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Cognitive biases in an experimental task of focalized selective attention in eating disorders

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Introduction. Cognitive processing differences based on attentional biases of words pertaining to eating disorders were investigated. We performed a computerized Stroop color-naming task in which the subjects named the colors of four word groups (food-related, eating disorders behaviours-related, emotional and neutral) to measure differences in the processing of these stimuli.

Method. Participants were 144 females with eating disorders (anorexia nervosa, bulimia nervosa, or a combination of both) and 172 female controls.

Results. In agreement with predictions, the three eating disorder groups were significantly slower than the controls in identifying the color of all word groups.

Conclusions. These findings indicate the existence of biases in stimuli processing related with eating behavior disorders.

Key words:
Eating disorders. Stroop effect. Bulimia nervosa. Anorexia nervosa.

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Sesgos cognitivos en una tarea experimental de atención selectiva focalizada en los trastornos de la conducta alimentaria

Introducción. Se investigan las diferencias en el procesamiento cognitivo, basadas en los patrones atencionales sesgados ante palabras relacionadas con los trastornos de la conducta alimentaria. Desarrollamos una prueba computarizada que replica el efecto Stroop, con la que presentamos cuatro tipos de palabras (alimentos, conductas relacionadas con el trastorno, emocionales y neutras) con el objeto de valorar las diferencias en el procesamiento de estos estímulos.

Método. Participaron 144 mujeres con trastornos de la conducta alimentaria (anorexia, bulimia o una combinación de ambas) y 172 mujeres controles.

Resultados. Consistentes con las predicciones, los tres grupos clínicos emplearon significativamente más tiempo en responder a la tarea que el grupo de control.

Conclusiones. Estos resultados sugieren la existencia de sesgos en el procesamiento de los estímulos relacionados con los trastornos de la conducta alimentaria.

Palabras clave:
Trastornos de la conducta alimentaria. Prueba Stroop. Bulimia nerviosa. Anorexia nerviosa.

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INTRODUCTION

Eating behavior disorders (EBD) have reached epidemic dimensions in western societies. Thus, it is estimated that between 5 and 10 million women have been diagnosed of eating behavior disorders in the USA[1].

In recent decades, cognitive theories applied to the understanding and treatment of EBD have accumulated considerable theoretical and experimental experience. This has decisively contributed to the elaboration of the evaluation procedures and increasingly effective treatment[2].

Basically, the premise underlying the different theoretical proposals within this line of investigation has the idea in common that the way which the subject perceives, assesses and responds to information regarding both her/his body image as well as that related with eating behavior can explain a high percentage of the variance related with the etiology, chronification and rehabilitation of these disorders[3].

The main hypotheses experimentally tested by the cognitive theories basically sustain that:

– Performance of subjects with EBD in experimental tasks should show the existence of persistent differential traits in the cognitive processing, in relationship with subjects free of these diseases.

– Differences in the performance of these tasks will make it possible to identify the main altered cognitive processes, related with the disorder etiopathogeny and chronification.

– Existence of different cognitive biases that modulate the motivational and affective processes mainly relate to obsession to be thin, excessive concern about body image and/or fear of obesity.

– Altered cognitive processes will not be exclusively present in EBD patients, but also in subjects excessively concerned about their body image and weight, even when they do not fulfill the diagnostic criteria of the different gnosological entities that are grouped within the EBD4 and, finally

– The link between thought and action justifies that the modification of the altered thought patterns leads to parallel changes in the altered behaviors, a premise which the different cognitive-behavior treatments are based on.

The concept of «schema» has special relevance in this context; it refers to the existence of relatively stable organized thought structures[5] that fulfill useful functions of psychological process facilitation and modulation: attention, perception, emotion, etc., in other words, the way that information is processed and organized in the memory. Although these schemas primarily fulfill adaptive functions, if these structures are altered, they may lead to the appearance of biased judgments that favor the appearance of maladaptive thoughts and behaviors.

Thus, it is assumed that those suffering EBD have developed a schema focused on constant maladaptive concern about the body and food[6] that supposedly contains stereotyped and affectively loaded information that overevaluates weight and one's own body image. This schema acquires, parallelly to the disorder evolution, a more determining role in the global information processing. This schema will involuntarily and unconsciously have a greater influence when faced with the ambiguous stimuli. This effect favors the fact that the patient's thought and behavior are constantly determined by this schema, facilitating the fact that certain stimuli are processed in a biased and maladaptive way.

The cognitive theories also sustain that thought globally influences eating behavior (fig. 1), inducing intake restriction, purgative processes, performance of excessive exercise, constant examination of the body and appearance of ritual behaviors before and during the meal.

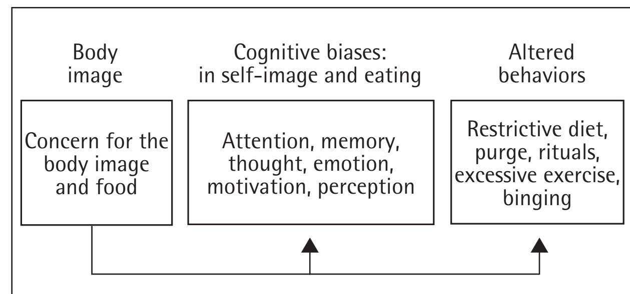

Figure 1 *Cognitive influences in the etiology of EBD. (Adapted from Williamson et al., 1999).*

Basically four types of cognitive biases have been studied in EBD: attentional, memory, interpretive or selective judgments and in body image. This study specifically deals with attentional disorders.

ATTENTIONAL BIASES IN EBD

There is abundant scientific literature regarding attentional cognitive biases and their relationship with adapted behavior and psychopathology[7]. These describe the existence of altered attentional processes, basically manifested by an increase in sensitivity to selectively heed in signals of the setting related with the disease itself. In other worlds, they refer to the existence of stable changes in the direction towards which the subject gives priority in his/her attention to specific aspects of the surrounding setting[8].

The role of attention biases in EBD is complex. Being aware of the presence of threatening stimuli facilitates the elaboration of avoidance strategies in potentially threatening situations, strategies that increase anxiety and negatively affect the problem, inducing avoidance of potentially anxiogenic situations. Fear of gaining weight makes it possible for the stimuli related with food and potential weight increase to be dealt with (and processed) in threatening terms. Thus, this type of stimuli is given priority over neutral stimuli while it seriously conditions cognitive activity and behavior[9].

Different research lines have approached the relationship between attentional cognitive biases and EBD (see Faunce[10] for a review). In his experimental study, strategies that evaluate facilitation or deterioration in task performance in which the subject must selectively deal with stimuli related with the disease have been mainly used. The most frequently used task has been a variation of the so-called «Stroop word-color effect,» described by John Ridley Stroop in 193511, in which a series of words-stimuli whose emotional content is representative of biases characteristic of

Table 1 Descriptive statistics of the groups

Group	Age					BMI				Weight			
	N	$\bar{X}$	(S_x)	Min	Max	$\bar{X}$	(S_x)	Min	Max	$\bar{X}$	(S_x)	Min	Max
Control	172	19.44	3.64	17	40	19.44	2.19	12.5	26.2	57.80	8.13	37.00	90
Anorexia	57	21.05	5.76	13	41	18.42	2.39	10.9	24.3	48.99	6.95	28.10	67
Bulimia	57	21.81	5.37	15	40	22.70	4.46	16.6	41.5	62.29	13.50	42.00	116
UEBD	30	21.35	6.43	15	41	21.99	4.15	14.5	30.9	58.21	9.49	39.20	76

BMI: body mass index (weight/height^2); UEBD: unspecified eating behavior disorders.

this study's object disorder is presented. This effect has become the experimental paradigm par excellence in literature on cognition and emotion[12].

Repeatedly, it has been proven that subjects with EBD obtained significantly different scores from the controls in that test. This same effect has been also observed in subjects with several emotional disorders[8]. On the other hand, this effect has not been observed exclusively in EBD diagnosed subjects but also in subjects excessively concerned with their body image who carry out restrictive diets[4]. However, it must be stated that some authors[13] question its use in the study of attentional biases in EBD.

In summary, these studies have concluded that excessive concern for food, weight and the figure seems to direct attention towards relevant stimuli that may maintain concern about body size/figure and/or food.

This study aimed to evaluate the possible existence of attentional biases in information processing, in an experimental task of focalized selective attention, in EBD subjects. To do so, we designed an experimental procedure in which we evaluated the differential attentional processes of EBD subjects and controls in response to an attentional task in which the subjects were presented stimuli related with their disease in addition to others having a neutral affective nature. We evaluated the reaction times to the stimuli of each one of the four subject groups (controls, anorexia, bulimia and non-specified EBD) in response to each one of the four stimulus categories used: *a)* neutral stimuli; *b)* emotion activating; *c)* food names, and d) stimuli related with behaviors and situations to which EBD patients are highly sensitive in relationship to food avoidance or maintenance of the disorder.

We hypothesize that in the stroop task, the EBD groups will experience a significant slow down in response times to eating descriptor stimuli, in affective and neutral words as well as to words related with stimuli and behaviors characteristic of EBD patients. We also hypothesize that the disorder seriousness (derived from the number of hospital admissions and treatment years) will significantly influence the response times to different stimulus categories in the EBD group. Finally, the third hypothesis we suggest sustains that the degree of lack of satisfaction and body image distortion will influence the response times to different stimulus categories in the EBD group.

METHOD

Subjects

A total of 316 women, whose ages ranged from 13 to 35 years participated in this study, 172 of whom made up the control group. All were students of the University of Murcia. The rest, 144, were patients diagnosed by the DSM-IV criteria[14] and were under treatment due to anorexia (n = 57), bulimia (n = 57) or unspecified eating behavior disorder (UEBD; n = 30), from the EBD Treatment Units of the Hospitals of Niño Jesús (Madrid) and Ciudad Real (table 1).

The number of hospital admissions as well as treatment years of the clinical sample are shown in table 2.

Table 2 Hospital admissions and years in treatment of the clinical sample

Group	Hosptial admissions					Years in treatment			
	N	$\bar{X}$	(S_x)	Min	Max	$\bar{X}$	(S_x)	Min	Max
Anorexia	57	1.00	1.41	0	6	2.98	3.51	0.00	20.00
Bulimia	57	0.30	1.19	0	8	2.42	2.33	0.10	10.00
UEBD	30	0.45	1.61	0	7	1.42	3.51	0.10	7.00

UEBD: unspecified eating behavior disorders.

Initially, we analyzed the characteristics of the clinical sample in relationship to the number of hospital admissions and treatment years for each group. The results showed the existence of statistically significant differences in the number of hospital admissions ($F_{[2.143]}$ = 3.77; $p < 0.05$); the post hoc analyses showed that the anorexia group had a significantly higher number of hospital admissions than the bulimia and UEBD groups. On the other hand, no differences were seen in the number of treatment years ($F_{[2.143]}$ = 2.32; p = 0.104) between the three clinical groups.

Materials

Gardner et al. Body Image Evaluation Scale15, in the Rodriguez et al.[16] Spanish adaptation. This scale is formed by thirteen, 8 cm high, silhouette drawings, which represent the schematic contours of the human figure, without any attribute such as hair, face, etc. This scale makes it possible to obtain three indexes: the first represents the present perception of the subject's body image, the second, the image that the patients consider «ideal» for themselves. Finally, the evaluator indicates the «real» image that each one of the patients shows. In this way, it is possible to assess the degree of adjustment between the perceived and desired image, as well as an estimation of the objective body image performed by the evaluator. The scale has three important psychometric properties. Thus, it has a high test-retest reliability level, both on comparing the image perceived with weight ($r = 0.59$; $p < 0.001$), as well as BMI (0.67, $p < 0.001$) after a three week period.

A questionnaire, specifically elaborated for this investigation, was also used. Sociodemographic and diagnostic data on those who participated in this study were gathered in it.

Stroop task

An adaptation of the stroop task[11], implemented initially by Martínez-Sánchez and Marín[17] was used, using an IBM compatible computer with color screen and standard keyboard. The program in charge of giving instructions and stimuli, response gathering and feedback administration is generated by the Micro Experimental Laboratory (MEL) program[18] that controls the presentation of instructions and stimuli as well as the response registry. This computer program has been used previously in the stroop effect study and its relationship with affective information processing[17,19-21].

All the necessary instructions to perform the experimental task appear on the screen. The stimuli are presented in the center of the screen on a black background with a letter size that is approximately 2 cm high by 1 cm wide of the system 72 type provided by the MEL program.

The instructions given stressed that the task consisted in «answering, as quickly as possible and without making mistakes, to the color (red, green or blue) in which the words appearing on the screen were written.» The response procedure consisted in pressing the number key present in the right side of the keyboard, pressing 1 to indicate the «red» response, 2 to indicate «green» or 3 to indicate «blue.» In order to control the possible existence of different reaction times for each color-response key combination assigned, a control system was implemented that consisted in randomly assigning the three types of different combinations possible at the onset of the procedure. In this way, the effect observed, consisting in the existence of a positive linear relationship ($F = 39.628$; $p < 0.000$) between response time and order of the key that should be pressed at each time, was controlled[7]. After each response, information regarding correct or erroneous answer, as well as time used by the subject to give it, appeared on the screen.

The task consists in two blocks of stimuli. Block I, formed by 18 affectively neutral stimuli (for example: house, chalk, etc.) is used to achieve adaptation and understanding of the task. In block II, 60 words-stimuli grouped in four categories were presented: *a)* 15 neutral stimuli; *b)* 15 emotion activating stimuli; *c)* 15 stimuli related with foods to which patients with EBD are sensitive, given their high protein and vitamin load, and finally, *d)* 15 stimuli related with behaviors and situations to which patients with EBD are highly sensitive in relationship to avoidance or maintenance of the disorder by eating avoidance (table 3).

Table 3 **Stimuli used in the second experimental block**

Neutral	Activators	Foods	Behaviors
E2R2J2KX	Aids	Cakes	Flabbiness
8SDFI5F	Death	Oil	Abdominals
00A0B00C	Drug	Cream	Food
A4ASER4	Infaction	Hap	Height
0KKLF22	Accident	Rolls	Dinners
FBHHH	Cancer	Sausage	Stretch marks
C1D1E1	Suicide	Chocolate	Vomiting
H9KLKLU	Vagina	Bacon	Binging
45GT66	Excrement	Sugar	Kilos
TRYY777	Orgasm	Chocolat cream	Scale
3300WWW	Blood	Fat	Calories
6XXX8	Foreskin	Black pudding	Diets
A1B2C3D4	Violation	Ice creams	Weight
Z44CC47	Terrorism	Chick peas	Mirrors
P055578	Fear	Butter	Obesity

PROCEDURE

The experimental task was performed individually, after informing the subject of its object and obtaining his/her consent.

After obtaining the anthropometric data of height and weight, the subjects were instructed to fill out the Gardner et al.[15] Body Image Evaluation Scale, in the Spanish adaptation by Rodríguez et al.[16]. They had to check the silhouette that represented the perception that they resently had of their body image with a cross (X). After, they were requested to estimate the silhouette that best represented the one they wanted to have with a circle (O). Finally, the evaluator indicated his/her estimation of the participant's real body image with an asterisk (*). In order to avoid biases in the evaluator's estimation of the body image of this study's participants, all the evaluations were performed by the same experienced evaluator.

All the instructions necessary to perform the stroop task appeared on the computer screen. When requested by the subject, the experimenter provided complementary information on the task. Finally, they were told that the experiment was made up of two test blocks, with a rest time between both.

Table 4 **Response times (in milliseconds) for each group and sitmulus category**

Category	Group	N	$\overline{X}$	(S_x)	Min	Max
Words without mecaning	Anorexia	57	759.58	147.08	510.20	1.175.9
	Bulimia	57	777.90	153.36	506.07	1.199.9
	UEBD	30	806.69	144.03	607.93	1.002.9
	Control	172	661.80	109.76	434.92	1.018.8
Emotionally arousing words	Anorexia	57	795.01	163.02	511.67	1.265.6
	Bulimia	57	809.06	167.73	545.87	1.191.5
	UEBD	30	813.67	157.79	565.93	1.076.1
	Control	172	662.92	113.92	491.21	1.145.0
Food names	Anorexia	57	789.47	168.72	554.47	1.332.6
	Bulimia	57	793.94	161.55	530.00	1.189.7
	TCANE	30	816.49	161.59	622.80	1.054.5
	Control	172	658.21	121.74	431.46	1.059.4
EBD related behaviors	Anorexia	57	799.81	175.27	500.00	1.401.2
	Bulimia	57	789.12	152.58	546.73	1.192.1
	UEBD	30	844.46	195.94	600.93	1.169.5
	Control	172	653.48	126.20	464.36	1.147.8

UEBD: unspecified eating behavior disorders.

STATISTICAL ANALYSIS

When the mean age of the three clinical groups (anorexia, bulimia and UEBD) was compared, no significant differences were found ($F_{[2.143]} = 1.2$; $p > 0.10$). On the other hand, the existence of significant differences was observed in the BMI ($F_{[2.143]} = 33.78$; $p < 0.000$), as well as in weight ($F_{[2.143]} = 37.09$; $p < 0.000$) between the three groups, so that the possibility of establishing intergroup comparisons is assured.

RESULTS

Initially, we performed the statistical analysis of the response time results for each one of the groups, in each one of the four stimulus categories used during the stroop task: *a)* name of food; *b)* behaviors and situations related with EBD; *c)* words without meaning, and *d)* emotion activating words. The descriptive statistics appear in table 4, and show the existence of marked differences in response times when comparing the control group with the three clinical groups.

We performed an ANOVA to evaluate the response times of each group for each one of the four stimulus categories. These results show significant differences in the four categories analyzed (table 5).

The post hoc analyses showed that these differences consistently appeared when response times of the clinical groups were compared (anorexia, bulimia and UEBD) with the control group, in that the clinical groups used significantly greater times than the controls in responding to the stimuli during the experimental phase, for each one of the four categories. Complementary post hoc analyses, using the Tukey multiple comparisons test, show the absence of significant differences when comparing the three clinical groups. The UEBD group is the one that shows superior response times, although this difference is not statistically significant when it is compared with the groups formed by patients with anorexia and bulimia.

In order to evaluate the second hypothesis that we initially posed, that is, that the seriousness of the disorder (derived from number of hospital admissions and treatment years) will significantly influence the response times to different stimulus categories, in the EBD group, we performed several covariance analyses (ANCOVAS) in which we used both indexes as covariates. We considered the «group» variable as independent variable and the mean reaction times to each category as dependent variable (DV). The results show the absence of significant effects of both variables over the DVs.

Finally, we assessed the third hypothesis that sustained that the degree of body image distortion and lack of satisfaction would influence the response times to the different stimulus categories in the EBD group. Thus, we used lack of satisfaction indexes with the body image (obtained from the differences between the image perceived and desired, considering it an index of lack of satisfaction with

Table 5 ANOVA: group response time during block II of the experimental procedure

Category	Sum of squares	GL	Square mean	F	Sig.
Food names					
Intergroups	794,963.13	3	264,987.71	12.108	0.000
Intragroups	3,720,434.47	312	21,884.90		
Total	4,515,397.60				
EBD related behaviors					
Intergroups	941,450.88	3	313,816.96	13.654	0.000
Intragroups	3,907,121.92	312	22,983.07		
Total	4,848,572.80	315			
Words without meaning					
Intergroups	544,329.54	3	181,443.18	10.119	0.000
Intragroups	3,048,350.37	312	17,931.47		
Total	3,592,679.91	315			
Emotion activating words					
Intergroups	841,515.39	3	280,505.13	13.342	0.000
Intragroups	3,574,169.51	312	210,224.52		
Total	4,415,684.90	315			

the body image). We also used another one of distortion of the body image (obtained from the difference between the perceived and real image) of the Body Image Evaluation Scale.

In order to evaluate the influence of both indexes, we performed several analyses of covariances (ANCOVAS) in which we used both indexes as covariates of the results, considering the «group» variable as independent variable and the mean reaction times to each category as DV. The results showed that both the lack of satisfaction index ($F_{[2.279]} = 6.64$; $p = 0.011$) as well as degree of body image distortion ($F_{[2.279]} = 5.73$; $p = 0.018$) are significant covariates exclusively for the category that gathers the situations and behaviors characteristic of patients with EBD in relationship to avoidance or the maintenance of the disorders by food avoidance.

Finally, in order to evaluate the magnitude of the interference present during the Stroop task, we performed an analysis of the differences between the four stimuli types that make up the Second Block in each group. To obtain an index of the magnitude of the interference, we subtract the mean reaction time (RT) obtained for each group in the stimulus category from the RT obtained for this same group in the «words without meaning» category, following the Jones-Cherster, Monsell and Cooper[22] criteria. The results of this subtraction are shown in table 6 (table 6).

DISCUSSION AND CONCLUSIONS

Globally, the results obtained confirm the existence of a marked and significant differential effect between the clinical and control groups in their attentional patterns during the Stroop test.

The most commonly accepted explanation of the meaning of these results attributes this effect to the fact that the attentional processes are conditioned by the presence of a series of biases that influence the attention given to stimuli related with the disease in the EBD patients, the attention given to these prevailing over the rest of the environment stimuli[9]. In the following, we discuss the most significant results obtained in this study, responding to the hypotheses initially established based on the results obtained.

The first hypothesis formulated established that during the affective Stroop task, the EBD groups would experience a significant slow down in response times to eating descriptor stimuli, in the emotional words, to words related with stimuli and behaviors characteristics of the EBD patients as well as affective stimuli. Our results verify this hypothesis. On the one hand, the three clinical groups used significantly greater response times than the control group. However, none of the clinical groups obtains statistically superior times to the rest. Although the differences between groups are not significant in relationship to the degree of interference produced by the stimuli on the response time, we must state that the anorexia (AN) group is the one that obtains the greatest degree of interference in its performance.

On the other hand, when these results are compared with those obtained by other authors[6,9,22-34], we see how the interference effect is reproduced again.

Table 6 Magnitude of interference in each group for each stimulus category

Difference	Group	Mean
Food names	Anorexia	29.89
Words without meaning	Bulimia	16.03
	UEBD	9.79
	Control	–3.59
EBD related behaviors	Anorexia	40.23
Words without meaning	Bulimia	11.21
	UEBD	37.77
	Control	–8.31
Emotional words	Anorexia	35.43
Words without meaning	Bulimia	31.15
	UEBD	6.97
	Control	1.12

The second hypothesis tested proposed that the seriousness of the disorder (derived from the number of hospital admissions and treatment years) would significantly influence the response times to the different stimulus categories in the EBD group. Our results reject this hypothesis.

Finally, the third hypothesis that sustained that the degree of lack of satisfaction and distortion of body image would influence the response times to the different stimulus categories in the EBD group is confirmed.

Considerations regarding the experimental procedure used in this study

It is necessary to make several methodological type comments that affect the procedure and, consequently, the validity and reliability of the results obtained. On the one part, we believe that the experimental procedures aimed at reproducing the stroop effect must be implemented by computer programs that guarantee and assure the ideal methodological conditions that assure their validity and reliability. In this sense, although it would not be reasonable to discredit the studies performed under similar conditions to those explained by J. R. Stroop in 1935[11], that is, using colored cards and parallelly calculating the response times by mechanical procedures, it is true that this type of stimulus presentations have many difficulties that seriously condition their results.

The alternative that makes it possible to drastically reduce, if not eliminate, the multiple error sources (for example, those derived from reaction times of the experimenters on chronometrically calculating the subjects' reaction times) entails the use of computerized tasks that guarantee greater accuracy in the calculations of the presentation times and registry of the subjects' responses. It is sufficient to mention that the magnitudes of the interferences obtained in our study occupy a range that is about 20 milliseconds. There are very few studies that have used these procedures that approach the ideal experimental condition, with the exception of a few studies[22,29,31,34,35].

In the present study, each application of the test randomly assigned the order of the keys assigned to each one of the colors. However, this previously implemented and solved solution[17], is far from the ideal solution. An alternative to this procedure is made up of the use of «voice activated keys» as response modality. Although we had the possibility of implementing this response procedure as in the study of Jones-Cherster, Monsell and Cooper[22], this was finally ruled out given the high rate of errors that it causes. In fact, in a recent study presented by Davidson and Wright[29], it was demonstrated that the response procedure based on the keyboard is more reliable than that using the voice activated key.

Considerations regarding the stimuli used in this study

Ideally, the investigator assumes that the sample used in his/her study constitutes a portion representative of all the subjects that he/she is trying to evaluate, in order to extrapolate the results to large populations. The use of representative sample sizes constitutes the ideal of all investigators. However, access to representative samples, with the difficulties that this entails, makes it difficult to achieve this objective.

Our study has used a higher number than that used in most of the studies. Thus, for example, Overduin, Cansen and Louwerse31 used a total of 50 subjects; Jones-Cherster, Monsell and Cooper[22] used 32 (16 of which made up the control group); Cooper and Fairburn[26] used 12 subjects per group (anorexia, bulimia and controls who kept a diet); Green, Elliman and Rogers[30] used a total of 53; Cooper, Anastasiades and Fairburn[28] assessed 36 bulimic and 18 control subjects; Perpiñá, Hemsley, Treasure and de Silva[32] used 32 patients with EBD and 14 controls; Perpiñá, Leonard, Treasure, Bond and Baños[33] used 15 patients with AN, 10 with BN and 18 controls, etc.

We also want to stress that, in our study, we have used a group formed by 30 patients with EBD diagnosed of unspecified eating behavior disorder (UEBD). The decision to include this group was fundamentally based on its high prevalence, since Morandé and Casas[36] estimate that this disorder represents 2.76 % in women and 0.54¯% in men, compared to 0.69 % of AN, and 1.24 % in women and 0.36 % in men in the case of BN.

Considerations regarding stimuli used in this study

The stimuli used in this study are comparable, and largely similar to those used by other authors. However, we have not taken into consideration the frequency of use in our language of each one of the words used as significant stimuli.

Three stimulus categories have commonly been used in most of the studies. The first one of them is formed by names of foods, the second by stimuli related with the body image, while the third has used hedonically neutral stimuli. In our case, we have used four categories. On the one hand, we have reproduced the classical stroop effect when performing the first part of this study (Block I). Its results have manifested that the method used assured the reproduction of the classical effect, while assuring that the procedure was valid for use in the experimental phase, in order to assess the experimental hypotheses.

On the other hand, it must be mentioned that we controlled the number of letters that each one of the stimulus groups had in order to control rare variables that could affect the results. Thus, all the stimulus categories were formed by 102 characters.

Only one study[22] has controlled the hunger state of the subjects prior to the test application, something that we omitted in our study.

Considerations regarding evaluation of the stroop effect as psychopathology index

Several studies[9,22-25] established the evaluation of the use of the stroop effect as a valid quantitative index of psychopathology of EBD patients among their main objectives.

Can the magnitude of the interference effect be considered as a quantitative index of the degree of psychopathology? In our opinion, the results that we have obtained partially confirm this hypothesis. If we consider the AN disorder as «relatively» more serious than the BN and UEBD, we observe that the magnitude of the interference in the Stroop effect is greater in the AN group versus the rest of the clinical groups in all the categories. However, Perpiñá, Leonard, Treasure, Bond and Baños[33] obtain superior times in the patient group with BN than in the AN group, as do Jones-Cherster, Monsell and Cooper[22], who used a comparable methodology to that used in this study.

Implications of our results for the EBD evaluation and treatment

The literature reviews of EBD treatments have reached the conclusion that the advances derived from the cognitive theories should be included in the lists of psychotherapeutic approaches for EBD treatment, given its repeated verified experimental validity[37]. Although in this study, we have restricted the research scope to the attentional disorders, the existent of other cognitive biases (memory, body image, etc.) is well known.

Procedures such as that used in this study are largely inherited from studies that began in the decade of the seventies, when the study of different cognitive biases (basically attention and memory) in anxiety and depressive disorders was initiated[38].

Much experimental evidence points to the fact that one of the main concerns of EBD patients is related with body size and shape as well as with the foods that (these patients consider) may alter their ideal body image (obviously distorted). Several studies[39] have demonstrated that although these biases occupy a key role in these patients, they are also present significantly, although to a lesser degree, in subjects with normal body mass indexes who are concerned about the body image.

If, as it seems to be confirmed repeatedly, excessive concern for body size and shape is a central psychopathological trait present in AN and BN, therapy of the EBD should consider this fact, as has been reinvindicated by Williamson et al.[5]. Thus, the need, presently implemented in many EBD treatment units, of modifying the cognitive biases and obsessive thoughts related with these concerns, is proposed. Parallelly, we believe that efforts should be doubled to prevent the development of EBD is pre-adolescents, dealing with their beliefs about body image and the obsession for thinness as the ideal body shape.

It also becomes necessary to consider that, even though most of the studies have demonstrated that these patients correctly estimate the body size and shape of others but not of themselves, the therapists should avoid believing that this fact makes them intentionally resistant to see their own bodies in a realistic way.

The therapists should also not underestimate the results obtained by these studies, that use complex experimental procedures which, for them, may be interpreted in terms of the existence of unconscious action tendencies and which, thus, poorly influence in the real contexts in which these patients perform. It is precisely the existence of these almost automatic biases, outside of the patients' will, which stress their strong determination on behavior.

If we assume that the emotions are caused by situations that are perceived as real, EBD persons perceive their emotional reactions as responses to real situations (for example, they believe that they have gained weight because they have not been capable of following a strict self-imposed physical exercise program). Efforts to convince them of their erroneous interpretation of reality meets with a rigid resistance, as is observed daily by the therapists and the patients' own relatives. Williamson et al.[5] state that it is «as if the others do not understand them, which is completely true, since the others do not share their apparent reality». It is important for the specialist to recognize this fundamental difference between subjective reality and their own evaluation of reality.

We consider that it is essential for the therapist to understand that the patient may be incapable of formulating a new belief or expectation due to the influence of memory and attention biases that form a central part of the origin of their disease.

The key question could be formulated in these terms: can these cognitive biases be modified? Reports of many studies seem to thus confirm it, however, this process is slow and full of difficulties. In an extensive review on the subject, Williamson, Womble and Zucker[40] strongly conclude this possibility, stating that the duration of these interventions prolongs from 4 to 6 months, and have the result of significant improvements in 60 % of the patients. Unfortunately, many others require years of treatment.

Finally, we believe that the therapists must understand and be instructed on the cognitive processes that determine the patients' reactions, both in relationship to the disorder

etiology as well as during the therapeutic process, integrating this knowledge into their daily practice.

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