Body Image Disturbances in Anorexia Nervosa

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8.1 Introduction

Anorexia nervosa (AN) is a severe mental illness with typical onset in female adolescents and largely unknown etiology. It is characterized by aberrant patterns of eating behaviors, extremely low body weight, restriction of energy consumption, and fear of gaining weight. Body image is also severely distorted so patients tend to perceive themselves as fat even when emaciated to death. A distorted body image is therefore a hallmark of this disorder. Body image disturbances in AN are defined as "a disturbance in the way in which one's body weight or shape is experienced" [1]. However, body image has been theorized as a multidimensional construct [2] with attitudinal aspects and perceptual dimensions of body image as entrenched aspects in determining and evaluating one's own body size and shape.

In AN, body image disturbances are a key aspect with respect to both etiology [3] and relapse prevention [4]; during the 1960s, Bruch described AN as a "disturbance in body image of delusional proportions" [5]. About 50% of patients with AN recover while about 20% develop a severe and enduring disorder [6]; however, outcome rates vary also depending on the inclusion of patients' overestimation of their body size. Body image distortions are crucial in AN with relevant consequences from a development, prognosis, and maintenance point of view [7–10]. Body image concerns have been linked to relapse as well; this is of interest given the unsatisfactory outcomes that characterize this disorder [11]. The available therapeutic armamentarium mainly relies on the modifications of body-related cognitions and behaviors rather than on the multisensory factors of patients' body image.

A number of different components of body image play a role in body image disturbances in AN: affective, i.e., subjective feelings towards their body's appearance and satisfaction/dissatisfaction and subjective preoccupations with body size

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or shape; cognitive, i.e., thoughts on body shape and body mental representation [12]; and perceptual, i.e., the accurate identification and estimation of one's own body size, shape, and weight and behavioral aspects [13, 14]. Overall, literature on AN showed that such dimensions are characterized by an overall overestimation of body size coupled with greater body dissatisfaction. However, data are overall mixed about accuracy in estimating body size in AN since a whole variety of assessments has been performed to date in order to reliably capture this complex and multifaceted construct. For example, assessments vary (e.g., asking participants to evaluate their total body versus some specific body parts) as well as assessment tools (pen-and-paper versions of silhouettes versus virtual reality), and phase of the illness (hospitalization, extreme versus mild body mass index) alike. On the other hand, the aforementioned multiple components of body image directly hamper a straightforward evaluation of this construct thus yielding inconsistent results and jeopardizing the overall generalizability of the study results from a methodological point of view [15, 16].

8.2 Sensory Modalities Involved in Body Image Disturbances in Anorexia Nervosa

As stated earlier, a number of different methods have been performed to measure perceptual dimension of body image disturbances in AN, including silhouette methods [17], distorting mirrors [18], and photograph and video techniques altering pictures of one's own body [19–22]. However, research tried to expand the assessment of body image in AN across different sensory modalities.

In fact, different classifications and hierarchical assessments of the different subrepresentations needed when experiencing our body exist [23–26]; for example, body schema refers to motor actions while body image to body representations [27–29]. All in all, these models highlight the variety of sensory modalities that come into play when our body is experienced. For example, it remains unclear as to whether individuals with AN have a perceptual disturbance biasing their own body experience. In addition to body size estimation tasks, several other methods of assessment have been performed. Therefore, literature on AN tried to expand the available knowledge on the analysis of the different senses that are involved in body representations, including haptic perception [30, 31], altered interoceptive awareness [32, 33], integration of visual and proprioceptive information [34–36], and tactile stimuli [37, 38]. For a review on this topic, see Gaudio and Quattrocchi [39].

For example, the rubber hand illusion paradigm has been used in order to study visuo-tactile abilities in AN. Such an experimental setting induces participants to experience a fake body part generating a visuo-tactile conflict, that is touching at the same time both actual and fake body parts. As a result, the brain is required to put together two different inputs [40, 41]. In AN, currently ill and recovered individuals showed greater likelihood of experiencing the rubber hand illusion than healthy controls did [34, 35, 42] and also that the overestimation of their hand width lowered over time [35], entailing potentially therapeutic effects.

Relatedly, in order to address the multisensory components of body image distortions in AN, virtual reality and full body illusions have also been performed [43, 44–47]. In these experimental conditions, participants can experience a modification of their body size, depending on the avatar. In AN, Keizer and collaborators [48] showed that patients with AN reported more marked alterations of the estimation of their body size and body circumference than healthy controls did. However, since patients could reliably describe and measure other parameters (including their height) a general bias in the assessment of body dimensions has been excluded. All in all, in line with everyday clinical practice, patients with AN tend to experience as "fat" those body parts which trigger more their body obsessions (e.g., abdomen, thighs).

8.3 State-of-the-Art of Body Image Distortions in Anorexia Nervosa

An earlier review was conducted on the published papers on body image distortions in AN by Farrell and collaborators [16]. The authors included in their review only those works recruiting more than 10 participants, and included a total number of 52 papers. Considering the different assessments performed, mixed results were collected and contrasting data were finally available. A half of the included studies showed AN sufferers as overestimating their body when compared to healthy controls thus providing support to the difficulty of patients with AN in accurately evaluate their own body. However, in two studies [49, 50] only specific body parts were evaluated as overestimated. Relatedly, one study [51] highlighted that only those patients with AN and a history of bulimia nervosa reported an overestimation of their body size. In contrast, two studies showed both patients with AN and healthy controls as underestimating their body size [16, 52]. With respect to selected body sizes, patients with AN overestimated certain body parts thus providing a more accurate description of their body than healthy controls did; however, in other studies no differences emerged between patients with AN and healthy controls in the accuracy of one's own body estimation [16]. All in all, although the majority of papers confirmed that AN patients tend to overestimate their body, data are far from being conclusive on this topic.

Subsequently, Gardner and Brown [53] reviewed the available literature on body size estimation in individuals with AN analyzing papers published from 2002 to 2014 and, on the basis of the available data, the authors concluded that AN sufferers overestimated their body size more than healthy controls did with two studies [54, 55] failing to reach statistical significance for such a difference. However, when effect sizes were calculated in order to overcome the bias of small sample sizes of some studies, the mainly large effect sizes obtained provided support to the reliability of overestimation of body size in AN. With more detail, shoulders, hips, waist, and thighs resulted as particularly oversized according to two studies [56, 57].

More recently, Caspi and collaborators [58] used a computerized assessment of body image to ascertain as to whether different diagnosis of eating disorders differ

in body image. The authors confirmed that those with an eating disorder show greater body disturbances than healthy controls; moreover, they found that patients with AN overestimated more than those with bulimia nervosa their own body size. Such a difference remained significant when other confounders were controlled for (e.g., age and body mass index) with respect to both perceptual and affective dimensions of body image, thus providing support to the role of body image distortion as maintaining factor for eating disorders. Additionally, the difference in body size overevaluation between patients with eating disorder and healthy controls remained significant also after controlling for anxiety and depression [58].

Finally, studies on recovered individuals show that body image disturbances persist also after recovery from both AN [59] and bulimia nervosa [60].

8.4 Body Size Estimation of Others in Anorexia Nervosa

It remains unclear as to whether the disturbance in body perception refers only to patients' own body or not. The available body of evidence showed that patients with AN can detect earlier than healthy controls the transition from thin to obese of a woman during a morphing video [61]. Also, patients with AN are known to consider thin bodies as more attractive when compared to normal weight bodies; still, the more the observer is underweight the more the body size is perceived as larger [62]. When observing a whole body, patients with AN paid more attention to the different body areas than face regions [63].

Biological motion, the ability of the visual system to perceive a biological entity while performing a recognizable activity, has also been used as a technique to assess body size estimation of others in AN. Poor emotion perception has been found in autism spectrum disorder [64] and schizophrenia [65] using this technique. Individuals with AN showed poorer identification of sad stimuli while recovered individuals reported results comparable to those of healthy controls [66]. More recently, Phillipou and collaborators [67] performed human biological motion in order to assess body size estimation of others in AN. The authors concluded that patients with AN can judge the body size of others as accurately as healthy controls do; nevertheless, patients with AN showed different ocular behavior with "hyperscanning," namely heightened fixations, of the presented stimuli.

8.5 Body Image Disturbances in Anorexia Nervosa and Body Dysmorphic Disorder

Body image disturbances are a common feature of body dysmorphic disorder (BDD) as well. In BDD, the main diagnostic psychopathology feature is preoccupation with perceived defects in appearance, which are unnoticeable, or slight, to others [1]. Both disorders share body image disturbance [68–70] with dysfunctional compensatory strategies and maladaptive cognitive processes as reinforcing and maintaining behavioral symptoms. Relatedly, patients with AN and BDD place

much emphasis on physical attractiveness in turn over-evaluating eventual bodily imperfections. A vicious cycle is generated since rituals and avoidance of stressful situations provide patients with temporary relief from anxiety and other negative emotions but in turn reinforce symptom-related dysfunctional cognitions and behaviors, namely fasting and binge-purging behaviors in AN and mirror checking in BDD. Nevertheless, the models of AN include also other components rather than focusing on avoidance and checking behaviors, more typical of BDD. The available body of evidence on the comparison of individuals with AN and BDD found comparable body image dissatisfaction across diagnoses but more marked avoidance and negative self-evaluation in BDD compared with AN [71]. Also, patients with BDD were found to report a greater variety of bodily concerns (e.g., hair, nose) while patients with AN and bulimia nervosa reported typical preoccupations with shape and weight [71]. More recent research using multidimensional assessments [72] showed patients with AN, bulimia nervosa, and BDD as more body dissatisfied than healthy controls. Consistently with previous findings, patients with BDD were found to show more severe body image disturbances and poorer quality of life than the other groups with an eating disorder [71]. Finally, a recent study by Kollei and collaborators [73] provided further support to marked body image dissatisfaction in BDD and AN, with the BDD group showing more compulsive checking and manipulation of physical appearance than those with AN. In line with the aforementioned researches, also Hartmann and colleagues [74] confirmed that individuals with AN and BDD report significantly higher body dissatisfaction and more dysfunctional coping strategies than healthy controls. However, differently from previous research [72] individuals with AN showed more marked body image dissatisfaction than BDD individuals. Methodological differences can be responsible for such differences but future studies are needed to shed light on these aspects in order to draw more firm conclusions on this topic.

8.6 Neural Bases of Body Image in AN

A growing body of evidence is accumulating on the neurobiology of AN [75] but literature is overall sparse on the neural basis of body image disturbances in AN. The neurobiology of body image distortion in AN is far from being clarified. However, posterior parietal regions have been linked to perceptive body attitudes while prefrontal and insula regions are mainly involved in affective body attitudes [39]. Favaro and collaborators [76] conducted a resting state functional magnetic resonance imaging study to investigate the functional connectivity of networks involved in visuospatial and somatosensory processing. The authors showed that both groups reported hypoconnectivity in the ventral visual network while currently ill patients displayed also hyperconnectivity in the somatosensory network.

Consistently with clinical research, also neuroimaging studies began using tasks based on photograph and video techniques altering pictures of one's own body instead of silhouettes and drawings in order to stimulate more the neurological underpinning of interoceptive, emotive, and motivational networks [77]. Pietrini

and collaborators [78] showed how dorsolateral prefrontal cortex (DLPFC), supplementary motor, insular, inferior parietal, fusiform, occipito-temporal, and cingulate regions are involved in body image processing in AN. Also, patients with AN when presented with body image stimuli, reported heightened activation of the amygdala and frontal, striatal, and insular cortices, namely those areas involved in the processing of emotions. In contrast, parietal cortices, involved in the visuospatial processing of the body were poorly active.

When presented with pictures of underweight individuals, patients with AN showed increased activation of the ventral striatum providing support to the reinforcing and rewarding value of emaciation for affected individuals [79]. The DLPFC as well as insula and putamen were more active in patients with AN than in healthy controls during a task comparing participants' body with idealized female bodies, highlighting the involvement of emotive and reward and decision making response in this regard [77, 80].

Via and collaborators [81] showed that the posterior cingulate cortex/precuneus play a role in body evaluation of both self and others in AN. It has been shown a hyperactivation of the dorsal posterior cingulate cortex while patients with AN process their own body image; in contrast, affected individuals failed to activate both precuneus and ventral posterior cingulate cortex while processing others' body. Patients with AN also reported increased connectivity in the dorsal posterior cingulate cortex when processing their own images and in mid-temporal areas then processing others' body image. During resting state, connectivity between posterior cingulate cortex and the angular gyrus was reported as well.

Amygdala [82] and DLPFC [83] have been found to be active when patients with AN saw oversized images of their own body. Still, patients with AN showed hyperactivation in the mesolimbic reward network when presented with underweight female stimuli; in contrast, healthy controls were mainly stimulated by normal weight female stimuli.

8.7 Body Image Distortions and Treatment Approaches and Outcome in Anorexia Nervosa

AN is currently characterized by poor outcomes with a standardized mortality ratio of about 6 [84] and a long-term mortality rate of 10% [85]. A better understanding of the core features of this disorder is needed in order to develop more effective treatments. Body image disturbances represent both a key clinical aspect of AN and a core element of psychological models of AN [15, 86]. With more detail, body image disturbance is a persistent symptom predicting relapse [87, 88] with recovered individuals still reporting overestimation of their own body [59, 60].

Body image disturbances tend to persist also after treatment even when other symptoms have improved [59, 89]. Nevertheless, scant attention has been paid to body image disturbances in treatment so far. Such an intervention is likely to increase anxiety in both patients and therapists [90]. Nevertheless, novel approaches have been pioneered. Mirror exposure with inpatients after weight restoration

significantly reduced body dissatisfaction [91]; such intervention was then revised yielding to a significantly improved body image in weight-restored patients [92]. Relatedly, Grant and Cash [93] had previously developed a cognitive behavioral body image treatment for patients with BDD, using mirror exposure and desensitization leading to improved body satisfaction in women not affected by eating disorders [93, 94]. Since then, mirror exposure has been included in therapeutic interventions for eating disorders, mostly focused on cognitive behavioral techniques [95, 96].

In fact, cognitive behavioral therapy (CBT) also provided evidence of effectiveness in patients with eating disorders including AN from a body image standpoint. CBT with mirror exposure delivered in a group format was helpful in reducing negative emotionality elicited by looking in a mirror [96]. Outpatient CBT reduced body dissatisfaction and body image dysphoria [97] and, more recently, an eight-session CBT group with in vivo exposure has been described as effective for patients with AN [98]. Also cognitive behavior therapy-enhanced (CBT-E) [99] reported a specific focus on body image.

More recently, BodyWise, a low-intensity group treatment, has been developed for patients with AN at low weights in order to avoid the challenging activities of therapeutic interventions designed for weight-restored patients [100]. Such an intervention showed preliminary effectiveness in improving weight and shape concerns and body checking.

A pilot study on the ten session body image therapy (BAT-10) has also been conducted [101]. The BAT-10 is a group therapy with a behavioral framework; sessions are delivered in a group format over a 10-week timeframe. Elements of psycho-education, motivational enhancement therapy, self-help, cognitive therapy, and mindfulness are included in the intervention that showed encouraging preliminary results in promoting affective and cognitive changes in body dissatisfaction and core beliefs of eating disorders [101].

Interestingly, body size estimation has been taken into account also from an outcome perspective. In fact, body image disturbances are hallmarks of eating disorders and represent diagnostic criteria for both AN and bulimia nervosa [1]. Also, body image concerns are of relevance from a treatment standpoint. In fact, the detrimental effects of body image disturbance for the long-term outcome of patients with AN were highlighted since the 1970s when Slade and Russell [88] showed that relapse was more likely for those patients whose body concerns persisted after weight restoration and that overestimation of body size tended to decrease with weight gain. Also, patients with more severe overestimation of their own body report heightened denial of illness, improve weight to a lesser extent during hospitalizations [102, 103], and tend to be re-hospitalized more over time [104]. A significant correlation between body size concern after mirror exposure and clinical improvement has been demonstrated in AN [105]; relatedly, body size overestimation has been linked to relapse as well [106, 107]. Other lines of research showed that persistent body dissatisfaction predicts relapse at follow-up [4, 86, 108]. More recently, Boehm and collaborators [109] showed that low body image dissatisfaction is predictive of a more positive long-term outcome in AN. Nevertheless,

contrasting findings are also available; for example, body size concern has been found to be unrelated to treatment outcome in a sample of patients with eating disorders using the video distortion techniques [110].

Conclusions

In closing, body image disturbances are a key element in AN with respect to development, maintenance, and relapse of this severe mental disorder that benefits from a limited therapeutic armamentarium [111, 112] and entails a heavy burden on sufferers [113]. Patients with AN tend to overestimate the perception of their own body also in the light of the multiple components (e.g., affective, cognitive, behavioral, and perceptual) of body image. In contrast, affected individuals can reliably assess other's body size. Research on the neurobiology of body image disturbances in AN is in its infancy; however, several brain regions have been found to be involved during tasks eliciting patients' body image perception including dorsolateral prefrontal cortex, supplementary motor, insular, inferior parietal, fusiform, occipito-temporal, and cingulate regions. The available therapeutic approaches showed encouraging results although larger controlled studies are needed to replicate the available findings. At now, mainly cognitive behavioral interventions exist, delivered in both individual and group setting also including mirror exposure. The detrimental effects of body image disturbance for the long-term outcome of patients with AN had been highlighted since the 1970s and subsequently confirmed by recent research. Therefore, further clinical and research efforts are needed to expand the knowledge on body image in AN and its therapeutic implications.

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