

Received: 02.02.2011
Accepted: 28.10.2011

A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection

COGNITIVE IMPAIRMENT IN HOSPITALIZED ADOLESCENT GIRLS SUFFERING FROM ANOREXIA AND BULIMIA NERVOSA

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SUMMARY

Background

The purpose of our study was to assess cognitive functions in adolescent inpatients with eating disorders, as the issue remains controversial.

Material/ Methods:

We used the Wisconsin Card Sorting Test and the Digit Span Test to assess working memory and executive functions in 30 female inpatients with anorexia and 30 with bulimia in the psychiatric adolescent unit, and in 39 age- and gender-matched controls. The results were correlated with clinical parameters and the psychopathological profile.

Results:

The adolescent anorectic and bulimic patients did not have cognitive disorders, and there was little correlation between measures of cognitive functions and clinical parameters.

Conclusions:

The results of our research do not confirm the presence of disturbances of working memory and executive functions in the group of eating disorders patients.

Key words: eating disorders, executive functions, Eating Disorders Inventory

INTRODUCTION

The question as to whether individuals suffering from eating disorders, especially from anorexia nervosa, have cognitive impairment remains unanswered. This is due to the difficulty of establishing impairment profiles in these patients (Green, Elliman, Wakeling & Rogers, 1996). Some researchers assert that genetic and neurobiological factors are crucial to the etiology of anorexia nervosa, and that these factors are reflected in primary cognitive deficits. The results of studies that used batteries of psychological tests to assess patients with eating disorders seem to support this. For example, some patients suffering from bulimia or anorexia nervosa have deficits in executive functions. These deficits are manifested by increased cognitive mistakes and an inability to effectively block irrelevant information in the Wisconsin Card Sorting Test (WCST) or in the Bexley-Maudsley Category Sorting Test (Ferraro, Wonderlicht & Josik, 1997; Palazidou, Robinson & Lishman, 1990). Toner, Garfinkel and Garner (1987), as well as Kaye, Bastiani and Moss (1995) also reported that both anorectic and bulimic eating disorder patients have problems in abstract thinking in the Matching Familiar Figures and the Matching Familiar Faces tests, as well as in the WAIS-R (Wechsler Adult Intelligence Scale – Revised), Digit Symbol Test, and the Trail Making Test (parts A and B) (Jones, Duncan, Brouwers & Mirsky, 1991). Bosanac et al. (2007), Ruiz, de Leon and Diaz (2008), and Pachalska (2008) also observed executive and memory impairment in anorexia and bulimia patients.

Use of the WAIS-R Block Design Scale Test and the Rey Complex Figure Test, among others, revealed differences in the visuo-spatial ability of eating disorder patients versus controls (Grunwald et al., 2001; Kingston, Szmukler, Andrewes, Tress & Desmond, 1996; Szmukler et al., 1992). In the Cognitive Drug Research Battery attentional deficits were observed by Bosanac et al. (2007). Some studies have shown that patients suffering from eating disorders also have problems with attention-vigilance, as shown by tests that measure attention continuity, such as the Stroop test and the Continuous Attention Test (CAT) (Fassino et al., 2002; Heilbrun & Worobow, 1991; Rieger et al., 1998; Waller, Watkins, Shuck & McManus 1996). However, Basińska-Starzycka et al. (2004) could not confirm these results; on the contrary, patients suffering from anorexia made fewer mistakes on this test than did the control group. Similarly, Pieters et al. (2004) assessed 15 anorectic patients using the Digit Substitution Test; these patients had better cognitive and worse motor functioning than the control group. Thus, when analyzing the results of research on cognitive deficits in eating disorder patients, one must remember that these patients have average or above average intelligence (Blanz, Detzner, Lay, Rose & Schmidt, 1997; Maxwell, Tucker & Townes, 1984; Rajewski & Talarczyk-Wieckowska, 1996; Witt, Ryan & Hsu, 1985). Connan et al. (2006) did not observe differences between anorexia patients and a control group in terms of WAIS-R results.

We think it is important to consider whether cognitive disorders in eating disorder patients are preexisting conditions, or whether they result from starvation

and are reversible. It is difficult to address this, as some studies do not consider malnutrition as a variable. In addition, malnutrition does not explain cognitive deficits in bulimic patients. Depression is another condition that is often comorbid with eating disorders and may affect performance on neuropsychological tests.

Bayless et al. (2002) assessed 59 patients hospitalized for anorexia nervosa with a battery of psychological tests; half showed mild cognitive disorders on at least two tests, and a third showed mild cognitive disorders on at least three tests. The level of depression and body mass index (BMI) did not correlate with cognitive disorder. Moser et al. (2002), Lena, Fiocco and Leyenaar (2004) and Śmiech and Rabe-Jabłońska (2006) had similar findings. In a comprehensive survey of the literature on cognitive disorders in eating disorder patients, Lena and coworkers suggested that neuropsychological deficits are part of eating disorders and may precede their appearance – thus, in adolescence, such deficits could be considered risk factors for eating disorders.

The consensus is that more research is needed to determine whether cognitive disorders are associated with eating disorders, and whether treatment of any of these disorders can be used to improve eating disorder therapy and prognosis. The aim of this study was to assess executive functions and cognitive disorders in a group of hospitalized adolescent girls suffering from anorexia and bulimia and to compare them with a group of healthy age-matched controls. An additional aim was to assess whether cognitive disorders in eating disorder patients were related to such clinical parameters as duration of the illness, weight loss, BMI at admission and discharge, and subscales of the Eating Disorder Inventory (EDI).

MATERIAL AND METHODS

Participants

The study participants included 60 adolescent female patients (age range 13-19 years) suffering from eating disorders: 30 anorectic patients and 30 bulimic patients (Table 1). All were consecutive inpatients in the adolescent psychiatry ward in our Institute in 2006 and 2007. The diagnosis of eating disorders was established by experienced psychiatrists after clinical interview. The control group consisted of a randomly selected group of 39 girls, with no psychiatric history and normal weight, from nearby secondary schools, who gave their informed consent. Informed consent was obtained from the patients, the members of the control group, and the parents/legal guardians of all underage participants.

Assessment

Both patients and controls were assessed using the Wisconsin Card Sorting Test (WCST) – computer version (Heaton, Chelune, Talley, Kay & Curtiss, 1993) and the Digit Span Test (DST) from the Polish version of the Wechsler Adult Intelligence Scale (Brzeziński et al., 1996). Both tests are commonly used to assess executive functions and working memory respectively. We recorded basic clinical data: patient

age, duration of symptoms, BMI at admission and discharge, and total weight loss since onset (Table 2); all patients completed the Eating Disorder Inventory (EDI 2) - Polish adaptation and normalization (Żechowski, 2007; see Table 3).

Data analysis

The participants from the two experimental groups were compared to the control group. There was a significant difference between in age between the anorexia and bulimia patients. For each patient group, a subgroup of 30 age-matched controls was formed from the whole group of 39 healthy controls. SPSS was used for statistical analysis. The distribution of results was assessed with the Kolmogorov-Smirnov Test, and for most of the variables the null hypothesis of normal standard distribution was rejected, so nonparametric tests were used. For intergroup comparisons we used the Mann-Whitney U test and Student's t-test (for age comparison); in correlation analysis, Kendall's tau-b coefficient was calculated.

RESULTS

Demographic and clinical data

Demographic and clinical data are presented in Tables 1 and 2. As mentioned above, there was a statistically significant difference in the age of the patients with anorexia and bulimia. We considered this during statistical analysis.

Eating disorder inventory

Symptom intensity

The scores of anorectic and bulimic patients were significantly different ($p < .05$) on every EDI scale except for Perfectionism and Maturity Fears (Table 3). The bulimic patients had higher scores than anorectic patients, except on the Body Dissatisfaction scale; this indicated a higher (declared) symptom intensity. These results were somewhat contradictory to the clinical observations, since the anorectic patients were hospitalized due to the severity of their psychological and physical symptoms. However, EDI is a self-assessment test, and anorectic patients often deny and consciously hide their symptoms. Thus, their scores on the EDI scales are low, approaching the results of healthy adolescents.

Table 1. Study group participants: number and age

	N	Mean age (range)
Controls – total (C)	39	15y, 10 mos (13y 2 mos – 19y 1 mos)
Anorexia ^a (A)	30	15y, 8 mos (13y 8 mos – 19y 0 mos)
Bulimia ^a (B)	30	16 y, 11 mos (14y 0 mos – 18y 9 mos)

Significant differences between A and B ($p = .001$; t test)

Table 2. Clinical data: anorexia nervosa and bulimia study groups

	BMI at admission		BMI at discharge		Total weight loss (kg)		Duration of illness (months)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Anorexia (A) n = 30	14.61	1.79	16.78	0.92	20.72	12.55	13.83	13.09
Bulimia (B) n = 30	20.95	3.33	19.71	2.35	14.3	12.05	33.38	17.14

Note: SD = standard deviation

Table 3. EDI: Results from the subscales for the anorexia and bulimia study groups

	Drive for thinness (p=0.004)	Bulimia (p<0.0005)	Body dissatisfaction (p=0.016)	Ineffectiveness (p=0.003)	Perfectionism	Interpersonal Distrust (p=0.005)	Interceptive awareness (p<0.0005)	Maturity fears
Anorexia (A) n = 30	1.07**	13.1**	8.37**	5.4	4.1**	6.4**	6.63
Bulimia (B) n = 30	14.87**	9.9**	7.06**	12.97**	6.9	7.1**	12.6**	7.93
Polish norms for EDI (Żechowski, 2007)	4.84	1.33	11.04	4.95	3.38	4.16	4.52

Note: EDI = Eating Disorder Inventory

The Mann-Whitney U test was used to compare the anorexia and bulimia groups. The mean values are reported. The results for anorectic and bulimic patients were significantly different ($p < .05$) for every EDI subscale except Perfectionism and Maturity Fears. Bulimic patients had higher values than anorectic patients except for the Body Dissatisfaction subscale.

Symptom correlations

We next correlated the EDI results and the clinical data for the anorexia and bulimia study groups (Tables 4 and 5). In the anorexia group there were only a few statistically significant correlations between the EDI scales and clinical data. *Drive for thinness* correlated with BMI at admission. When the BMI value was higher, the declared *drive for thinness* was also more pronounced; this seems understandable within the context of anorectic thinking. In turn, the higher the BMI at discharge, the better the results on the scale of *interpersonal distrust*. This may mean that patients who improved the most (as measured by BMI at discharge) improved their interpersonal relations as well. During hospitalization, the patients participated in numerous forms of psychotherapy. In fact, for some patients, hospitalization was one of the first positive group experiences in their lives.

Table 4. Correlation of EDI results and clinical data for the anorexia study group

EDI subscales	Drive for thinness	Bulimia	Body dissatisfaction	Ineffectiveness	Perfectionism	Interpersonal distrust	Interoceptive awareness	Maturity fears
BMI at admission	0.308**	0.144	0.172	0.234	0.236	-0.071	0.13	0.033
BMI at discharge	-0.061	0.036	-0.096	-0.005	0.07	-0.384**	-0.064	-0.064
Maximum body mass loss, kg	-0.109	0.129	-0.207	0.067	-0.217	0.04	0.075	-0.184
Duration of illness, months	-0.134	0.192	-0.059	-0.087	-0.045	-0.005	-0.096	0.268
Age, months	-0.138	-0.209	-0.092	-0.153	-0.161	-0.206	-0.291**	-0.141

Correlation coefficient Kendall's tau-b. (** - correlations statistically significant at the level of $p < 0.05$).

Table 5. Correlation of EDI results and clinical data for the bulimia study group

EDI subscales	Driver for thinness	Bulimia	Body dissatisfaction	Ineffectiveness	Perfectionism	Interpersonal distrust	Interoceptive awareness	Maturity fears
BMI at admission	0.319**	0.389**	0.413**	0.403**	0.152	0.249	0.448**	0.01
BMI at discharge	0.382**	0.371**	0.363**	0.363**	0.098	0.235	0.45**	-0.167
Maximum body mass loss, kg	-0.034	-0.114	0.003	0.027	0.012	0.209	0.057	-0.033
Duration of illness, months	-0.022	-0.032	-0.027	-0.054	0.103	0.268	0	0.158
Age, months	-0.218	0.057	-0.152	-0.203	-0.064	0.05	-0.055	0.079

Correlation coefficient Kendall's tau-b (** - correlations statistically significant at the level of $p < 0.05$).

On the other side, according to Polish law, patients older than sixteen who withdraw their consent for hospitalization must be released unless their condition is life threatening. In anorexia treatment, patients with BMI > 16 can be released. Thus, the group of patients who withdraw their consent generally has a low BMI at discharge, obvious difficulties in cooperativeness, and may have problems in interpersonal relations as well.

Patient age was negatively correlated with the *interoceptive awareness* scale. One would expect the opposite correlation, i.e. that older patients would have higher *interoceptive awareness*. These correlations should be viewed with some skepticism: as noted earlier, anorectic patients have a tendency to deny their symptoms when completing the EDI.

Table 6. WCST and DST test results in the anorexia nervosa, bulimia, and control study groups

Parameter of WCST	Anorexia	Controls	P	Bulimia	Controls	p
TA	103.27	95.2	0.058*	93.33	93.3	0.233
TC	71.7	72.03	0.722	70.43	70.8	0.321
TE	31.57	23.17	0.079*	22.9	22.5	0.303
% TE	28.53	22.93	0.089	22.17	22.37	0.433
PR	17.57	13.5	0.086	11.7	12.7	0.573
% PR	15.8	13.7	0.093	11.63	12.5	0.672
PE	15.93	11.83	0.066*	14.07	11.3	0.917
% PE	14.37	11.63	0.056*	10.73	11.23	0.917
NE	15.63	11.33	0.097	14.33	11.2	0.505
% NE	14.13	11.3	0.14	13.97	11.13	0.807
CLR	63.13	66.77	0.477	62.33	65.77	0.103
% CLR	64.1	72.07	0.061*	70.37	72.93	0.756
CC	5.17	5.7	0.165	5.50	5.63	0.652
T1C	24.4	17.7	0.428	17.7	16.4	0.892
FS	0.9	0.7	0.323	0.37	0.7	0.189
LL	-1.34	0.48	0.898	0.50	-0.02	0.761
DST forward	5.5	5.83	0.209	6.33	5.83	0.426
DST backwards	5.43	5.8	0.264	6.63	5.8	0.044**

Note: * Tendency to significance $p < 0.08$

** Statistically significant at the level of $p < 0.05$

The Mann-Whitney Test was used.

Abbreviations: TA – total answers; TE – total errors; %TE – percent of total errors; PR – perseverative responses;

%PR – percent of perseverative responses; PE- perseverative errors; %PE –percent of perseverative errors;

NE – nonperseverative errors; %NE – percent of nonperseverative errors; CLR – conceptual level responses;

%CLR – percent of conceptual level responses; CC – categories completed; T1C – trials to complete first category;

FS – failure to maintain set; LL – learning to learn; DST – Digit Span Test

In the bulimia group, the scores on most of the EDI subscales (except for *perfectionism*, *maturity fears*, and *interpersonal distrust*) correlated with BMI at admission and at discharge. Higher BMI was associated with symptom severity on the EDI subscales; this is in agreement with clinical knowledge in terms of the importance of body weight and self-esteem in bulimia.

Cognitive performance

The Mann-Whitney U Test was used to compare cognitive impairment (executive functions) in anorectic and bulimic patients and in healthy adolescents. Differences were considered statistically significant at $p < 0.05$, and considered to have a tendency toward statistical significance at $p < 0.08$.

There were no statistically significant differences in the performance of anorectic patients and healthy adolescents (control group) on the WCST and DST (Table

6). However, anorectic patients had worse scores than the control group (with a tendency to statistical significance, $p < .08$) on some WCST parameters: TA (all answers); TE (all errors); PE (number of perseverative errors); %PE (percentage of perseverative errors); and %CLR (percentage of conceptual level responses). There were also no statistically significant differences in the performances of the control and bulimia groups on WCST and DST Forward. There was a statistically significant difference ($p = .04$) between two of the groups on the DST Backwards, with bulimic patients performing better than healthy adolescents on this part of the test. These results are difficult to explain. One possible explanation is that the control group worked in a classroom with some interruptions; thus, the conditions may have been less ideal than for the bulimia group. However, this was true for all tests and should have affected all results in a similar way.

Compared with the group of anorectic patients, the bulimic patients performed significantly better ($p < .05$) on several WCST parameters: TA (total answers), TE, %TE (number and percent of errors), PR and %PR (number and percent of perseverative responses), %PE (percent of perseverative errors), FS (Failure to Maintain Set), and on the DST Back. WCST results and clinical data showed no correlation in either patient group. There was a significant correlation ($p < 0.05$) of DST Forward results and BMI and admission in both patient groups. In bulimic patients, a higher BMI correlated with worse DST Forward results, and in anorectic patients, higher BMI correlated with better DST Forward results.

RESULTS SUMMARY

- According to the WCST and DST, these groups of anorectic and bulimic eating disorder patients did not have executive function cognitive disorders.
- A comparison of the anorexia and bulimia study groups found that participants with bulimia performed somewhat better than participants with anorexia on many WCST measures and on the DST Back. However, there was a significant difference in the age of the two groups, and the patients' results were not different from control group results.
- There was no correlation between the WCST results and clinical data in either group of patients.
- There was a correlation between BMI at admission and DST Forward results in both patient groups. In bulimic patients, higher BMI correlated with worse DST results, and in anorectic patients, higher BMI correlated with better test results.
- Bulimic patients had higher EDI scores on almost all scales than did anorectic patients.

DISCUSSION

A review of the literature concerning cognitive disorders in eating disorder patients shows that the results are not clear-cut. Different studies have used different cognitive function tests and have assessed different aspects of the test in small groups of patients that are often heterogeneous in terms of age, duration

of illness, and clinical condition. These differences make it difficult to compare and analyze results from different studies. However, in spite of these difficulties, most researchers conclude that patients with anorexia and bulimia nervosa have at least a mild cognitive disorder.

There is still the question of whether such cognitive dysfunctions are primary disorders or are secondary to the poor physical state of patients who are anorectic. In fact, sometimes the cognitive test results become normalized after the patient's physical condition improves. At the same time, the presence of cognitive disorders in the group of bulimic patients, whose physical state is usually relatively good, argue against the idea that cognitive dysfunctions are secondary to the eating disorder.

Our results did not confirm the existence of executive dysfunction in two groups of anorectic and bulimic patients: their performance did not differ from that of normal, healthy adolescents. Despite the lack of statistically significant differences in the WCST and DST results between the patient groups and the control group, there were some statistically significant differences between bulimic and anorectic patients on these tests. Patients suffering from bulimia performed better on the WCST and on the DST Back than did anorectic patients. The results we obtained from bulimic patients on the WCST may indicate that these patients can pay attention better and have better operational memory compared to the anorexia group. Patients with bulimia also had better results on the DST, which measures operational memory and resistance to distraction. It is worth noting that patients with bulimia tended to perform even better on this test than the control group. The better performance of patients with bulimia versus patients with anorexia may be explained not only by the age difference, but also by their better physical state. These findings are consistent with some earlier studies, which are cited in the Introduction; however, our results are not in agreement with those of Basińska-Starzycka et al. (2004). In that study, anorectic patients performed better than healthy controls on the CAT test, which measures maintenance of attention.

The results of this study did not confirm that anorectic and bulimic patients have disorders related to executive functions. This may be due to the fact that our research group was homogenous in terms of age (Table 1), and all the patients were in the beginning stages of the illness. The number of patients in each group ($n = 30$) was relatively high considering the incidence of the illnesses, and certainly higher than in many published studies. One might expect that as the illness progresses, executive functions might deteriorate. This would indicate that the cognitive problems are secondary to the eating disorders, especially in the anorexia group.

We found no correlation between clinical data, such as BMI at admission and discharge, total body mass loss, and performance on the WCST in either group of patients. In both groups of patients, performance on the DST Forward correlated with BMI at admission. In bulimic patients, a higher BMI at admission correlated with poorer performance on the DST. It is difficult to interpret these results. Perhaps a higher BMI does not always mean a better clinical state; rather, it may indicate the degree to which the compensatory behaviors are effective. Body weight was closely tied to the intensity of bulimic symptoms on the EDI, except on the Perfec-

tionism and Maturity fears subscales and on the scale of interpersonal relations. This confirms the importance of body weight for the self-esteem of these patients.

Further research is needed to address the problem of cognitive disorders in anorexia and bulimia nervosa. Even if the existence of some mild cognitive deficits in eating disorders patients is confirmed, the intensity and characteristics will certainly be different than in other psychiatric, especially psychotic patients. It is extremely important to conduct this research in a relatively homogenous group of eating disorder patients, taking into consideration the physical condition of these patients, especially their total body mass loss and BMI, as well as comorbidities, such as depression, anxiety, and obsessive-compulsive symptoms, which may contribute to their cognitive difficulties.

CONCLUSION

The results of our research do not confirm the presence of disturbances of working memory and executive functions in the group of eating disorders patients.

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