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Do subjects with obesity underestimate their body size? A Narrative review of estimation methods and explaining theories

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ABSTRACT: The widespread of overweight and obesity in the developed countries is a real societal issue, nevertheless a considerable amount of subjects with obesity do not recognize their condition. Researchers used different methods to assess body size perception by obese subjects and the results show that while some subjects with obesity estimate accurately or overestimate their body size, others underestimate their weight and their body size measures. A failure to identify overweight or obesity has serious consequences on the subject's health, as it is widely recognised that self-awareness is the first step to engage in a rehabilitation program. The spread of obesity underestimation and its implications make the case for a new hypothetical body image disorder, which has been called *Fatorexia*TM. It consists in the significant underestimation of body size by subjects with obesity, as they are unable or unwilling to acknowledge their condition. Some researchers proposed a social explanation to the underestimation phenomenon, but here an alternative hypothesis, the *Allocentric Lock Theory (ALT)*, is outlined to describe the mechanisms behind the underestimation of body size by subjects with obesity.

Keywords: obesity, body image, body size perception, body size underestimation, *fatorexia*

¿Los sujetos con obesidad subestiman su tamaño corporal? Una revisión narrativa de los métodos de estimación y teorías explicativas

RESUMEN: La generalización del sobrepeso y la obesidad en los países desarrollados es un verdadero problema social, sin embargo, una cantidad considerable de personas con obesidad no reconocen su condición. Los investigadores utilizaron diferentes métodos para evaluar la percepción del tamaño corporal de los sujetos obesos y los resultados muestran que mientras que algunos sujetos con obesidad calculan con precisión o sobrestiman su tamaño corporal, otros subestiman su peso y sus medidas de tamaño corporal. El hecho de no identificar el sobrepeso o la obesidad tiene graves consecuencias para la salud del sujeto, ya que se reconoce ampliamente que la autoconciencia es el primer paso para participar en un programa de rehabilitación. La propagación de la subestimación de la obesidad y sus implicaciones hacen que se presente el caso de un nuevo trastorno hipotético de la imagen corporal, el cual se ha denominado *Fatorexia*TM. Esta consiste en la subestimación significativa del tamaño del cuerpo por parte de los sujetos con obesidad, ya que no pueden o no quieren reconocer su condición.

Algunos investigadores propusieron una explicación social para la subestimación, pero hay una hipótesis alternativa, la Teoría del Bloqueo Allocéntrico, la cual se ha diseñado para describir los mecanismos que subyacen a la subestimación del tamaño corporal por parte de sujetos con obesidad.

Palabras clave: obesidad, imagen corporal, percepción del tamaño corporal, subestimación del tamaño corporal, fatorexia

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Introduction

The World Health Organization reports that in 2016 39% of adults aged 18 years and older were overweight, while 13% were obese; moreover, between 1975 and 2016 the prevalence of obesity has nearly tripled worldwide. Obesity is associated with many complications, like coronary heart disease (Huffman et al., 2013), type II diabetes (Nguyen, Nguyen, Lane, & Wang, 2011), hypertension (Rahmouni, Correia, Haynes, & Mark, 2005) and all-cause mortality (Flegal, Kit, Orpana, & Graubard, 2013), so it is clear why the widespread of this condition has now reached the dimensions of a global crisis. As the global epidemic of obesity increases, a considerable amount of studies points out that some subjects with obesity fail to recognize their actual weight and underestimate their body size (Robinson, 2017; Schwartz & Brownell, 2004). A failure to identify obesity is a hindrance to engage in weight loss interventions, because if one does not acknowledge their condition, they won't seek the help of professionals (Wetmore & Mokdad, 2012; Yaemsiri, Slining, & Agarwal, 2011). Due to its widespread and the relevant implications, the underestimation of body size draw the attention of experts in the field of nutrition and mass media. Firstly Jaime Brugos (1992), and then Sara Bird (2010) gave the phenomenon an actual name that is Fatorexia™, but although the scientific community recognises the existence of underestimation, the word Fatorexia™ is not commonly used. The aim of the present review is to summarize the scientific literature about body size underestimation and making the case for a new hypothetical body image disorder, which is Fatorexia™, while also providing an explanation for it with the Allocentric Lock Theory (Riva, 2017).

Development

Underestimation of weight and body size

Researchers used different methods to assess the perception in subjects with obesity of their own body weight and size. Gregory and colleagues (2008) asked to a large sample of American subjects if they perceived themselves as very underweight, slightly underweight, about the right weight, slightly overweight or very overweight, and found that one third of participants with Class II obesity (BMI ≥ 35.0) perceived themselves only as slightly overweight. Jones et al. (2010) asked to a sample of subjects with Class II obesity if they perceived themselves as underweight, about right, overweight or obese. Half of them classified themselves as being overweight, in particular men.

Another method which has been used by researchers are figural drawing scales, also referred to as silhouette or contour line drawings, and consist of a series of frontal images ranging from

thin to obese (Gardner & Brown, 2010). Individuals are typically asked to select the image that better represents their current body size. The discrepancy between the chosen figure and the actual body size represents a measure of body size distortion. Bjerggaard and colleagues (2015) used the Figure Rating Scale (FRS) (Thompson & Altabe, 1991; Stunkard, 1983) to assess the association between self-perceived body image and BMI. The authors recruited a large sample of subjects (2082) from the community, ranging from underweight to obese. Only 11% of subjects with obesity rated themselves as obese, while the majority chose an overweight or healthy weight figure to represent their actual body size. On the other hand, among overweight and healthy-weight subjects there was consistency between their perceived body size and their actual BMI. Another recent example comes from Nikniaz et al. (2016), who used the Figure Rating Scale on a sample of 500 Iranian women recruited in an outpatient clinic. Once again 70.7% of subjects with obesity underestimate their body size, while underweight and healthy weight women have a more realistic body perception.

Metric methods have been used too: participants are asked to estimate their size on a spatial measure by indicating the size of different body parts for example with a caliper, a rod or movable markers in a dedicated space in front of them (for example a wall). An example of a metric method is the Askevold perception test (Askevold, 1975) used by Valtolina (1998) in the modified version proposed by Allamani and colleagues (1978). A total of five dimensions were taken into account, giving four body areas: the head area, the thoracic area, the abdominal area, the pelvic area and a total area calculated by summing these areas. On a total of 120 female subjects involved in the study, the 60 subjects with obesity underestimated all five dimensions, while the 60 healthy-weight controls underestimated the head and the thoracic areas, but overestimated the pelvic and abdominal area.

Another study by Manzoni et al (2017) used the body estimation task to analyse body size perception in a group of subjects with obesity and healthy-weight subjects. Participants were asked to provide an estimation of the width and circumference of three different body parts: shoulders, waist and hips. According to the results, subjects with obesity underestimated their body size, especially their shoulders width and waist circumference; while healthy-weight subjects estimated accurately or overestimated the same body parts. The underestimation of body size affects both men and women with obesity (Sánchez-Villegas et al., 2001), of all race and ethnicities (Schuler et al., 2008), and of all ages (Paul et al., 2014), thus there is evidence of a large group of subjects with obesity that do not get to health services because they do not acknowledge their condition.

Implications of underestimation

Weight loss is an essential intervention for obesity, as losing a modest amount of weight would yield substantial benefit. Weight loss reduces hypertension, hypercholesterolemia and type 2 diabetes, moreover, it reduces the incidence of coronary heart disease and stroke, resulting in an increased life expectancy (Xiao & Yang, 2012). Perception plays an important role in weight loss, as the perception of one's own actual body weight, especially when overweight or obese, is the first step towards a successful weight reduction. Studies report that people who recognize their overweight condition show a greater desire to lose weight and intentions to diet

(Nissen & Holm, 2015; Wardle, Haase, & Steptoe, 2006; Yaemsiri et al., 2011). On the other hand, failing to self-identify the presence of excessive weight by individuals that are overweight or suffer from obesity prevents those subjects from asking for help (Kuchler & Variyam, 2003; Yaemsiri et al., 2011) and, in a long term perspective, favors weight gain (Lynch et al., 2008). Thus, the effort of providing effective weight loss interventions for subjects with obesity is a waste of energy if the target audience believes that those programs are irrelevant to them. Health services should firstly implement strategies to help people acknowledge that they actually have a weight problem, like it has been done for tobacco use or alcoholism, other important public health threats.

Fatorexia

As shown in the previous paragraphs, underestimation of body size is often found in subjects with obesity, and since it has important implications for the subjects' health, it can no longer be ignored.

The first person who noticed the underestimation of body size in subjects with obesity was Jaime Brugos (1992). In 1992 the Spanish nutritionist published the book "Dieta isoproteica", in which he used the term Megarexia to describe the failure to recognise the overweight condition in subjects with obesity. The term echoed in the Hispanic world, but it has been often confused with the word "Bigorexia", also known as muscle dysmorphia, which describes the delusional or exaggerated belief that one's own body is too small, insufficiently muscular, although the individual's build is normal or even exceptionally muscular (Pope, Katz, & Hudson, 1993).

In 2010 Sara Bird published the book "Fatorexia™, what do you see when you look in the mirror?", using the English word that is now more common. Starting from the experience of Sara Bird a subject suffering from *Fatorexia™* is someone who is overweight or obese but unable or unwilling to acknowledge it. Although the underestimation of body size has relevant clinical implications, searching for the term *Fatorexia™* in electronic databases like PubMed, Web of Science or Scopus does not provide any result, meaning that *Fatorexia™* has not been recognised by the scientific community yet. It is estimated that for each person that suffers from Anorexia Nervosa (AN), there are ten people suffering from *Fatorexia™* (Seijo, 2016). Just like people suffering from this eating disorder, subjects with *Fatorexia™* suffer from body image disturbance, as the perception of their body is distorted, but while anorexics feel overweight, individuals with *Fatorexia™* see themselves as healthy weight or just overweight. *Fatorexia™* could be associated with body dysmorphic disorder, whose main characteristic is an excessive concern about physical appearance, but at the opposite side, subjects suffering from *Fatorexia™* do not pay attention to the appearance of their body.

Fatorexia™ is not clinically defined yet, hence investigations are needed to help identifying the psychological characteristics of those individuals who suffer from it. Recognising those subjects in the population that suffer from obesity and *Fatorexia™* is a fundamental step to develop specific strategies to motivate those subjects making healthier life choices.

The visual normalization theory

Researchers who tried to explain underestimation of body size in subjects with obesity report a social or a cultural explanation. They are both based on the same assumption: individuals with obesity may shift their idea of what is a normal weight body in the direction of overweight, as they are exposed to overweight bodies in their family and social networks (Gardner, 2014; Kabir, Zafar, & Waslien, 2013; Lynch et al., 2008; Paul et al., 2014). Robinson (2017) called this hypothesis “the visual normalization theory”. The widespread weight gain in the population has resulted in a frequent exposure to heavier body weights, which has altered visual perceptions of what constitutes a ‘normal’ weight and shifted the visual threshold at which a person is identified as being overweight (Robinson, 2017).

The social explanation is also supported by neuroscientific data, in fact, judgements about complex stimuli, such as bodies, are made by reference to a template based on the average of all that class of stimuli that we have seen (Leopold, O’Toole, Vetter, & Blanz, 2001; Winkler & Rhodes, 2005). If someone has seen many high BMI bodies, then their internal reference (what they perceive as a representative body size) will be shifted towards a heavier body size. It follows that an individual’s failure to recognize their own obesity may be caused by the comparison to a reference point that is much closer to their current body size, as opposed to an absolute comparison point (Oldham & Robinson, 2015; Robinson & Kirkham, 2014).

The Allocentric Lock Theory

An integration to the visual normalization theory comes from Riva and colleagues with the Allocentric Lock Theory – ALT (Dakanalis et al., 2016; Gaudio & Riva, 2013; Riva, 2012, 2014, 2017; Riva & Dakanalis, 2018; Riva, Gaudio, & Dakanalis, 2014). Every subject grows in a cultural context that provides a prototypical ideal of physical appearance and attractiveness, which participates in the processing of the objectified and social body, two of the six representations that contribute to our bodily experience (Riva, 2017). Individuals use these models to orient themselves while judging their bodies in a continuous process of self-evaluation. In the case of restrictive eating disorders, the ideal model is clearly the Western body ideal, but subjects with obesity may have been exposed to a different ideal, an overweight one, as previously explained by the visual normalization theory (Robinson, 2017).

In time, our body experience evolves by integrating the different multisensory bodily signals and the six body representations within what is called the “body matrix” (Moseley, Gallace, & Spence, 2012; Sedda, Tonin, Salvato, Gandola, & Bottini, 2016): a coarse supramodal representation of the body and the space around it. In particular, inside the body matrix lower level sensory signals within an egocentric frame of reference are integrated with higher-level abstract bodily information within an allocentric frame of reference. However, according to the Allocentric Lock Theory, in some individuals the ability to update the body matrix’s content may be impaired: they may be locked to an allocentric (from outside) memory of the body that is no longer updated by contrasting egocentric representations driven by perception. In the case of subjects with *Fatorexia*TM, even if they perceive egocentric sensory signals about their overweight bodies, these information do not update the allocentric body memory, which is

anchored to an overweight representative body size. It follows that these individuals do not recognize their condition as problematic and consequently underestimate their body size.

Conclusions

Evidence suggests that the underestimation of body size is common, as a large number of subjects with a BMI higher than 30 fail to identify that they are actually obese. Underestimation is detrimental to weight loss interventions, as if one does not recognise that they are overweight, then they won't seek the help of health care professionals. Health services could make the most of their efforts in obesity prevention and treatment if they focused on strategies to address the underestimation, rather than exclusively disseminating information about what overweight and obese individuals should do to lose weight. Further investigations about underestimation and *Fatorexia*TM are needed, because they could help defining the characteristics of those subjects with obesity who do not recognise their condition. Moreover, understanding the underlying mechanisms with the Allocentric Lock Theory, is the first step to develop an intervention that would allow the subjects who suffer from *Fatorexia*TM to overcome the lack of concern about the body.

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