion compared to controls, and BED diagnosis was associated with an high risk of miscarriage. Considering the possible mechanisms underlying fertility problems in AN, they could be due to a combination of anovulation and a rejection of sexual activity. The reduced libido in AN can be associated with both psychological mechanisms (reduced self-esteem, body dissatisfaction; see section 3 of the Results) and low concentrations of circulating sex hormones. The main endocrine dysfunctions leading to amenorrhoea in anorexia nervosa are low concentrations of gonadotrophins and hypoestrogenism [148, 149] caused by inhibition of gonadotrophin-releasing hormone pulsatility [150–152], a blunted response of luteinizing hormone to gonadotrophin-releasing hormone, and diminished pulsatile release of luteinizing hormone [153], loss of feedback effect of estrogen, and multifollicular changes in the ovaries, resulting in the failure of follicle selection and dominance [154, 155]. In premenarchal patients there is a delay in pubertal development due to the continuation of these pre-pubertal secretory patterns [155]. Finally, it is important to note that most of the endocrine disturbances are due to starvation and may be considered a metabolic adaptation of the body to a negative energy balance [156].

Eating disorders and sexual dysfunction

Few studies considered sexual dysfunctions in EDs patients. Sexual functioning is seldom considered an important component of treatment or outcome predictor, and 175 PubMed records on related to the combination of “sexual dysfunction” and “eating disorders” were found. Among them, only 26 were original research actually focused on sexual dysfunctions.

Different studies considered the way sexual function is perceived by persons with EDs, according to different perspectives. In particular, some sexual behaviors have been considered as risky and impulsive behaviors correlated with other pathological EDs features, such as binge eating and purging behaviors [36, 52, 53, 157–162]. Moreover, number of partners and quality of sexual intercourse were taken into account. Sexual functioning in EDs has been considered as either hypersexuality either decrease sexuality [34]. In particular, in the period between 1995 and 2005 a large number of studies supported a model which was based on impulsivity as a mediator of the relationships between trauma, pathological eating behaviors and the tendency to impulsively engage in sexual activities with strangers or in risky situations and without using protections [52, 55, 157, 159, 163, 164]. Different research demonstrated an association between bulimic and purging behaviors and a number of dyscontrol behaviors, namely bullying, truancy, excessive drinking and sexual disinhibition in BN patients [24, 52, 159]. Number of partners and sexual intercourses has also been considered as a manifestation of multi-impulsivity, and the rates of specific disordered eating behaviors were associated with higher numbers of sex partners [165]. Indeed, BN patients and AN binge/purging type patients reported higher rate of multiple partners compared with AN restricting type patients [62]. Therefore, it has been hypothesized that individuals with EDs who are emotionally constricted and over-controlled (as AN restricting patients) report limited sexual functioning, whereas those with emotional dysregulation and low self control report more impulsive and chaotic sexual profiles [166]. However, being in a stable relationship can be considered a protective factor for psychopathology and especially for EDs, for different reasons correlated with the ability to establish emotional bonding, as well as with self-esteem and quality of life. Indeed, several studies showed that married women have lower EDs symptomatology as compared with single women [167–169]. For example, Keel et al. [169] found that being married predicted significant decreases in drive for thinness, bulimic symptoms, and

dieting frequency in women, but not in a sample of men that was predominantly heterosexual.

The decrease of sexual interest in AN patients has been associated with hypogonadism and emaciation [170, 171], while weight restoration has been reported to favor an increase in sexual drive [46, 47, 64]. Indeed a specific correlation between the severity of underweight and sexual dysfunction has been reported [61, 117], while Castellini et al. [62] did not confirm such observation.

According to different reports [32, 98, 107–110) sexual dysfunction is not limited to AN but can be found also in BN patients [34, 61, 62, 64, 66] and BED patients [60, 172], who usually do not suffer from hypogonadism. The comparisons of sexuality between AN and BN subjects showed conflicting results, with a similar pattern found in Castellini et al. study [62], while a Mangweth-Matzek et al. [34], demonstrating a worse condition in AN.

As far as AN is concerned, it is of note that few studies compared AN subtypes, searching for a correlation between pathological behaviors and sexual dysfunction [55, 62, 64, 171]. Castellini et al. [62] demonstrated that purging anorectics had greater sexual drive than non-purging patients, and Rothschild et al. [171] reported that sexual fantasy distinguished AN subgroups, with a paucity of fantasy among restrictive anorectics at normal weight compared with binge/purging anorectics. Castellini et al. [62] found that AN restricting/type patients showed lower female sexual function index arousal, lubrication, orgasm, satisfaction, and pain scores compared with AN binge/purging type and BN patients, confirming that pathological eating behaviors were associated with different levels of sexual dysfunction.

The relationship with own body has been considered as a possible mediator of the sexual dysfunction in EDs. Indeed, a shared psychopathological feature of all EDs is body image distortion and body dissatisfaction [1, 4]. Body image dissatisfaction has been indicated as one of the most relevant predictors of treatment response and long-term outcome of EDs [10, 11, 173, 174], and the most relevant antecedent of both AN and BN [175]. Furthermore, recent research in female sexuality found that several aspects of body satisfaction, sexual attractiveness, body worry during sexual activity, as well as preoccupations about body weight correlates with different extent to sexual satisfaction in healthy women [56, 58, 176]. Persons with a healthy attitude toward their own body have been shown to report more frequent sexual experiences and a wider range of sexual activities, as they feel more sexually desirable and self-confident [177, 178]. This line of research was followed by some groups, which demonstrated that body dissatisfaction significantly correlated with the

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severity of sexual dysfunction [60–62]. In particular, lower female sexual index scores were correlated with higher shape concerns measured by means of the eating disorder examination in AN, BN [62] as well as in BED [60] patients. A further confirmation that EDs specific psychopathology could be considered as a specific maintaining factor for sexual dysfunction in EDs subjects was provided by a 1-year follow-up study after a cognitive behavioral intervention in AN and BN [64]. This kind of intervention is generally targeted to the common core psychopathological features, including dysfunctional attitudes toward eating and overvalued thoughts regarding weight [22, 179]. The above mentioned research confirmed that the psychological intervention allowed an improvement in sexual functioning in both AN and BN groups by the mediation of intrapsychic processes related to the treatment effects on these core features.

Severity of sexual dysfunction has been also associated with frequency of binge eating behaviors in AN binge/purging type, BN [62] and BED [60] patients. In both these studies sexual dysfunction was correlated with emotional eating, a psychological dimension defined as “eating in response to a range of negative emotions” [180]. Therefore, authors hypothesized a shared maintaining factor for both binge eating and sexual dysfunction, associated with dysfunctional mood modulatory mechanism, supported by the relevance of cognitive and emotional dimensions in the modulations of women’s sexual desire [181]. This hypothesis is confirmed by the relationship between sexual and the impulsive-compulsive spectrum symptoms, and negative emotions [57, 59, 61]. Indeed, sexual dysfunction has been associated with different adverse emotional states such as sadness, guilt, and anger associated with negative automatic thoughts during sexual activity [182].

As already observed in AN, even in BED patients it can be hypothesized by a relevant role of BMI modification in determining the sexual dysfunction. Obesity has been demonstrated to affect several aspects of sexual functioning [11, 183–186], and the weight loss following bariatric surgery has been reported to be correlated with a significant improvement in hormonal profiles as well as sexual functioning in both men [187, 188] and women [65, 189]. The impaired sexuality in obese subjects can be due to the psychological consequences of obesity as well as to the organic conditions associated with metabolic syndrome [190]. However, also in BED patients it can be hypothesized to be a specific effect of psychopathology, considering that the sexual functioning of obese patients with EDs has been found to be more impaired as compared with obese subjects without EDs [60, 63].

Sexual abuse and eating disorders

The relationship between sexual abuse and EDs has been clearly established from different perspectives. In the last 20 years, 33 reviews and meta-analyses articles on this topic have been published. Although a recent meta-analysis [107] showed that sexual abuse is particularly associated with a diagnosis of BN, most of the available reviews of the literature [16, 18, 107, 191–195] indicated that childhood sexual abuse (CSA) – defined as a sexual encounter in which touching or penetration of the genitals happened before age 16 with someone at least 5 years older [196] – represents a well-demonstrated risk factor for the development of all EDs in a trans-diagnostic fashion.

It is important to note that most of the meta-analyses demonstrated that the strength of the association varied across the large amount of studies in this field, as well as the moderators of the relationship between sexual abuse and EDs. Several methodological issues account for such differences in the literature. Most of the studies adopted a cross-sectional design based on case-control approach [107] and the strongest association was reported in the non-clinical control groups [107, 197, 198]. However, only longitudinal studies can demonstrate the role of a life event as a risk factor for the onset of a disorder, clarifying causal priority, and avoiding recall and sampling bias. Indeed, the retrospective design may be biased by the poor reliability of the memories relevant to childhood, memory distortions, and influence of adulthood psychopathology [199–201]. The population taken into account is also a relevant issue, as evidence of greater reliability and generalizability can be derived from studies utilizing large random community samples, birth cohorts, and twin cohorts.

Therefore, evidence for the association between CSA and EDs increase from reliable and representative community studies such as those performed by Sancı et al. [198], Cutajar et al. [202], and Jonas et al. [203]. Cutajar et al. [202] evaluated almost 3000 children whose sexual abuse was assessed at the time by forensic medical examinations, using the records of the Victorian Institute of Forensic Medicine (VIFM), which, since 1957, has provided medical examinations in cases of suspected CSA. This strategy allowed establishing a very reliable evaluation of the life event. Jonas et al. [203] performed a representative study for the general population, avoiding the bias of a selected clinical sample. Authors used the detailed information available from the 2007 Adult Psychiatric Morbidity Survey of England (APMS 2007), including a large random sample of the English household population. Another

reliable survey was the one by Sancı et al. [198], based on the Victorian Adolescent Health Cohort Study, and providing evidence of a significant association of CSA with bulimic symptoms in young females.

Most of these studies demonstrated that CSA and sexual abuse in adulthood [201] are risk factors for many forms of comorbid psychopathological conditions. Furthermore, EDs have a multifactorial pathogenesis, and therefore are caused by a sequence or combination of risk factors rather than a single influence. Accordingly, sexual abuse may combine with certain other risk factors such as other types of abuse (emotional, physical, neglect) resulting in different psychopathological phenotypes [204]. The reason why CSA may result in EDs could be the combination of the trauma with different environmental or biological conditions, which represent the so-called “moderators”. Moderator analyses allow identifying specific sub-populations of subjects in which a certain relationship is stronger than in the general population or allowed to predict in which persons the EDs outcome after a CSA is more likely. For example, Vanderlynden and Vandereyken [205] hypothesized that CSA occurring in early developmental stages leads to a higher probability to develop an ED rather than other psychiatric conditions. From this perspective, EDs represent a severe consequence of CSA occurring when the foundation of brain architecture is being wired and it can disrupt the development of neural circuits that interfere with typical patterns of brain development, heightening vulnerability to psychopathology. Therefore, it compromises a child’s ability to successfully master stage-salient developmental tasks, including secure attachments, emotion regulation, stress response, and his/her relationship with ones own body [206–208].

Furthermore, several studies considered the synergic effects of sexual abuse and repeated traumatic experience [209–211]. Sancı et al. [198] found that two or more episodes of CSA before the age of 16 years predicted a >5-fold elevated cumulative risk of new bulimic syndrome during adolescence. Moreover, Favaro et al. [212] took into consideration traumas preceding the CSA, demonstrating a synergic effect of neonatal dysmaturity and childhood abuse in increasing the risk for AN, which might be explained by the hypothesis that a prenatal programming of stress response systems can result in an impairment of the individual’s resilience to severe stressful events.

Even though the scientific literature converges on a clear association between sexual abuse and EDs psychopathology, no conclusive explanation was provided regarding the possible mechanisms mediating such relationship. It is well known that sexual abuse and especially CSA determine a pattern of several concomitant

psychopathological conditions, characterized by pathological eating behaviors, sexual dysfunction [62, 213], dissociative experiences [214, 215], mood disorders [202], and suicidal thoughts [107].

Given that a person’s sexuality, mood regulation and eating behaviors are multifaceted and interconnected phenomena, several models of interaction related with sexual abuse have been proposed involving biologic, cognitive, and affective processes [210, 213, 216–218]. Therefore, common underlying maintaining factors of these symptoms which are typical consequences of traumatic sexual experience, have been proposed, such as severe body image disturbances [19, 44, 219] and emotion dysregulation [197, 220].

Several psychopathological trajectories have been proposed for the development of EDs among women with a history of sexual abuse or CSA. Sexual abuse may interfere with sexual maturation [221], leading a woman to feel revulsion about her body in a way that may manifest with concerns about body weight, shape, and size [19]. Furthermore, sexual trauma might act specifically by inducing feelings of poor self-esteem, triggering self-starvation, as a reflection of the individual’s effort at regaining control on her life [107].

Dissociation, which consists in “a disruption in the usually integrated functions of consciousness, memory, identity, and perception of the environment” [214], has been considered as a shared maintaining factor of both sexual dysfunction and pathological eating behaviors in sexual abuse survivors [62, 204]. For example, a disconnection between body and mind and the dissociation during sex reported by sexual abuse survivors have been associated with individual’s subjective experience of sexual arousal inhibition [222]. Indeed, sexually abused persons experiencing sexual difficulties may have learned to automatically pair sexual stimuli with fear (implicit sexual memories) [213]. As a partial confirmation of this hypothesis, Castellini et al. [66] found a significant association between sexual desire and cortisol levels in a group of EDs reporting a history of CSA, and Rellini et al. [213] found a greater cortisol response associated with greater perceived states of physiological sexual arousal in subjects reporting abuse. The authors hypothesized that in people who have been abused during childhood, the emotional involvement in the sexual relationship would result in activation of the mechanisms of stress. In the same way, dissociation has been implicated in the pathogenesis of bulimic symptoms [214, 215], according with the “mood modulation” theory [223] and the “escape” theory [224]. Several authors suggested that binge eating occurs in dissociative states [214, 215, 225] as a way to manage the

effect of a sexual abuse. In particular, the awareness of the traumatic experience creates negative affects, and favors the onset of the escape mechanism, which occurs by the patient narrowing his or her awareness from abstract levels (self-evaluation) to the level of the physical surroundings or stimulus (i.e. food) [215].

Indeed, CSA has been supposed to determine emotion dysregulation – encompassing the ability to adaptively identify and cope with negative mood states – which resulted in several psychopathological outcomes associated with eating disorder behaviors (including binge eating, purging, or starving), such as self-harm and suicide attempts [197]. In this model, disordered eating behaviors are conceptualized as a maladaptive means of dealing with negative affect. Binge eating behavior likely acts as a negative reinforcement via this pathway because it acts to decrease or block negative affect, at least in the short term, by relieving the experience of painful emotions [180].

Moreover, body image disturbance and body dissatisfaction represent common psychopathological consequence of sexual abuse both associated with sexual dysfunction and EDs. The relationship with one's own body has been often reported among victims of sexual abuse [19, 219].

Finally, recent studies suggest a mediating effect of sexual dysfunction in the relationship between CSA and dangerous sexual behaviors [218]. Indeed, the body is the real battleground for EDs who experienced sexual abuse, who are more likely to engage in self-destructive behaviours [212]. The recourse to self-harming behavior in these patients has been interpreted as a way to regain control on a compromised interoceptive awareness by cutting and burning the body [219]. Compulsive cleaning behaviors have also been associated with a history of CSA by the mediation of a disease related to ones own body, and specific compulsive behaviors could be interpreted as an attempt to symbolically clean out the body of the impurity associated with the past abuse [19]. Finally, according to a psychodynamic perspective, it is possible that the relationship between sexual dysfunction, eating disorders and history of abuse can be interpreted in the light of a denial of adult sexuality in relation to either childhood conflicts or on the refusal of the body as a symbolic refusal of the abuse instead.

Sexual orientation and gender identity

When searching for “sexuality” and “eating disorders”, a considerable proportion of original studies (27.0%) deal

with the relationship between EDs, sexual orientation and gender identity. Several studies indicated that non heterosexual men (homosexual and bisexual persons) are at higher risk to develop an ED [67, 69–72, 85, 226, 227]. Considering specific pathological behaviors, Austin et al. [96] found that non-heterosexual persons reported an elevated odds of purging and diet pill use in both girls and boys (odds ratios [OR] range=1.9–6.8). From a different perspective it has been reported that up to 42% of men seeking treatment for an eating disorder have self-identified as homosexual or bisexual [68, 228].

As a general explanation for all non-exclusively heterosexual persons, the Minority Stress Model suggest that sexual minorities might experience more stress and therefore are more susceptible to developing pathological eating behaviors [75, 76, 229, 230]. However, more specific explanation has been provided. For example, it has been observed that gays or bisexual men develop a higher body shape concern due to the pressure to obtain a lean physique to attract a male partner, as men emphasize physical appearance when selecting mates [226]. This excessive preoccupation with one's physical appearance might result in an ED as well as for heterosexual women. Furthermore, it has been noted that homosexual men have a heightened emphasis on a thin, muscular, and youthful figure [73, 231, 232]. This could lead to a greater drive for thinness as compared to heterosexual men [67]. Indeed, the presence of EDs behaviors in gays appeared to be mediated by a higher body dissatisfaction in homosexual than heterosexual men [86, 233]. Gay men scored significantly higher on drive for thinness, body dissatisfaction, and body image-related anxiety than their straight counterparts [88, 95]. The objectification theory might represent a possible explanation: gay men tend to report higher levels of exposure to sexually objectifying media, body surveillance, body shame, which in turn leads to disordered eating behaviors than heterosexual men [88, 90, 91]. It has been suggested that the gay men's increased vulnerability to media influence partially accounts for the relatively high rate of eating pathology observed in this population, as perceptions of media influence were higher for gay men, and it has been found to significantly mediate the relation between sexual orientation and eating and body image concerns [88].

Less evidence has been found in women [79, 81, 82, 93]. Some studies reported that lesbian sexual orientation is predictive of positive body image and fewer negative attitudes toward eating and weight [80, 83, 110]. Matthews-Ewald et al. [79] found that lesbians reported more dieting to lose weight compared to those identifying as heterosexual. Authors speculated that the risk of dieting

may be due to the increased incidence in overweight and obesity among lesbian women [234]. Regarding a possible mechanism involved in women, Brewster et al. [97] examined the roles of antibisexual discrimination and internalized biphobia in a group of bisexual women. They found that antibisexual discrimination and internalization of sociocultural standards of attractiveness were correlated with body surveillance, body shame, and eating disorder symptoms. Finally, a moderating role of childhood sexual abuse has been hypothesized, as, for example, men with a history of childhood sexual abuse showed a higher rate of bulimic symptoms compared with men who do not have a history of childhood sexual abuse [75].

The issue of the relationship between gender identity and EDs has been more recently addressed by the scientific literature, as compared to the sexual orientation one. A population study performed on 289,024 students from 223 US universities [97] showed that transgender students had greater odds of past-year self-reported EDs diagnosis, use of diet pills, and vomiting or laxatives, confirming previous observations [99, 102]. As for sexual orientation, it has been postulated that the rate of psychopathology can be attributed to the high rates of discrimination suffered by transgender persons [235, 236]. Indeed, several authors support the hypothesis that transgender persons lack a primary psychopathology [237–240], and the psychiatric disorders often reported may be the consequence of difficulties in coping with social stigma [241, 242] or rejection by family and friends [243].

However, it has been noted that transgender persons may be at increased risk of body dissatisfaction, which may predispose them to disordered eating [99]. This is especially true for gender dysphoria (GD) persons who show a strong and persistent identification with the opposite sex, discomfort with one's own sex, and a sense of inappropriateness in the gender role of that sex [3]. GD subjects live in a cognitive state where their physical body is in contrast with their self-perceived identity [244], and this experience is a source of deep and chronic suffering [245]. While several case reports have been published on GD patients with EDs [e.g. [246–248]], few larger studies took into consideration this issue. Vocks et al. [103] and Bandini et al. [105] reported that both male-to-female and male-to-female persons show higher levels of EDs specific psychopathology, as compared to a control group. In a recent study, Witcomb et al. [249] demonstrated that trans individuals showed greater body dissatisfaction than controls, and trans males had comparable body dissatisfaction scores to eating disordered males. According to Pauly and Lindgren's [250] position, the authors supported the position that the body is the primary source of suffering

in these persons, even with regard to nonsexual body parts and aspects. A further confirmation of the centrality of the body in GD is also demonstrated by the fact that its successful treatment is also capable of relieving these symptoms [106].

Several studies [98, 100, 101], took into consideration the relationship between gender role EDs pathological behaviors and body dissatisfaction. In general, masculinity seems to be a protective factor, independently by the biological gender, while femininity appears to be more associated with body dissatisfaction and in turn with pathological eating behaviors [100, 101].

Expert opinion

Sexuality in EDs does not have a unique significance and it has been considered according to different lines of research in the scientific literature. From an etiological point of view, the timing of puberty with its hormonal consequences and the changes in the way persons perceive their own body represent a crucial period of life for EDs onset. Even though several review articles have been provided on this topic, still there are few research studies which clarify the mechanisms underlying this association. Furthermore, there are few studies which took into consideration how the attitude toward one's own body changes across this period, together with the eating and physical exercise habits. Indeed, in most Western countries (especially in the south of Europe) sexual education is almost neglected at school.

According to our research of the literature, the multifactorial etiopathogenesis of EDs include sexual abuse, and CSA is a well-recognized risk factor for the onset of all forms of EDs. The underlying mechanisms of the several psychopathological consequences of sexual abuse have been studied in different ways, providing conflicting and non-conclusive results. However, it has been demonstrated that CSA and sexual abuse identified a sub-population of EDs with a worse long-term outcome. According to our research, an adequate clinical approach should always consider the possibility of sexual abuse when treatment of ED does not follow the expected course or improvement. Furthermore, it would be crucial to specifically target the comorbidities of CSA before useful treatment of an ED can begin. Finally, it is reasonable to hypothesize that effective treatments specifically targeted on body image perception and cognitive/emotional consequences of sexual abuse would improve not just sexual activity and pathological eating behaviors but the long-term recovery process too.

Q8:
In the original manuscript ref. 206 (now ref. 235) is not cited in the text. Please check and confirm the insertion of ref. 235 in text citation is correct here

Q9:
Please check "both male-to-female and male-to-female persons" do you mean male-to-female and female-to-male persons?

It is noteworthy that the evaluation of sexual functioning in EDs patients represents a limited proportion of the studies included in the category of “sexuality and eating disorders”. Sexuality of EDs has been studied in terms of hypersexuality as a form of dangerous consequence of impulsivity. Therefore, the scientific literature followed an approach that sounds like: “EDs patients do not have sex and, if they have it, they use it in a compulsive self-damaging way”. Recent researches overcome this perspective considering the sexuality of EDs persons in terms of sexual desire, satisfaction, orgasm and pain. In other words, authors evaluated sexual functioning of patients who really have a form of sexual activity, even though damaged. Results from this line of research are promising, and describe a clear relationship between sexual dysfunction and the core psychopathological features of EDs, such as body image disturbances. Therefore, a relationship with one’s own body, as well as sexual function, should become the target of psychological interventions, as well as the pathological eating behaviors.

As far as the relationships between sexual orientation, gender identity and EDs are concerned, the analyses of the literature showed that the majority of the studies were carried out by experts in the field of sexual minorities or gender dysphoria. In most cases they took into consideration EDs psychopathology in groups of homosexual and gender dysphoric persons. However, from the opposite point of view, the issue of sexual orientation and gender identity in EDs is barely considered by clinicians and research studying EDs. However, several lines of research are developing new models of maintaining factors of EDs psychopathology related the topic of self-identity. Accordingly, impairments in overall identity development and the failure to establish multiple and diverse domains of self-definition have been suggested as the core pathoplastic mechanism of EDs.

Outlook

Taking into consideration the complex relationship between sexuality and EDs would significantly improve the way of recognizing and treating these patients in the future.

For example, longitudinal studies should take into account the temporal relationship between hormonal effects, body modification induced by puberty, subjective perception of increasing sexual drives and the changes in eating habits as predisposing factors for EDs

onset. As extensively reported in the puberty and sexual abuse section, from a methodological point of view, these kind of studies should be based on a general population survey, in order to provide a more comprehensive and representative explanation of the phenomena. The main reason for this choice would be that the main EDs diagnoses provided by the DSM 5 represents only the tip of an iceberg, while the reality of EDs psychopathology in the general population is much more complex, and it should be considered in a dimensional rather than categorical perspective.

From a clinical point of view, future research focused on treatment and long-term outcome of EDs patients should take into account the complex relationship between psychopathological core features such as body image distortion and sexual dysfunction. In particular, there is a need for clinical trials which take into consideration the role of sexual dysfunction (and amenorrhea for AN patients) as potential moderators and mediators of the efficacy of the psychological and pharmacological interventions. Future researches should evaluate whether the recovery of a good sexuality represent a prognostic factor for the treatment, or in which extent relationship with one’s own body and sexual functioning could be considered as the final hurdle in the recovery process of persons with EDs.

Highlights

- Sexuality in EDs has been considered in a heterogeneous way, including different lines of research.
- Puberty is a risk factor for the onset of EDs, and timing of puberty with its hormonal consequences represent a crucial period of life for EDs onset.
- Few studies which took into consideration how the attitude toward one’s own body change during puberty, together with the eating and physical exercise habits.
- Sexual abuse and especially childhood sexual abuse are well-demonstrated risk factors for the onset of EDs, and they determine long-lasting psychopathological consequences, which could interfere with the treatment of the disorders.
- From a clinical point of view, an adequate clinical approach should always consider the possibility of sexual abuse when treatment does not follow the expected course or improvement.
- A large proportion of the studies focused on sexuality in EDs patients considered the relationship between

impulsivity, pathological eating behaviors and compulsive sexuality.

- Recent research focused on the sexual satisfaction of eating disorders patients, demonstrating a clear relationship between sexual dysfunction and core psychopathological features, such as body image disturbances.

Several studies documented that non heterosexual orientation is associated with body uneasiness and pathological eating behaviors in men; transgender persons may be at increased risk of body dissatisfaction, which may predispose them to disordered eating.

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