



Subjective experience of sensation in anorexia nervosa



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ABSTRACT

The nature of disturbance in body experience in anorexia nervosa (AN) remains poorly operationalized despite its prognostic significance. We examined the relationship of subjective reports of sensitivity to and behavioral avoidance of sensory experience (e.g., to touch, motion) to body image disturbance and temperament in adult women currently diagnosed with AN ($n = 20$), women with a prior history of AN who were weight restored ($n = 15$), and healthy controls with no eating disorder history ($n = 24$). Levels of sensitivity to sensation and attempts to avoid sensory experience were significantly higher in both clinical groups relative to healthy controls. Sensory sensitivity was associated with body image disturbance ($r(56) = .51, p < .0001$), indicating that body image disturbance increased with increased global sensitivity to sensation. Sensory sensitivity was also negatively and significantly correlated with lowest BMI ($r^2 = -.32, p < .001$), but not current BMI ($r^2 = .03, p = .18$), and to the temperament feature of harm avoidance in both clinical groups. We discuss how intervention strategies that address sensitization and habituation to somatic experience via conditioning exercises may provide a new manner in which to address body image disturbance in AN.

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Disturbance in the experience of the body is a defining feature of anorexia nervosa (AN). Historically, body image disturbance has been parsed along dimensions of cognition, perception, and experience (Gleaves, Williamson, Eberenz, Sebastian, & Barker, 1995; Mohr et al., 2010). However, as elegantly summarized by Park, Dunn, and Barnard (2011), the vast majority of research on body image disturbance in AN has examined cognitive components, such as body dissatisfaction and perceptual aspects such visual image distortion, but has neglected the subjective *experience* of the body. Subjective body experience is a broad domain that includes interoceptive, exteroceptive, vestibular, and proprioceptive inputs and thus extends from sensations within the body (e.g., a heartbeat) to sensations that define and impinge upon body boundaries (e.g., limb position, pressure on the skin). Characterizing disturbances in subjective body experience among individuals with AN is critical to understanding and altering the pathophysiology of this illness, as both the relentless pursuit of an unhealthy body weight and the

disordered eating behaviors that typify AN may be motivated, in part, by a desire to alter body experience – not merely body appearance (Cserjesi et al., 2010; Sachdev, Mondraty, Wen, & Gulliford, 2008). Furthermore, body image disturbance has prognostic significance, predicting illness onset, maintenance, and remission (Fairburn et al., 2003; Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004; Keel, Dorer, Franko, Jackson, & Herzog, 2005; Killen et al., 1994). Thus, study of the experiential aspects of body image disturbance in AN has the potential to guide the development of novel intervention approaches to address this pernicious symptom that eludes change.

Sensation constitutes the foundation of one's subjective body schema (Fisher, Cleveland, & Davis, 1957; Gallagher & Cole, 1995; Watanabe, 2005). As such, aberrations in basic sensory processes such as proprioception and kinesthesia (processes responsible for sensing the position of the body in space and the boundaries that define the body's limits respectively) may contribute to the disturbance of body experience in AN (Guimon, 1997). Similarly, capacities to sense pressure on the skin and the ability to integrate sensations, as in what one feels and what one sees, all play a role in constituting a cohesive sense of one's body boundaries (Anema et al., 2009; Gallagher & Cole, 1995; Kammers, de Vignemont, Verhagen, & Dijkerman, 2009). These basic processes may be or

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become disrupted in those with AN. Indeed, the role of sensation in contributing to or constituting body image disturbance has long informed research in AN, and was first postulated by Bruch in the realm of interoceptive signals (Bruch, 1962). More recently, atypical sensory experiences are increasingly suggested by the results of neuroimaging paradigms focused on self-reflection (Mohr et al., 2010), self-perception (Sachdev et al., 2008; Seeger, Braus, Ruf, Goldberger, & Schmidt, 2002; Vocks et al., 2010), and perception of bodies of others (Sachdev et al., 2008). Studies of basic proprioceptive or kinesthetic processes, however, are lacking with some noteworthy exceptions (e.g., Keizer et al., 2011).

Sensation is dynamic (Thompson, 2009). Thus, understanding the contribution of sensation to body image disturbance requires information about how individuals with AN notice and adapt to changing bodily experience. Two processes that characterize such change are habituation and sensitization. In brief, habituation refers to decreased awareness of or responsiveness to a persistent or repeating stimulus (Thompson, 2009). The process of habituation is efficient in that it allows an individual to ignore sensory stimuli after they are initially registered (Thompson, 2009). The clinical presentation of AN suggests slower habituation to visceral experience, at least in certain illness relevant contexts, such as difficulty habituating to the sensation of fullness from the gut (Halmi & Sunday, 1991; Radomsky, de Silva, Todd, Treasure, & Murphy, 2002). There also is evidence that perpetual awareness of body schema impinges on adaptive functioning in individuals with AN. For example, the impaired concentration noted in AN may be related to altered somatic sensations, not just cognitive concerns related to weight and shape. Characterization of such subjective sensory experiences may provide novel interpretations for the motivations underlying frequently associated behavioral patterns in AN. For example, the tendency to wear loose clothing in AN may be less about concealing low body weight and more about aversion to the experience of tactile sensations (e.g., the feeling of clothing touching the skin or being tight or restricting). Similarly, perpetual awareness of the body may be less about overvaluation of thinness and more about aberrations in habituation to a proprioceptive or kinesthetic sense (e.g., visual and tactile body checking may reflect deficits in habituation rather than overvaluation). This is in contrast or in addition to cognitive accounts that ascribe such sensation to attitudinal factors which are informed by the current culture and may better be understood as epiphenomena of AN (Shafran & Robinson, 2004).

In contrast to habituation, sensitization is a process whereby individuals exhibit enhanced responsiveness to specific stimuli relative to their baseline experience with those stimuli. Thus, habituation and sensitization work in concert: individuals may be primed to differentially notice certain salient stimuli and then habituate to such stimuli if not relevant to ongoing motivations. For example, using a series of thermal stimuli that variously increased or decreased in intensity, Vierck, Riley, Wong, King, and Mauderli (2010) found that individuals were differentially sensitized to experience a sensation as more or less intense based on their immediate prior sensory experiences. In the context of chronic pain, robust evidence of lowered pain thresholds suggest that individuals who experience a chronic painful stimulus are more sensitive to the presence of novel sensory stimuli (Martucci, Yelle, & Coghill, 2012; Nickel, Seifert, Lanz, & Maihofner, 2012). The state of starvation, and associated low body weight, has been robustly reported to alter sensory experience in animal models and similarly may influence the experience of the body in AN (Wang, Hung, & Randall, 2006). Critically, the ill state of AN is often sought by those affected. Thus, understanding the relationship of body mass index (BMI) to sensory experiences of sensitization and habituation may highlight why the ill state is reinforcing for those

with AN. For example, a low BMI may mute aversive sensory experiences. In general, decreased sensitization would be maladaptive in that an individual would be less able to respond to the demands of a given moment. However, sensory changes may prove subjectively adaptive if such changes make the individual “feel” better. Relevant clinical examples include decreased sensitization to hunger and increased sensitivity to smell – adaptations that may facilitate survival of a starving animal but also may perpetuate the ill state of AN (Colbert & Bargmann, 1997; Halmi & Sunday, 1991; Korbonits, Blaine, Elia, & Powell-Tuck, 2007; LeBoeuf, Guo, & Garcia, 2011).

To be sure, the processes of sensitization and habituation are also subject to complex subjective interpretation, i.e., putative top-down influences that impact the interpretation of sensory experience. Motivation affects sensation far earlier in the temporal chain of sensory experience than previously documented (Laycock, Crewther, & Crewther, 2007). For examples, visually guided attention is captured by what is motivationally salient, and prior learning history affects the meaning ascribed to visceral and exteroceptive inputs (Fecteau & Munoz, 2006). An individual may ascribe a temporary bloated feeling in the gut to excess salt from popcorn, their premenstrual status, or weight gain. Alternatively, individual differences in awareness of changes in the body may influence attention allocation. Thus, study of the role of sensation in contributing to or constituting body image disturbance in AN is complicated by the influence of motivation on perception. Combined this argues that both objective sensory thresholds and subjective interpretations are needed to fully understand the nature of somatic experience in AN.

Finally, sensation motivates behavior (Thompson, 2009). Individuals actively seek to alter their sensory experience, a motivation that may relate to models of homeostasis or allostasis in achieving a relatively stable sense of arousal (McEwen, 2004). Thus, in documenting a person’s sensory experience, it is important not only to characterize his/her sensitivity to and interpretation of sensation, but also whether s/he actively seeks or avoids sensation. For example, an individual who is very sensitive to specific visual stimuli (e.g., scary movies), but actively seeks such experiences may be very different from an individual with matching sensory capacities who actively avoids such sensation. Such complex, temporal influences on sensory experience suggest that subjective body experience may be integrally related to temperament. In fact, organizational schemes of childhood temperament have been forged on a child’s capacity and tendency to sense, regulate, seek, or avoid sensory experience (Beauchaine, Gatzke-Kopp, & Mead, 2007; Gray, 1970; Moehler et al., 2006; Rimm-Kaufman & Kagan, 2005). In the field of eating disorders, the biologically-based temperament classification scheme of Cloninger has been the most researched (Cloninger, 1986). Within this framework, harm avoidance has been repeatedly documented in those with AN (Klump et al., 2000, 2004). Harm avoidance has largely been operationalized in the behavioral domain (i.e., actively avoiding uncertain circumstances). However, the research foundation laid by temperament research in children suggests that those with elevated harm avoidance may also experience enhanced sensory sensitivity and that behavioral avoidance may actually be secondary to or reinforcing of sensory sensitivity (Ben-Sasson, Carter, & Briggs-Gowan, 2009; Goldsmith, Van Hulle, Arneson, Schreiber, & Gernsbacher, 2006). If so, consistent findings of harm avoidance in those with AN may be related to more basic processes of perception.

In summary, subjective awareness of and behavioral responses to sensory experiences may be important contributors to the sensation and experiential aspects of body image disturbance in AN. Thus, in this study, we used systematic subjective reports of the

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