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Body Image Assessment Software: Psychometric data

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The aim of the present study was to analyze the psychometric characteristics of the Body Image Assessment Software (BIAS), an innovative interactive computer program developed to assess body image disturbances. The program was tested on 252 psychology students at the University of Barcelona and 51 patients with an eating disorder (ED). The subjects filled in the Eating Attitudes Test–26, the Body Shape Questionnaire, the body dissatisfaction scale of the Eating Disorders Inventory–2, and the Body Image Assessment–Revised (a test of silhouettes). Results showed good validity and very high reliability. Furthermore, BIAS was able to discriminate between people who were at risk of an ED and those who were not, as well as between people with and without a history of an ED. Those at risk of having an ED and those with a current ED showed more body image distortion (overestimation of body size) and higher levels of body image dissatisfaction.

Hilde Bruch (1962) was one of the first authors to consider body image disturbances as an essential feature in the development and maintenance of eating disorders (EDs), especially anorexia nervosa (AN). At the same time, Stunkard and his colleagues (Stunkard & Burt, 1967; Stunkard & Mendelson, 1967) provided evidence for the importance of body dissatisfaction as an emotional factor of distress associated with obesity. These authors found that most individuals who developed obesity during their youth showed severe levels of body dissatisfaction as adults. Later, Slade and Russell (1973) showed that people with AN overestimated the size of their body, in comparison with people without an ED. As a result of these and other studies, several publications appeared during the 1970s and 1980s on the role of body image in EDs, as well as on different methods for assessing body size estimation. However, in the 1990s, inconsistencies were found in the scientific literature regarding the presence of body image disturbances as a characteristic of EDs, and this led to a decline in the concept (Cash & Deagle, 1997; Hsu & Sobkiewicz, 1991; Sepúlveda, Botella, & León, 2001; Skrzypek, Wehmeier, & Remschmidt, 2001; Slade & Brodie, 1994). Despite the problems associated with the body image concept, interest in investigating its relationship with EDs has again increased recently.

According to Rosen (1990), body image disturbances are an essential aspect of the differential diagnosis for an ED, which distinguishes this group of disorders from others that show ingestion disturbances and changes in body weight. In addition, there is evidence that the persistence of body image disturbances after treatment is a factor in negative prognosis in the long term (Skrzypek et al., 2001). Similarly, several authors have shown that there is considerable risk of relapse among ED patients when no changes in body image are observed during therapy (Fairburn, Peveler, Jones, Hope, & Doll, 1993; Freeman, Beach, Davis, & Solyom, 1985; Rosen, 1990, 1992).

Thompson (1995) defines body image disturbances as any form of affective, cognitive, behavioral, or perceptual disturbance that is directly concerned with an aspect of physical appearance. Throughout the history of the concept, at least two dimensions have been considered: one perceptual and another cognitive–affective (which refers to the cognitive distortions, attributions, beliefs, and expectations of the subject regarding his/her body and the emotional states derived from them). Research into body image disturbances has also focused on two aspects: the perceptual distortion of the body image and body dissatisfaction (Cash & Brown, 1987; Cash & Deagle, 1997; Thompson, 1990). Body image distortion is understood as the inability to perceive accurately the size of one's own body and is usually measured using visual tasks of size estimation. Body dissatisfaction refers to the extent to which a person likes or dislikes the size and shape of his/her body and is usually evaluated by means of questionnaires or tests of silhouettes.

The aim of assessing body size estimation is to analyze the differences between subjective measures of a person's own body, or a part of it, and the corresponding objective measurements. This difference is an indicator of the degree of distortion of the body image. The aim of assessing ideal body image estimation is to analyze the differences between how the subject sees him/herself and how he/she would like to be, which indicates the individual's degree of body dissatisfaction. Traditionally, two groups of techniques have been used to assess these disturbances:

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estimation methods that evaluate parts or segments of the body and methods that evaluate the whole body.

With the body part estimation method, the subject is requested to draw, mark, or choose the width of a determined part of his/her body, using different techniques. With whole-body estimation methods, subjects are shown, also using different techniques, the distorted image of a human figure and are asked to modify this image until it resembles how they think they are in reality. In both cases, when the figure that is modified by the subject is compared with the figure that represents its real measures, the degree of perceptual distortion is estimated. When subjects are requested to modify the figure until it resembles the ideal, the degree of dissatisfaction with their own image can also be measured, comparing how they see themselves with how they would like to be.

Body part size procedures include such techniques as the movable caliper technique (Gleghorn, Penner, & Schulman, 1987; Reitman & Cleveland, 1964), the visual size estimation procedure (Ruff & Barrios, 1986; Slade & Russell, 1973; Thompson & Spana, 1988), the image-marking technique (Askevold, 1975; Molinari, 1995), and the kinesthetic size estimation apparatus (Gila, Castro, Toro, & Salamero, 1998). Whole-body assessment procedures include such techniques as the distorting mirror (Traub & Orbach, 1964), projection of photographs with distorting lenses (Garner, Garfinkel, & Bonato, 1987; Glucksman & Hirsch, 1969), the video-distortion technique (Allebeck, Hallberg, & Spamark, 1976; Fernández-Aranda, Dahme, & Meermann, 1999; Freeman, Thomas, Solyom, & Hunter, 1984; Meermann & Vandereycken, 1988; Probst, Van Coppenolle, Vandereycken, & Goris, 1992; Smeets, Ingleby, Hoek, & Panhuisen, 1999), the life-size screen distortion method (Gardner & Bokenkamp, 1996; Probst, Van Coppenolle, Vandereycken, Kampman, & Goris, 1991; Probst, Vandereycken, & Van Coppenolle, 1997; Probst, Vandereycken, Van Coppenolle, & Vanderlinden, 1995; Shafran & Fairburn, 2002), and the silhouette method (Bell, Kirkpatrick, & Rinn, 1986; Furnham & Alibhai, 1983; Williamson, Davis, Bennett, Goreczny, & Gleaves, 1989).

These body assessment procedures are usually based on one of the three following psychophysical methods.

Method of adjustment. With this method, the subject is shown a figure that is larger or smaller than his/her real size. The size of the image is adjusted by the experimenter or by the assessed subject to match his/her perceived or his/her ideal body size. One of the main methodological problems with these procedures is the named anchor effect (Probst et al., 1992): The initial size (smaller or larger) that is shown to the subject significantly influences the final response of the subject. Subjects tend to overestimate their body size on descending trials and underestimate on ascending trials (Gardner, Martinez, & Sandoval, 1987). Despite this, some studies have shown that subjects tend to be more accurate on descending trials than on ascending trials (Gardner, Urrutia, Morrell, Watson, & Sandoval, 1990), so averaging ascending and descending trials is not an appropriate solution. On the other hand, the method of adjustment fails to distinguish between the perceptual sensitivity of the assessed subject and nonsensory variables that may bias his/her performance. Factors such as the subject's motivation, attitudes, and beliefs can influence his/her report. Although this method has several limitations, it is the one most commonly used, and most of the procedures mentioned earlier are based on it.

The theory of signal detection method. This method has been used to analyze sensory (d') and nonsensory (β) components in the detection of body image distortion (Gardner & Moncrieff, 1988). Gardner and Moncrieff used this theory and found no differences between anorexic patients and control subjects in relation to their ability to detect body size distortion. The theory of signal detection has its own methodological disadvantages. First, large numbers of trials are required to get stable values of d' and β; second, a single amount of distortion must be found for all subjects; finally, this theory reveals information only on the subject's ability to detect size distortion but does not reveal information about the amount of underestimation or overestimation present in the subject's judgments (Gardner & Bokenkamp, 1996). Gardner and colleagues (Gardner & Boice, 2004; Gardner & Bokenkamp, 1996; Gardner, Jones, & Bokenkamp, 1995) used a hybrid of psychophysical techniques based on the method of constant stimuli (*adaptive probit estimation*) to overcome these disadvantages. They estimated the mean and standard deviation of the error distribution for body size estimates and present four stimulus distortion levels at ± 0.45 and ± 1.35 z values. The subjects were asked to judge whether each body image was too fat or too thin, as compared with their actual size.

Staircase method. This method is a variant of the psychophysical method of adjustment (Cornsweet, 1962; Gardner & Boice, 2004). The subject is shown an image whose width increases sequentially. The distortion rate is constant, and the assessed subject is asked to stop the increase when he/she perceives the body size as similar to the actual size or ideal size, depending on the instructions. The direction of distortion is then reversed, and the percentage of overestimation and underestimation is recorded at each direction.

Both whole-body and body part procedures have specific methodological drawbacks. In whole-body assessment, subjects modify the shape or size of the whole body; that is, they introduce the same amount of distortion throughout. Therefore, the test does not provide information about distortions in specific body parts. In turn, body part size estimation procedures allow the differential distortion of body parts but do not offer a holistic vision of body image. The fact that most of these techniques offer only a frontal view of the body is an additional problem (Schlundt & Bell, 1993).

In recent decades, the development of new technology and, especially, the growth of computer applications have led to the creation of new assessment instruments with which researchers have sought to overcome the above-mentioned limitations. Most of these instruments allow distortion of the different body parts, as well as an overall vision of body image: Examples are Body Build (Dickson-Parnell, Jones, Braddy, & Parnell, 1987), Body Image Test-

ing System (Schlundt & Bell, 1993), the application proposed by Phillip Benson (Benson, Emery, Cohen-Tovée, & Tovée, 1999), BodyImage (Shibata, 2002), the Body Virtual Image Reality Scale (Riva, 1997, 1998), and the Virtual Body (Perpiña et al., 1999; Perpiña, Botella, & Ramos, 2000). The latter two, when virtual reality is used, allow the presentation of modifiable silhouettes in three dimensions. This increases the degree of realism of the figures and, consequently, facilitates the assessed subject's identification with them. Although these programs are of great interest and obvious utility, they have several drawbacks that must be considered. Some of them show figures that are not very realistic, and subjects may find it difficult to identify themselves with the presented images. In others, the figure is generated in a subjective way. Finally, some of these programs face the same problems as traditional assessment methods: They do not allow parts of the figure to be modified or show only a modifiable part of the body, thus losing the holistic perspective on the body.

The Body Image Assessment Software (BIAS; Letosa-Porta, Ferrer-García, & Gutiérrez-Maldonado, 2005) is a new computer program for the evaluation of body image disturbances. The software is based on the method of adjustment. It is easy to process by subjects and allows assessment of estimations of the size of the whole body and different body parts at the same time. Thus, subjects can modify six body parts in the context of the rest of the body.

The main advantages of BIAS are, first, that it enables a figure to be generated that fits with the subject's proportions, because it is based on his/her objective measures. The therapist enters the real measures (length and width) of the different body parts into the computer, and the program uses these data to generate a figure that is proportional to the real image of the subject. Second, it allows the modification of different parts of the body while simultaneously giving a holistic vision of it. In addition, BIAS can be run on any computer that has Windows and Microsoft Access 2000 or Microsoft Access 2000 RunTime, and the data can be exported to applications such as SPSS and Excel. Thus, its strong points are its accessibility and its ability to generate a female figure proportional to the subject's real silhouette. BIAS has been used to study body image variations in ED patients who are exposed to different virtual reality environments, and the initial findings from this research were reported in Gutiérrez-Maldonado, Ferrer-García, Caqueo-Urízar, and Letosa-Porta (2006).

In the present study, information is provided about the psychometric properties of BIAS.

METHOD

Subjects

Two hundred fifty-two women, psychology students from the University of Barcelona, and 51 patients with an ED from different hospitals and clinics in the city of Barcelona (Hospital Germans Trias i Pujol, Hospital Clínic, LABOR Centre, and ABB Centre) participated in this study. The students volunteered to participate after being informed about it. Underweight (body mass index [BMI] $<$ 18.5) and overweight (BMI $>$ 24.9) students were excluded from the sample. Five students over 40 years old were excluded too for being outliers. The age of the remaining subjects ($N = 208$) varied from 18 to 31 years ($M = 21.56$ years, $SD = 2.3$ years). Each of the subjects was weighed and measured in order to obtain her BMI, yielding a mean value of 21.16 and a standard deviation of 1.70.

Fifty-one patients with an ED and in treatment (33 patients with AN, 11 patients with bulimia nervosa (BN), and 7 patients with a nonspecified ED [EDNOS]) participated in the study after being informed by their therapists. Twenty-three patients were on medication: 5 subjects with BN took both tomiramate and selective serotonin reuptake inhibitors (SSRIs); a subject with BN took only topiramate; 12 patients with AN took both SSRIs and benzodiazepines (BZDs); 2 patients with AN took only SSRIs, and another only serotonin–norepinephine reuptake inhibitors (SNRIs); 1 patient with AN took both SNRIs and BZDs; and finally, a patient with EDNOS took SSRIs. The mean age of the patients was 19.25 years ($SD = 5.22$), and the mean BMI was 19.37 ($SD = 3.22$) (see Table 1).

Instruments

Eating Attitudes Test–26 (EAT–26). The EAT–26 (Garner, Olmsted, Bohr, & Garfinkel, 1982) is the reduced version of the EAT (Garner & Garfinkel, 1979). Its main objective is the detection of characteristic symptoms of EDs in nonclinical samples. It is a self-administered questionnaire of 26 items in its reduced version. The evaluated subject can choose between six possible answers that go from *never* to *always*. The total test score distinguishes between patients with AN and the normal population and between patients with BN and the normal population, but it does not distinguish between people with restrictive AN and compulsive–purgative AN. It is recommended for use as a screening instrument (Garner, Olmsted, Bohr, & Garfinkel, 1982, 1983), with a cutoff point of 20 (Gonzalo, 1995). In this study, the Spanish translation of the reduced version of the EAT was used (Bulbena, Berrios, & Fernández de Larrinoa, 2000).

Body Shape Questionnaire (BSQ). The BSQ (Cooper, Taylor, Cooper, & Fairburn, 1987) measures the dissatisfaction produced by one's own body and the degree of preoccupation with weight. It is a self-administered questionnaire of 34 items and is scored on a 6-point scale ranging from *never* to *always*. A high score on the BSQ reflects a possible disorder of body image and, according to its authors, is able to discriminate between people with an ED and the normal population. It has shown good internal consistency and concurrent validity. In this study, the Spanish version developed by Rosa Maria Raich (1994) was used.

Body dissatisfaction scale of the Eating Disorders Inventory–2 (EDI–2). The EDI–2 of David M. Garner (1991) is used to assess symptoms that usually accompany AN and BN. Its

Table 1
Demographic Data for Control and Eating Disorder (ED) Groups Classified According to Diagnosis

		Age				Body Mass Index			
Group	No.	Min.	Max.	Avg.	*SD*	Min.	Max.	Avg.	*SD*
Control	208	18	31	21.56	2.30	18.52	24.88	21.16	1.70
ED (AN)	33	13	32	19.42	5.60	12.76	20.05	17.88	1.68
ED (BN)	11	15	28	21.18	4.47	18.58	31.95	23.46	4.00
ED (EDNOS)	7	13	18	15.43	1.62	18.74	22.49	19.97	1.31

Note—AN, anorexia nervosa; BN, bulimia nervosa; EDNOS, nonspecified ED.

Table 2
Pearson's Correlations Between the Size Distortion Measures of Different Body Parts in the Frontal and Side Body Estimation Task (Total Sample)

		Body Part				
Body Part	Perspective	Arms	Chest	Waist	Hip	Thigh
Head	Frontal	.595	.560	.497	.512	.591
	Side	–	.544	.499	.559	.605
Arms	Frontal		.611	.545	.575	.706
	Side		–	–	–	–
Chest	Frontal			.624	.695	.645
	Side			.497	.613	.398
Waist	Frontal				.650	.630
	Side				.671	.672
Hip	Frontal					.710
	Side					.651

Note—All values are significant at $p < .001$. $n = 259$.

objective is the precise evaluation of certain psychological characteristics or symptoms relevant to understanding EDs and treating them. It consists of 91 elements, which are answered on a 6-point scale. Subjects must indicate whether each situation happens to them *never*, *not very often*, *sometimes*, *often*, *almost always*, or *always*. These 91 elements are grouped into 11 scales: drive for thinness, bulimia, body dissatisfaction, ineffectiveness, perfectionism, interpersonal distrust, interceptive awareness, maturity fears, asceticism, impulse regulation, and social introversion. In this study, only the body dissatisfaction scale of the Spanish version of the questionnaire was used (Corral, González, Pereña, & Seisdedos, 1998). This scale measures the subject's dissatisfaction with the shape of his/her body or with some parts of them (stomach, hips, thighs, rump, etc.).

Body Image Assessment–Revised (BIA–R). The BIA–R (Beebe, Holmbeck, & Grzeskiewicz, 1999) is a visual method of obtaining an overall estimate of body image. The BIA–R shows nine female silhouettes on a sheet of paper. The silhouettes appear in the following order (where 1 is the thinnest figure): 7, 2, 6, 4, 1, 9, 5, 3, 8. In the original BIA (Williamson et al., 1989), each of the silhouettes was presented alone on a card. The BIA–R facilitates presentation by placing all the silhouettes on a single sheet of paper and, thus, allows the collective application of the instrument, avoiding at the same time the effect of order.

Subjects are asked three questions related to the figures. First, they are asked to indicate which figure best depicts the cognitive representation of their own size ("Your actual size, the size that might be shown in a mirror"); second, they are asked to indicate which figure best depicts their affective evaluation of their size ("How large you feel you are, your emotional evaluation of your size"); finally, they are asked to indicate which figure best depicts their desired body size ("your ideal body size, the size you would prefer to have"). The normative data of the BIA–R present six equations, which are the result of crossing the three instructions (cognitive, emotional, and desired) given to the subjects. By means of these formulas, the direct scores of the test are transformed into *T* scores (TSs).

In this study, only the cognitive and the desired body image aspects have been evaluated (first and third questions of the BIA–R).

Body Image Assessment Software. BIAS (Letosa-Porta et al., 2005) is a new computer program developed to assess body image disturbances. The program displays, on a computer screen, side and frontal views of a female human figure that is proportional to the subject. The image can be adjusted by independently modifying, with the keyboard, six body parts (head, arms, breast, waist, hips, and legs) in the frontal view and five body parts (head, breast, waist, hips, and legs) in the side view.

A series of measurements corresponding to the real length and width of each of the parts into which the subject's figure is divided are recorded beforehand and entered into the database. As a unit of reference, the program uses the twip (the unit of measurement used by Microsoft Access, in which 567 twips equal 1 cm). This unit permits calculation using the real measurements to obtain a scale image. The image shown on the screen can be modeled to scale, thanks to its segmentation into a total of 111 fragments for the frontal image and 138 fragments for the side image. These fragments are horizontal rectangles, which the program modifies automatically by means of a programming module that scales the image. The formula used to model the fragments is $T_n = T_{n-1} - [(R_s - R_i)/N]$, where T_n is the size of fragment n, T_{n-1} the size of the previous fragment, R_s the superior reference, R_i the inferior reference, and N the total number of fragments between the superior and the inferior references. To ensure that the image is not polygonal (and thus unrealistic), a module smooths the reference measurements and gives the image a more natural appearance. All these specifications can be found in Letosa-Porta et al. (2005).

The program proposes two visual tasks, which can be carried out independently. In the first, subjects are asked to modify several frontal and side body parts in order to make a human figure as similar as possible to their real body image. In the second task, subjects modify frontal and side body parts to make a human figure that represents their ideal body image. The discrepancy between their objective and perceived body sizes provides information about their degree of perceptual distortion. The discrepancy between subjects' perceived body size and their ideal body size (the size that the subjects would

Table 3
Main Components Analysis of Items on the Body Image Distortion Scale and the Body Image Dissatisfaction Scale (Frontal and Side Views) for Total Sample

Body Image Distortion Scale			Body Image Dissatisfaction Scale		
	Component			Component	
Body Part	1	Communality	Body Part	1	Communality
Front thigh	.858	.736	Side hip	.902	.814
Side hip	.846	.716	Front thigh	.887	.787
Front hip	.830	.689	Side thigh	.883	.779
Side thigh	.825	.681	Front hip	.881	.776
Front chest	.820	.672	Side waist	.876	.768
Side waist	.790	.624	Front chest	.867	.753
Side head	.789	.623	Front arm	.851	.724
Front arm	.788	.622	Front waist	.826	.683
Front waist	.783	.613	Side head	.796	.634
Front head	.740	.547	Front head	.784	.615
Side chest	.646	.417	Side chest	.695	.483
Eigenvalue	6.94			7.81	
% of variance	63.08			71.05	
% accumulated	63.08			71.05	

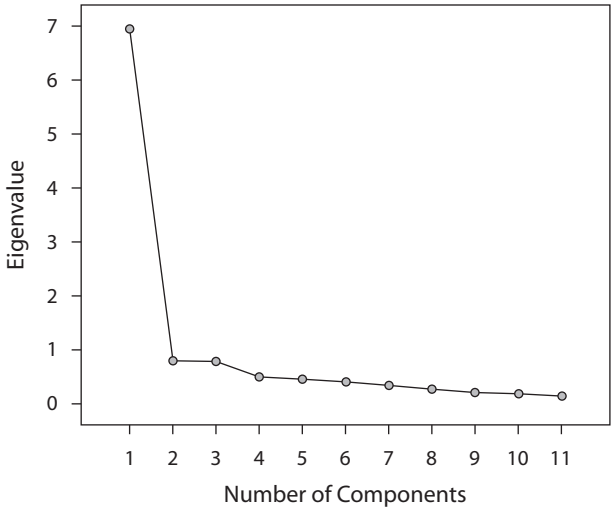

Figure 1. Scree test of the factor analysis of items on the body image distortion scale (front and side body parts).

like to have) provides information about their degree of body image dissatisfaction.

Let's take the following example. A total perceived frontal body image of 91.66 means that the perceived frontal image of this subject is 91.66% of her real mean frontal size. It can be expressed as a distortion index of −8.33 (−8.33 = 91.66 − 100). On the other hand, if the perceived side image is 100, meaning that it is 100% of her real mean side size, the distortion index is 0. If the total perceived body image is 95.83% of her real body size, the total distortion index is −4.16. If the desired body image is 105, meaning that she would like to be 5% bigger than she actually is, the dissatisfaction index is 9.17, obtained by subtracting the perceived body image (95.83) from the desired body image (105). In the same way, dissatisfaction indexes are obtained for frontal and side body parts.

Distortion and dissatisfaction indexes are calculated by BIAS when new perceived body image assessments or desired body image assessments are completed by the subject. If a desired body estimation session is completed and there is no perceived assessment, BIAS will indicate that one needs to be made. BIAS is a freeware application, with versions in English, Italian, and Spanish that can be downloaded from www.ub.es/personal/rv/ecic.htm.

Procedure

Voluntary participation in the study was requested from students in different courses in the Faculty of Psychology. After being informed about the research, female volunteers immediately filled out the self-report questionnaires (EAT–26, the body dissatisfaction scale of the EDI–2, BSQ, and BIA–R). Male students and female students who refused to participate in the study left the classroom. Once the subjects had completed the questionnaires, the researcher asked them for their telephone number. Later, they were called and invited to the second phase of the study. The first phase lasted approximately 30 min.

The second phase of the assessment was carried out individually in one of the laboratories of the faculty. The students' weight and height were recorded, along with measures of the following different parts of the body: frontal head width (taken at eye height), frontal chest width, frontal waist width, frontal hip width, frontal thigh width, side head width, side chest width, side waist width, side hip width, side thigh width, length from the crown to the base of the neck, length from the base of the neck to the waist, length from the waist to the groin, and length of the leg from the level of the groin to the sole.

The width of each of the assessed body parts was obtained by using a 50-cm caliper. A tape measure was used to measure length. A 33-year-old female researcher took all measures. Then the measures were entered into the database of the BIAS, and subsequently, a scale figure of the assessed subject was generated.

BIAS uses a methodology similar to the adjustment method, but here, the subject does not modify her own image but, rather, the silhouette of a female figure. In the adjustment method, modifications usually start with a widened or narrowed image of the subject. Previous research showed big differences in scores depending on how fat or thin the figure was shown on the starting image, with perceived size estimation as well as ideal size estimation (e.g., Gardner, Martinez, Espinoza, & Gallegos, 1988; Gardner et al., 1987; Probst et al., 1992; Whitehouse, Freeman, & Annandale, 1986, 1988). Some authors have pointed out that the initial body size that is shown to the subject serves as an anchor that influences the final size judgment (Gardner & Boice, 2004). In order to avoid this anchor effect, in BIAS, body part modifications are done starting from a human figure that is proportional to the subject—that is, proportional to the objective measures of the subject.

After providing measures, subjects proceeded to carry out two consecutive tasks—first, the perceived body image assessment task and, second, the desired body image assessment task—the aim being to obtain the corresponding distortion and dissatisfaction indexes. The tasks were not counterbalanced across the subjects. It was considered more adequate to assess the perceived body image first (to facilitate being conscious of the perception of their own body) and, after that, express the body dissatisfaction. There was no time limit for completing both tasks. The subjects were instructed to be accurate and to make as many adjustments as necessary until they believed that the image was an accurate representation of their actual or their desired body size. Once done, the subject pressed the "end" button. The entire process lasted approximately 15 min.

Patients with an ED were assessed individually in one of the offices of the hospital or medical center at which they were being treated. Consent forms had been previously obtained. When the patients were under legal age, consent forms were filled in by their parents or tutors. The first and second phases of the experiment were administered consecutively. The entire process lasted approximately 1 h.

BIAS validation showed the following results. In analyzing internal consistency and construct and convergent validity, the following order was chosen: First, the complete sample ($n = 259$) and after that, the control ($n = 208$) and ED ($n = 51$) groups separately. Finally, in analyzing discriminant validity, the control group was subdivided into two groups, depending on EAT–26 scores: subjects at risk of having an ED (EAT–26 > 20; $n = 14$) and subjects without risk of an ED (EAT–26 < 20; $n = 194$). This subdivision was made in order to assess BIAS's capability of detecting the risk population. Finally, it is important to note that some subjects were excluded from the analysis due to missing data, usually because they did not complete some of the tests successfully.

Table 4
Pearson's Correlations Between the Dissatisfaction Measures of Different Body Parts in the Frontal and Side Body Dissatisfaction Task (Total Sample)

		Body Part				
Body Part	Perspective	Arms	Chest	Waist	Hip	Thigh
Head	Frontal	.663	.618	.609	.611	.651
	Side	–	.569	.615	.644	.651
Arms	Frontal		.736	.634	.729	.792
	Side		–	–	–	–
Chest	Frontal			.713	.762	.743
	Side			.592	.678	.520
Waist	Frontal				.702	.691
	Side				.796	.816
Hip	Frontal					.797
	Side					.773

Note—All values are significant at $p < .001$. $n = 259$.

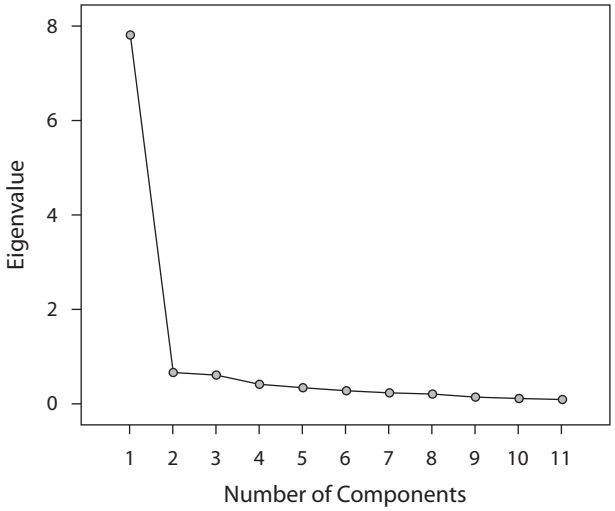

Figure 2. Scree test of the factor analysis of items on the body image dissatisfaction scale (front and side body parts).

RESULTS

Internal Consistency

Cronbach's α was calculated in order to determine the internal consistency of the BIAS distortion and dissatisfaction indexes. The body image distortion scale yielded a Cronbach's α of .917, whereas in the body dissatisfaction assessment scale, the value of Cronbach's α was .943.

Cronbach's αs for both the control and the ED groups were calculated separately too. The results for the control group yielded a Cronbach's α of .885 in the body image distortion scale and a Cronbach's α of .915 in the body dissatisfaction assessment task. The results for the ED group yielded a Cronbach's α of .911 in the body image distortion scale and a Cronbach's α of .947 in the body dissatisfaction assessment task.

Construct Validity

Scores obtained for each body part in the body size estimation task were correlated in order to determine whether BIAS offers a good measurement of body image distortion. They were also subjected to a principal components analysis.

As Table 2 shows, all correlations between the measures of distortion of the different body parts for the frontal and side perspectives were positive and significant.

A principal components analysis was then conducted to check whether the distortion measures of different body parts were grouped into a single component. As is shown in Table 3 and Figure 1, a single component was obtained (eigenvalue greater than or equal to 1) that accounted for 63.08% of the variance. The fit of the measurement sample was correct (Kaiser–Meyer–Olkin measure of sampling adequacy, KMO = .904).

In a similar way, it was analyzed whether BIAS offers a good measure of body image dissatisfaction. All the correlations between the body dissatisfaction measures of the different body parts in the frontal and side perspectives were positive and significant (see Table 4).

As is shown in Table 3 and Figure 2, the principal components analysis revealed a single component (eigenvalue greater than or equal to 1) that explained 71.05% of the variance. The fit of the measurement sample was correct (KMO = .923).

The same analysis was repeated using the results for the control and the ED groups separately. All the correlations between the measures of distortion of the different body

Table 5
Pearson's Correlations Between the Size Distortion Measures of Different Body Parts in the Frontal and Side Body Estimation Task for Control and Eating Disorder (ED) Groups Separately

			Body Part				
Body Part	Group	Perspective	Arms	Chest	Waist	Hip	Thigh
Head	Control	Frontal	.612	.459	.542	.426	.568
		Side	–	.447	.561	.541	.587
	ED	Frontal	.515	.644	.398	.547	.589
		Side	–	.390	.528	.496	.554
Arms	Control	Frontal		.398	.454	.373	.545
		Side		–	–	–	–
	ED	Frontal		.617	.362	.545	.692
		Side		–	–	–	–
Chest	Control	Frontal			.483	.507	.352
		Side			.434	.453	.208*
	ED	Frontal			.568	.747	.749
		Side			.374	.690	.471
Waist	Control	Frontal				.616	.524
		Side				.650	.594
	ED	Frontal				.510	.510
		Side				.477	.618
Hip	Control	Frontal					.563
		Side					.525
	ED	Frontal					.689
		Side					.633

Note—For the control group, $n = 208$; for the ED group, $n = 51$. All values except * are significant at $p < .001$. * $p = .003$.

Table 6
Main Components Analysis of Items on the Body Image Distortion Scale and the Body Image Dissatisfaction Scale for the Control Group (Frontal and Side Views)

Body Image Distortion Scale			Body Image Dissatisfaction Scale		
	Component			Component	
	1	Communality		1	Communality
Front waist	.808	.652	Side waist	.872	.761
Side head	.806	.650	Front waist	.851	.725
Side waist	.795	.633	Side hip	.848	.719
Side thigh	.786	.618	Side thigh	.839	.703
Side hip	.774	.599	Front hip	.837	.700
Front head	.767	.589	Front thigh	.830	.688
Front thigh	.757	.573	Front arm	.753	.566
Front hip	.731	.534	Front head	.737	.543
Front arm	.684	.468	Front chest	.714	.510
Front chest	.657	.431	Side head	.678	.460
Side chest	.489	.239	Side chest	.564	.318
Eigenvalue	5.98			6.69	
% of variance	54.42			60.85	
% accumulated	54.42			60.85	

parts in the frontal and side perspectives obtained from the control and ED groups were positive and significant (see Table 5).

The principal components analysis using only the results for the control group revealed a single component (eigenvalue greater than or equal to 1) that explained 54.42% of the variance (see Table 6 and Figure 3). The fit of the measurement sample was correct (KMO = .879). Due to the small size of the ED sample, it was not possible to carry out a principal component analysis in this group.

Likewise, all the correlations between the body dissatisfaction measures of the different body parts in the frontal and side perspectives were positive and significant in both control and ED groups (see Table 7).

The principal component analysis of the control results also shows a single component (eigenvalue greater than or equal to 1) that explains 60.85% of the variance (see Table 6 and Figure 4). The fit of the measurement sample was correct again (KMO = .917). Once again, due to the small size of the ED sample, it was not possible to carry out the principal component analysis in this group.

Convergent Validity

In order to verify whether BIAS is a good measurement of body image distortion, scores obtained on the test were correlated with those obtained on the cognitive image scale of the BIA–R. The resulting correlation was positive and significant when the BIA–R was compared with the mean frontal body image distortion, as assessed by BIAS ($r = .540$, $p < .001$), and also when it was compared with the mean side body image distortion ($r = .561$, $p < .001$). The correlation between the measurement obtained via the cognitive image scale of the BIA–R and the total distortion according to BIAS was also highly significant ($r = .570$, $p < .001$).

When we consider both the ED and the control groups separately, similar results arise. All correlations between cognitive image scale of the BIA–R and different measures of BIAS obtained from the control group ($n = 205$) were positive and significant (frontal body distortion of BIAS, $r = .361$, $p < .001$; side body distortion of BIAS, $r = .417$, $p < .001$; total distortion of BIAS, $r = .408$, $p < .001$). Also, all correlations between the cognitive image scale of BIA–R and frontal, side, and total distortion measures of BIAS obtained from the ED group ($n = 47$) were positive and significant (frontal body distortion of BIAS, $r = .510$, $p < .001$; side body distortion of BIAS, $r = .532$, $p < .001$; total distortion of BIAS, $r = .551$, $p < .001$).

In addition, scores obtained on the body image dissatisfaction scale of BIAS were correlated with other instruments with known validity (body dissatisfaction scales of EDI–2, BSQ, and BIA–R; see Table 8).

Body dissatisfaction measured with BIAS was significantly correlated with all the instruments used in the study, in the total sample and in the control and ED groups separately.

Both the BSQ and the body dissatisfaction scale of the EDI–2 assess the degree of dissatisfaction in subjects, but

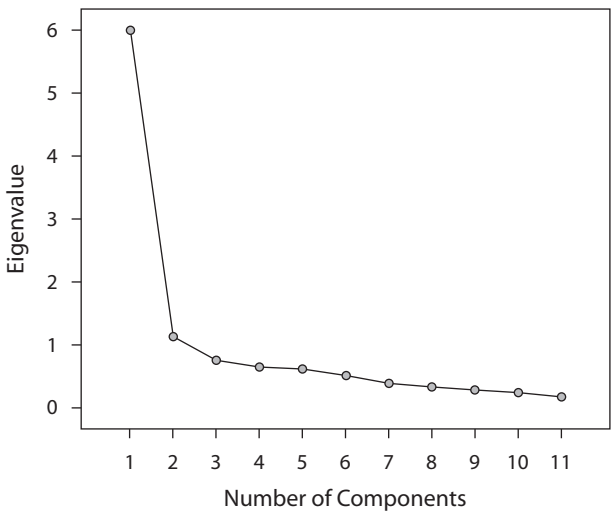

Figure 3. Scree test of the factor analysis of items on the body image distortion scale (front and side body parts) for the control group.

Table 7
Pearson's Correlations Between the Dissatisfaction Measures of Different Body Parts in the Frontal and Side Body Dissatisfaction Task for the Control and the Eating Disorder (ED) Groups Separately

Body Part	Group	Perspective	Body Part				
			Arms	Chest	Waist	Hip	Thigh
Head	Control	Frontal	.594	.435	.575	.500	.582
		Side	–	.396	.536	.526	.517
	ED	Frontal	.639	.675	.536	.616	.628
		Side	–	.664	.587	.661	.696
Arms	Control	Frontal		.521	.549	.563	.689
		Side		–	–	–	–
	ED	Frontal		.792	.533	.777	.798
		Side		–	–	–	–
Chest	Control	Frontal			.586	.582	.506
		Side			.487	.533	.323*
	ED	Frontal			.510	.510	.510
		Side			.647	.820	.676
Waist	Control	Frontal				.711	.605
		Side				.712	.744
	ED	Frontal				.586	.631
		Side				.806	.832
Hip	Control	Frontal					.728
		Side					.652
	ED	Frontal					.785
		Side					.824

Note—For the control group, $n = 208$; for the ED group, $n = 51$. *$p = .003$; for all other values, $p < .001$.

they do not specify whether this dissatisfaction is caused by the fact that the person wants to be thinner or fatter. In these questionnaires, a high score indicates the presence of greater body dissatisfaction. However, the BIA–R (test of silhouettes) does indicate whether dissatisfaction is due to the fact that the person desires a thinner or fatter figure. The test also provides formulas to convert direct scores (DSs) into *T* scores (TSs) according to the BMI of the person assessed. These TSs, with a mean of 50 and a standard deviation of 10, indicate whether subjects have chosen an ideal silhouette similar to their perceived image, a fatter silhouette (TS < 50), or a thinner silhouette (TS > 50). The scores of all these questionnaires are always positive. However, with BIAS, both positive and negative scores can be obtained. A negative score indicates that the person wishes to have a smaller size than he/she perceives having in reality, whereas a positive score indicates that he/she wishes to have a bigger size than he/she perceives in reality. The fact that most subjects show body dissatisfaction in the sense of wishing to be thinner than they perceive they really are means that the scores of the body dissatisfaction scale of BIAS are negative. For the same reason, the correlations with the other tests are also negative.

When BIAS scores are correlated with the direct scores obtained with the BIA–R (dissatisfaction = direct score of the ideal body image minus direct score of the perceived body image), something different occurs. In this test, the result can be either positive or negative, depending on the direction of the dissatisfaction. Therefore, the correlation between BIAS and BIA–R (DS) is positive.

Discriminant Validity

The next step was to determine whether distortion and dissatisfaction scores on BIAS could discriminate between subjects at risk of an ED (EAT–26 > 20; Group 1), those with no apparent risk of an ED (EAT–26 < 20; Group 2), and patients diagnosed with an ED (Group 3).

The results showed significant differences between the subjects in each group in terms of body size distortion [$F(2) = 58.52$, $p < .001$], and the post hoc tests revealed significant differences between all the groups. The biggest difference appears between the group of students without risk of an ED and the patients with an ED. The latter showed more body image distortion, followed by the group of students at risk of an ED (see Figure 5).

Similarly, significant differences were found in body image dissatisfaction as reported by the subjects in the three groups [$F(2) = 52.79$, $p < .001$]. Dual comparison tests showed significant differences in body dissatisfaction between Groups 1 and 2 ($p < .001$) and between Groups 2 and 3 ($p < .001$). However, no significant differences were found between students at risk of an ED (Group 1) and patients (Group 3) ($p = .98$). The subjects without risk of an ED showed less body dissatisfaction, whereas the dissatisfaction shown by patients and students with scores over 20 on the EAT–26 was similar (Figure 6).

Some studies have explored body image disturbances within adolescent versus adult groups. Baile and colleagues (Baile, Guillén, & Garrido, 2002), for example, found that the body dissatisfaction of the girls increased (measured by the BSQ) in the interval from 12–13 to 15–16, keeping it afterward at higher ages. The scores obtained by the 15- to 16-year-old girls group (BSQ = 81.2) was similar to the scores obtained by adult Spanish women. These authors concluded that body image is established in the period from 12 to 16 years.

Due to the age differences between the no-ED ($M = 21.59$, $SD = 2.33$), the risk-of-ED ($M = 21.14$, $SD = 1.70$), and the ED ($M = 19.25$, $SD = 5.22$) groups, discriminant validity was analyzed, excluding patients younger than 16 years old. Once these subjects were excluded, mean age

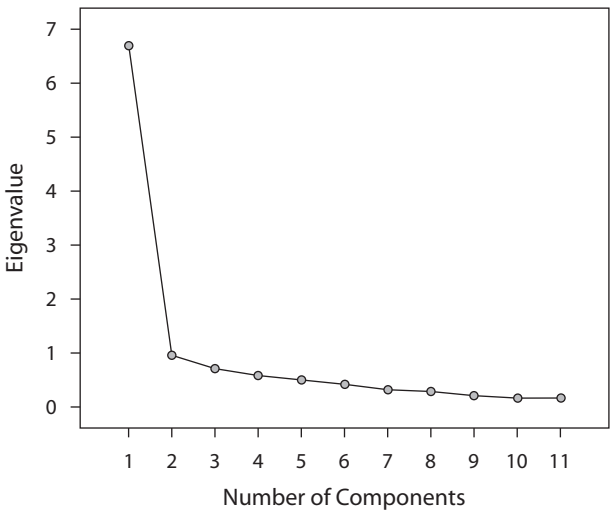

Figure 4. Scree test of the factor analysis of items on the body image dissatisfaction scale (front and side body parts) for the control group.

Table 8
Correlations Between BIAS and Other Body Image Dissatisfaction Measures

BIAS Body Dissatisfaction Scale	Group	BSQ		EDI–2 (BD)		BIA–R (TS)		BIA–R (DS)	
		r	*n*	*r*	*n*	*r*	*n*	*r*	*n*
Frontal	Total sample	−.682	255	−.635	252	−.655	252	.673	255
	Control	−.649	206	−.637	203	−.617	205	.682	205
	ED	−.506	49	−.478	49	−.529	47	.580	50
Side	Total sample	−.655	255	−.612	252	−.635	252	.675	255
	Control	−.603	206	−.564	203	−.592	205	.656	205
	ED	−.538	49	−.533	49	−.524	47	.606	50
Total	Total sample	−.685	255	−.641	252	−.661	252	.690	255
	Control	−.654	206	−.626	203	−.628	205	.694	205
	ED	−.523	49	−.514	49	−.535	47	.603	50

Note—All values are significant at $p < .001$. ED, eating disorder.

was similar in all groups (mean age in the ED group = 21.85, $SD = 4.77$). The results showed significant differences between groups in the area of body image distortion [$F(2) = 37.22$, $p < .001$] and body image dissatisfaction [$F(2) = 34.11$, $p < .001$]. Post hoc tests revealed significant differences regarding body image distortion between students without risk of an ED and patients ($p < .001$) and between students without risk of an ED and students with risk of an ED ($p = .001$). There were no differences between students at risk of an ED and patients ($p = .179$). Significant differences were found too in the area of body image dissatisfaction between students without risk of an ED and patients ($p < .001$) and between students without risk of an ED and students with risk of an ED ($p < .001$). No significant differences were found between patients and students with risk of an ED ($p = .412$). Patients showed higher distortion and dissatisfaction indexes. So, BIAS shows good discriminant validity once young adolescent subjects have been excluded.

Finally, no significant differences were found between the scores for distortion obtained by patients with different ED diagnoses [AN, BN, and EDNOS; $F(2) = 0.209$, $p = .889$]. Neither were any significant differences found in the degree of body dissatisfaction between patients with AN, BN, and EDNOS [$F(2) = 0.073$, $p = .974$].

Table 9 shows a summary of all mean data obtained during various tests with the ED group, the group at risk of an ED, and the group without an ED. The ED group and the group at risk of an ED show the highest levels of body disturbances and ED symptomatology.

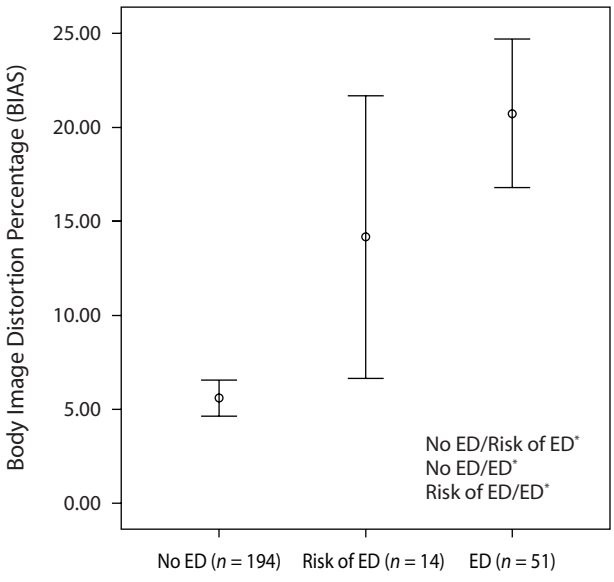

Figure 5. Plot of standard errors of the means obtained for the three groups on the body image distortion scale. Data points reflect the mean values for each group ± the standard errors of the mean. Results show significant differences between all the groups (*$p < .05$). ED, eating disorder.

DISCUSSION

This study provides information about the psychometric characteristics of BIAS. The results show good internal consistency, construct validity, convergent validity, and discriminant validity.

The findings indicate that patients with an ED overestimated their body image to a significantly higher degree than did the group of students without an ED. These results are similar to those obtained by Benninghoven et al. (2006), who observed that patients with AN and BN overestimated the size of their body considerably. Shafran and Fairburn (2002) reported similar findings. These authors found that ED patients overestimated their size by approximately 17%, this being significantly higher than the overestimation observed among controls (approximately 6%). Although several authors have observed similar results (Cash & Deagle, 1997; Farell & Shafran, 2005; Gardner & Bokenkamp, 1996; Smeets, 1997; Striegel-Moore et al., 2004; Tovée, Benson, Emery, Mason, & Cohen-Tovée, 2003), there have been some studies that have not reported this overestimation (Collins, 1987; Fernández, Probst, Meermann, & Vandereycken, 1994; Fernández-Aranda et al., 1999; Gardner & Moncrieff, 1988; Mizes, 1992; Probst et al., 1992). Furthermore, some authors have found a wide variety in results obtained with groups of ED patients, who tend to overestimate or underestimate body size to a greater extent than do controls (Bowden, Touyz, Rodriguez, Hensley, & Beumont, 1989; Collins et al., 1987; Hennighausen, Enkelmann, Wewetzer, &

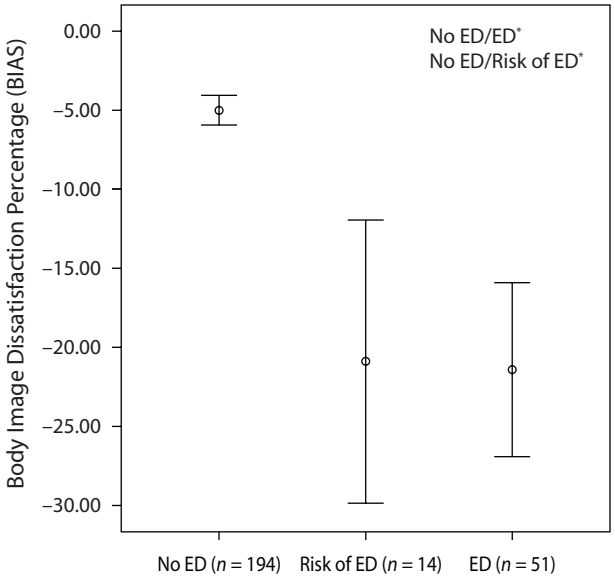

Figure 6. Plot of standard errors of the means obtained for the three groups on the body image dissatisfaction scale. Data points reflect the mean values for each group ± the standard errors of the means. Results show significant differences between the no eating disorder (ED) group and the ED risk group and between the no-ED group and the ED group. There are no significant differences between the ED risk and the ED groups (*$p < .05$).

Remschmidt, 1999; Touyz, Beumont, Collins, McCabe, & Jupp, 1984).

Several explanations have been proposed to account for the heterogeneity of these results. The main one is that the estimation methods used in different studies have varied widely and this has led to inconsistent results and has made comparisons difficult (McCrea, Summerfield, & Rosen, 1982). However, different results have been obtained with the same assessment method (Birchnell, Lacey, & Carter, 1985; Hennighausen et al., 1999; Probst et al., 1995), and this suggests that other factors influence the estimation that patients make of their own body image—for example, the instructions handed out to study subjects. In this regard, Proctor and Morley (1986) found that their subjects made greater overestimates when they were asked to adjust their own image to the point where "they themselves felt" they were, as compared with when they were asked to adjust their image to the point where "they felt others saw them."

In addition to methodological factors, certain personality traits, state of mind, and other cognitive and affective factors may influence the estimation of body size. Probst, Vandereycken, Van Coppenolle, and Pieters (1998) noticed that AN patients who clearly overestimated their body size (20% of the total) showed a more negative attitude toward their body and scored higher on the neuroticism scale of the SCL–90. With these results in mind, Skrzypek et al. (2001) suggested that patients who overestimate could be considered as a subgroup with a worse prognosis than the rest. Overestimation could, therefore, be considered as a factor of poor prognosis for AN. Some authors have observed that the induction of a negative state of mind gives rise to higher levels of overestimation (Baker, Williamson, & Sylve, 1995; Plies & Florin, 1992; Taylor & Cooper, 1992). Similarly, Grubb, Sellers, and Waligroski (1993) found that depression and body size estimation are related in patients with an ED. Various studies have also investigated the impact that exposure to certain objects or situations can have on the stability of body image (Carter, Bulik, Lawson, Sullivan, & Wilson, 1996; Crisp & Kalucy, 1974; Heilbrun & Flodin, 1989; McKenzie, Williamson, & Cubic, 1993). There is also a hypothesis about the influence of the menstrual cycle on body size estimation (Altabe & Thompson, 1990). Given the great variety of results obtained from studies in which the presence of altered body size perception in EDs has been assessed, some investigators have emphasized the fact that body image can be considered as a state, rather than as a trait (Cash & Deagle, 1997; Slade & Brodie, 1994; Smeets, 1997), and that it is subject to change depending on situational or emotional variables.

In agreement with Cash and Deagle (1997), our results show no differences between body size distortions in patients with respect to their diagnosis. Fernández-Aranda et al. (1999) also failed to observe significant differences in body size estimation between patients with AN and those with BN. Furthermore, they found evidence of cognitive–emotional alterations (dissatisfaction), rather than alterations in the perception of body image. In contrast, some studies (Tovée et al., 2003) have reported that patients with BN tend to overestimate their body size to a larger extent than do patients with AN, whereas others (Benninghoven

Table 9
Summary of All Mean Data for the Three Groups

	Group								
	ED			ED Risk			No ED		
Measure	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
EAT–26 (DS)	38.08	21.22	50	30.79	7.78	14	3.76	4.69	193
BSQ (DS)	141.57	47.507	49	141.86	24.59	14	74.99	28.82	192
EDI–2 dissatisfaction scale (DS)	15.90	8.48	49	18.00	7.50	14	6.32	6.43	189
BIA–R perceived scale (TS)	67.94	14.65	47	67.65	11.08	14	54.85	9.37	191
BIA–R dissatisfaction scale (DS)	−2.76	2.65	50	−3.29	1.68	14	−1.18	1.26	191
BIA–R dissatisfaction scale (TS)	64.17	19.28	47	63.61	12.43	14	48.72	8.89	191
BIAS distortion scale (DS)	20.72	14.12	51	14.15	14.08	14	5.56	6.67	194
BIAS dissatisfaction scale (DS)	−21.42	19.72	51	−20.90	16.75	14	−4.98	6.58	194

Note—ED, eating disorder.

et al., 2006) have shown that the discrepancy between perceived body size and real body size is greater in patients with AN.

Our results also show that ED patients were significantly more dissatisfied with their body than were students in the control group, but not when compared with students at risk of an ED. This was not the case with the distortion measures. Patients scored significantly higher than both students without risk of an ED and those at risk of an ED, which seems to indicate that body dissatisfaction is a better risk indicator than is distortion. These results are in line with those of other studies (Cash & Deagle, 1997; Freeman, Thomas, Solyom, & Koopman, 1985; Striegel-Moore et al., 2004). In fact, most authors have agreed that cognitive–emotional measures discriminate better between patients and control groups than do perceptual measures. Cash and Deagle also have emphasized the ability of body dissatisfaction measures to discriminate between patients with AN and those with BN. After reviewing 66 studies conducted between 1974 and 1993, they concluded that patients with BN are more dissatisfied with their body than are patients with AN. Other authors have supported these results (Benninghoven et al., 2006; Fernández et al., 1994). Our data, in contrast, show no significant differences in levels of dissatisfaction according to diagnosis. These inconsistencies between results may be due to the use of different indicators of body dissatisfaction. In our case, the difference between ideal body image and perceived image was considered as an indicator of body dissatisfaction, whereas other studies (Fernández et al., 1994; Shafran & Fairburn, 2002) have used the difference between the objective body image and the ideal image as an indicator or have referred directly to the ideal image as a measure of dissatisfaction.

One advantage of using the discrepancy between the ideal image and the perceived image as an indicator of dissatisfaction is that it provides more detailed information about the nature of the dissatisfaction. The software used in the present study enables us to determine whether the degree of body dissatisfaction is due to a distortion of body image, to the fact that the patient has an ideal body image far from his/her objective image, or to a combination of both factors. Any treatment offered may then vary according to the answer to this question. If high levels of dissatisfaction are due to the fact that the patient overestimates his/her body image, treatment should be focused on training in body perception, so that the patient learns to assess correctly the size of each body part and to look at him/herself in a more objective way. On the other hand, if high levels of dissatisfaction are due to the fact that the patient's ideal image is very different from his/her objective measures, the treatment should be centered around the development of a more realistic ideal image and/or adjusted to a healthy image—that is, an image that corresponds to the patient's age and height. It is interesting to note that in our study, the high levels of dissatisfaction found in patients with an ED were caused by the presence of overestimation, rather than by their having an ideal image far from the objective image. In general, the evaluated patients presented an ideal that, in terms of size, was similar to their objective measures, although once again there was a lot of variety. Given that the indicator of body dissatisfaction applied in this study was the discrepancy between ideal body image and perceived body image, the dissatisfaction came from the fact that the subjects perceived their body size to be a lot bigger than it was in reality.

Our results show that BIAS can also discriminate between women without an ED and patients with this diagnosis, as well as between controls and women at risk of an ED. Women at risk of an ED showed a significantly higher level of distortion and body dissatisfaction. In fact, the presence of high body dissatisfaction is considered an important risk factor for the development of an ED (Polivy & Herman, 2002; Stice & Shaw, 2002; Stice & Whitenton, 2002). In addition, the presence of high levels of overestimation in patients with AN is associated with a more negative attitude toward the body (Probst et al., 1998).

CONCLUSIONS

BIAS has good psychometric qualities. It may be a suitable instrument for assessing and monitoring patients with EDs, and as part of protocols for detecting an at-risk population.

The findings indicate that patients with an ED overestimate their body image to a significantly higher degree than did the group of students without an ED. ED patients were significantly more dissatisfied with their body than were students in the control group, but not when compared with students at risk of an ED. This was not the case with the distortion measures. Patients scored significantly higher than did both students without risk of an ED and those at risk of an ED, which seems to indicate that body dissatisfaction is a better risk indicator than is distortion. Finally, the results show that BIAS can also discriminate between women without an ED and patients with this diagnosis, as well as between controls and women at risk of an ED. Women at risk of an ED show a significantly higher level of distortion and body dissatisfaction.

Nevertheless, it is important to mention the limitations of the present study. The sample of patients with an ED was small. The patient sample would need to be increased to check whether the results obtained here will be maintained. The same applies to the group of students at risk of an ED.

Moreover, future research may include several procedural changes. In this study, the subjects completed body image estimation and ideal body image tasks in just one trial, although they could make all the modifications and rectifications they wanted before pressing the "end" button and giving a definitive answer. Probst et al. (1992) assessed body image distortion and dissatisfaction using video distortion and found the highest correlations between the scores on second and third trials. They concluded that it might be better to retain only the final scores and that a procedure with three trials is more correct. In future research with BIAS, having subjects complete several trials for every task, in order to obtain more reliable data, could be of interest.

In order to avoid the anchor effect, in BIAS, body parts modification can be done by starting with a human figure

that is proportional to the subject—that is, proportional to the objective measures (height and width) of the subject. Although this offers a partial solution to the problem of the anchor effect, the proportional figure generated by the software will be smaller than the real figure, due to its presentation on a computer screen, which could influence the subject's estimation. In order to overcome this drawback, it would be interesting to use a life-size screen in future research using BIAS software.

Authors such as Gardner and Boice (2004) have taken into account the time required by subjects to reach final judgments in body image estimation and ideal body image tasks. It would be interesting to explore whether response time plays any role in body image assessment.

Finally, it would be interesting to use BIAS to assess body image distortions in male samples too. One of each 10 patients with an ED is male, and several studies have shown that disordered eating, poor body image, and dangerous weight loss and weight gain techniques may have important physical, mental, and social implications for the lives of young men (e.g., Gila, Castro, Cesena, & Toro, 2005; Toro, Castro, & Gila, 2005; Vanardo-Sullivan, Horton, & Savoy, 2006). The application of BIAS to a male population would provide further information about body image disturbances and the validity and utility of the software.

AUTHOR NOTE

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