INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

Bell & Howell Information and Learning
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
800-521-0600

Specificity of Relationships Among Vulnerability Factors and Symptom Dimensions in Bulimia Nervosa

Stéphanie Léonard
Psychiatry Department
McGill University, Montreal

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment of the requirements of the degree of Master of Science (M.Sc.)

September 1998

Acknowledgments

Numerous people have taken part in the evolution and completion of this thesis, and I would like to take this occasion to thank them.

To begin with, I would like to thank my supervisor, Howard Steiger, for giving me the opportunity to carry out a very interesting research project. I want to thank you for creating a motivating environment for me to work in, as well as for your monetary support concerning this project. I feel that in the past two years I have acquired numerous skills and tools, which will serve me for many years to come. I would also like to thank François Ng for his contribution to this project, as well as for his consideration and availability.

Many people have worked as co-researchers and research assistants for this project, and I would like to thank them. Many thanks to Pascale Lehoux, Jamie Rishikof, Marla Engleberg, Don Ramdoyal and Mira Thakur. I would also like to thank all the staff at the Eating Disorders Unit of the Douglas Hospital for contributing to this project by helping me recruit subjects.

I would like to thank Suzanne King for providing me with so much support (statistical and emotional). Suzanne, you have been very kind, patient and empathic, and I am grateful that you were there during these past years. Three years ago, you gave me my first chance at doing research, and I believe that you have played an important role in what I have become today. I also want to thank Rhonda Amsel for making me like statistics, and for her extensive statistical support throughout this project. You are by far the best statistics

teacher I have ever had, and your patience and comprehension have meant a great deal to me.

I would like to thank my friends Sophie, Saskia and Louis for supporting me throughout this project, and especially for listening to me during times of joy and despair. I would like to thank Sophie for being there every step of the way. Thank you for your kindness, patience and experience, you have been an incredible friend. I feel blessed to have you in my life, and I sincerely hope that our friendship will remain for many years to come.

I would like to thank my parents Louise and Gilles, as well as my brother Alexandre for their encouragement and support. I would like to thank my mother for her sincere interest in my work, and for her emotional support. You have followed me closely these past years, and I feel very blessed to have a mother as generous as you are. I would like to thank my father for his encouragement, and especially for his substantial monetary support. I would also like to thank my brother for being there for me, and for being patient and understanding. I am very proud of you and I hope to be able to support you in you future projects. I love you all very much.

Finally and most importantly, I would like to thank my husband Gilbert. You have provided me with immense support throughout this project, and your encouragement was a great source of motivation. Thank you for listening to my ideas, my presentations and sometimes my despair. Sharing my life with you has been fun, enriching and simply a blessing. I love you very much and look forward to sharing many more wonderful years with you.

Table of Contents

List of Tables

Abstract

Bulimia Nervosa (BN) is believed to have a multidimensional causality including developmental factors and neurobiological vulnerabilities. This study examined diverse clinical features (e.g., binge and vomit frequency, eating attitudes, impulsivity, dissociative symptoms, and affective instability) and two putative causal agents (e.g., childhood sexual/ physical abuse and serotonin abnormalities) in bulimics with and without a comorbid Borderline Personality Disorder (BPD). Twenty-seven BN sufferers and 25 normal-eater controls underwent a multidimensional assessment of eating symptoms, psychiatric symptoms, personality disturbances, experiences of childhood abuse and serotonin (5-HT) dysfunction. The latter was measured using paroxetine binding in blood platelets. In contrast to control subjects, borderline and nonborderline bulimics both displayed comparable abnormalities on paroxetine binding Bmax measure and eating symptomatology, whereas the borderline bulimics alone displayed particular elevations on measures of childhood trauma, impulsivity, dissociation, and to some extent affective instability. We interpret our results as suggesting that problems of 5-HT neurotransmission may be associated generally with BN, whereas developmental abuse may be relevant to characterological disturbances seen in only a subset of BN sufferers.

Résumé

La Boulimie Nerveuse (BN) semble avoir une causalité multidimensionnelle qui inclut des facteurs de vulnérabilité liés au développement et d'autres de nature neurobiologiques. Le but de cette étude était d'examiner certaines caractéristiques cliniques (ex.: la fréquence d'orgies alimentaires et de vomissements, les attitudes alimentaires, l'impulsivité, la dissociation et l'instabilité d'humeur) ainsi que deux agents de causalité plausible (ex.: l'abus sexuel/physique durant l'enfance et les anomalies liées à la sérotonine) au sein d'un groupe de patientes souffrant de BN avec et sans un diagnostic comorbide de Trouble de Personnalité Borderline. Au total, vingt-sept participantes souffrant de BN et vingt-cinq participantes-contrôle ont complété une batterie de tests mesurant les symptômes alimentaires, les symptômes psychiatriques, les troubles au niveau de la personnalité, les expériences d'abus durant l'enfance et les anomalies liées à la sérotonine. Ces dernières furent mesurées à l'aide de la liaison plaquétaire au paroxetine. À l'opposé des sujets-contrôle, les boulimiques "borderline" et les boulimiques "non borderline" ont démontré des symptômes alimentaires et des anomalies liés à la sérotonine similaires. Par contre, les boulimiques "borderline" sont celles qui ont démontré distinctement plus d'impulsivité, de dissociation, et d'expériences d'abus durant l'enfance, ainsi qu'une tendance vers l'instabilité d'humeur. Ces résultats suggèrent que les anomalies liées au système sérotonergique présynaptique sont généralement associées à la BN, mais que l'abus durant l'enfance est plutôt associé aux symptômes du trouble de la personnalité retrouvés chez seulement un sous-groupe de boulimiques.

Introduction

Bulimia Nervosa (BN) is a severe eating disorder characterized by dietary dyscontrol (or binge eating) followed by recurrent compensatory behaviours intended to control shape and weight. The latter can include extreme dieting or fasting, self-induced vomiting, misuse of laxatives, or intense exercise. It has been estimated that BN affects from 1-4% of young women in Western industrialized nations (Fairburn & Beglin, 1990). However, estimates based on less stringent diagnostic criteria (e.g., less frequent binge episodes) have suggested that up to 10% of young females may display bulimia-spectrum eating disturbances. BN is believed to have progressively increased in incidence in the past few decades (Fairburn & Beglin, 1990).

Whereas Anorexia Nervosa seems to manifest itself in early adolescence, BN often develops later, in early adulthood. BN is also noted to occur in men, but it has been estimated to be 1/10th as common in males (Fairburn & Beglin, 1990). Similarly, BN seems to be less frequent in certain racial groups, like Blacks and Asians (Crago, Shisslak, & Estes, 1996), but is believed to have an even distribution across socioeconomic classes (Gard & Freeman, 1996).

Aside from pathognomonic eating behaviours, BN is noted to co-occur with a range of other psychological symptoms and psychiatric syndromes. Among these, commonly described characteristics include impulsivity, dissociative behaviour and affective instability (Mitchell, Hatsukami, Pyle, & Eckert, 1986; Chandarana & Malla, 1989; Steiger, Jabalpurwala, Champagne, & Stotland, 1997). BN sufferers have been described as being highly impulsive (e.g., showing self-damaging acts, suicidality, or shoplifting), affectively

unstable (tending toward dysphoric and reactive mood) and prone to dissociative symptoms (including feelings of depersonalization and derealization, and amnestic experiences). However, such symptoms are also defining features of Borderline Personality Disorder (BPD), which is comorbid in up to a third of BN sufferers (Vitousek & Manke, 1994; Johnson & Wonderlich, 1992; Wonderlich, Brewerton, Jocic, & Danski, 1997; Steiger & Seguin, in press). Such frequent co-occurrence of BN and BPD creates a potential confound in efforts to identify causal processes involved in BN, since similar developmental as well as neurobiological factors (e.g., childhood trauma and dysfunction of central serotonin systems) have been postulated to act etiologically for both disorders. The main goal of this study was to clarify whether impulsivity, affective instability and dissociation are generally associated with BN, or are characteristics of only some BN cases showing borderline-spectrum comorbidity. Another goal of this study was to clarify the relationships between potential causal factors (developmental and neurobiological vulnerabilities) and BN, in function of presence or absence of BPD comorbidity.

Impulsivity

Individuals suffering from BN are often noted to be impulsive. Sufferers are noted to engage in substance abuse, sexual promiscuity, stealing, and reckless driving (Mitchell et al., 1986). Impulsivity in BN sufferers also manifests itself in the form of repeated self-mutilative or parasuicidal acts (Mitchell et al., 1986). Likewise, BN sufferers display more impulsivity than do normal-controls on measures reflecting motor, cognitive, and non-planning impulsivity (Fahy & Eisler, 1993).

While most authors agree that impulsivity is a common characteristic in BN, opinions diverge as to the meaning of this connection. Some studies have shown that those BN sufferers who display the highest levels of impulsivity also have the most severe bulimic symptoms (Newton, Freeman, & Munro, 1993; Wiederman & Pryor, 1996). In this sense, binge eating could be seen as a manifestation of impulsivity, such that more severe impulsivity problems would engender more severe binge-eating. However, other studies have suggested that impulsivity and severity of bulimic symptoms are quite independent. These studies have shown that in bulimic patients, the ones with the highest levels of impulsivity, are not necessarily the ones with the most disturbed eating behaviours (Fahy & Eisler, 1993; Wolfe, Jimerson, & Levine, 1994). This being the case, it is possible that impulsivity is not so much a "characteristic" of the BN sufferer, as a "symptom" of a comorbid disturbance found in only some cases.

A comorbid personality disorder could explain the presence of impulsivity disturbances in some BN sufferers. In fact, it has been observed that a certain number of BN sufferers do not exhibit elevated signs of impulsivity, suggesting that those who do, represent a distinct group of highly impulsive individuals (Lacey & Evans, 1986; Fahy & Eisler, 1993; Wiederman & Pryor, 1996). Impulsivity is a characteristic feature of BPD, which is a highly prevalent comorbid disorder in BN sufferers. Therefore, impulsivity may only be present in the subgroup of BN patients suffering from a comorbid BPD.

Dissociation

Dissociative phenomena, which include experiences of depersonalization (feelings of detachment or estrangement from oneself) and derealization (sensation that the external world is strange or unreal), identity disturbances (failure to integrate various aspects of the "self") and amnestic experiences (inability to recall important experiences) have been noted to be common in BN sufferers (Chandarana & Malla, 1989; Miller, McCluskey-Fawcett, & Irving, 1993). In addition, BN subjects are found to be more hypnotizable, which has been interpreted as implying susceptibility to dissociative process. Bulimics also score higher on self-report measures of dissociation than do normal-controls (Covino, Jimerson, Wolfe, Franko, & Frankel, 1994).

The relationship between BN and dissociation remains, however, unclear. It has been suggested that dissociation originates from childhood trauma, and represents a defence against such an experience (Putnam, 1985; Demitrack, Putnam, Brewerton, Brandt, & Gold, 1990). Consistent with this idea, empirical evidence links increased dissociative potential to a traumatic history (Putnam, 1985). Similarly, there is evidence suggesting that in BN sufferers, those who report a history of severe sexual abuse are more dissociative than are those reporting less severe abuse, or absence of abuse (Miller et al., 1993; Vanderlinden, Vandereycken, van Dyck, & Vertommen, 1993). It is therefore possible that dissociative symptoms are consequences of childhood trauma, and might be present in only a subgroup of BN patients who have experienced such trauma. One aspect of the present study was to explore the possibility that dissociative tendencies seen in BN patients are attributable to a traumatic history. Here, too, the potential impact of comorbid disorders, like BPD, needs to

be assessed.

Affective instability

Affective instability is another feature which is found to be common in BN. Affective instability implies a marked reactivity of mood (e.g., intense, episodic dysphoria, irritability, or anxiety, lasting a few hours or a few days) (American Psychiatric Association, 1994). Various empirical observations link BN to mood disturbances. BN sufferers have been noted to display signs of dysphoric and labile mood (Herzog, Keller, Lavori, & Kenny, 1992; Steiger et al., 1997; Lehoux, Steiger, & Jabalpurwala, in press). Recent studies report, for example, that from 25% to 60% of BN patients are clinically depressed (Brewerton, 1995; Garfinkel, Lin, Goering, Spegg, Goldbloom, Kennedy, Kaplan, & Woodside, 1995; Herzog et al., 1992; Steiger, Thibaudeau, Ghadirian, & Houle, 1992). Another study links BN to Seasonal Affective Disorder (SAD), finding 69% of BN patients to display signs of SAD (Levitan, Kaplan, Joffe, Levitt, & Brown, 1994).

Although affective instability is a frequent comorbid symptom in BN sufferers, the nature of this relationship remains to be specified. Some evidence supports the idea that BN and depression may be linked neurobiologically, since treatment with antidepressant drugs reduces binge eating as well as depressive symptoms (Pope & Hudson, 1986; Kennedy & Goldbloom, 1991). Other evidence points to the possibility of co-transmission in families, of risk for depression and BN. This, too, may imply shared neurobiological substrates for BN and affective disturbance. For example, a recent study in a non-clinical sample found that BN participants reported higher parental rates of depression than did participants without BN

(Garfinkel et al., 1995). In a similar vein, another study found that 40% of their BN sample had a family history of affective illness (Mitchell et al., 1986). These results suggest that mood instability may involve similar neurobiological vulnerabilities to those involved in BN.

In other words, it is possible that mood disturbances in BN sufferers do not represent symptoms of BN, but rather reflect the presence of some independent form of psychopathology. Suggesting such independence, the presence of a comorbid mood disorder in BN sufferers does not seem to influence severity of bulimic symptoms (Bulik, Sullivan, Carter, & Joyce, 1996).

Personality Disorders

Among all of the comorbid tendencies seen in BN, personality disorders are arguably the most frequent (Skodol, Oldham, Hyler, Kellman, Doidge, & Davies, 1993). A recent review paper estimates the prevalence of formal personality disorders among BN sufferers to be between 21% to 85% (Vitousek & Manke, 1994). Available findings indicate high prevalences of "Dramatic-Erratic" personality disorder diagnoses, like borderline, histrionic, and narcissistic personality disorders among BN sufferers (Skodol et al., 1993; Steiger et al., 1992), with the most prevalent personality disorder diagnosis in BN being Borderline Personality Disorder (Herzog, Keller, Lavori, & Kenny, 1992; Rossiter, Agras, Telch, & Schneider, 1993; Skodol et al., 1993). BPD is estimated to occur in up to a third of cases (Vitousek & Manke, 1994).

BPD is characterized by a combination of marked impulsivity, hostility, moodiness, identity disturbances, and turbulent interpersonal relationships. Individuals with BPD make

efforts to avoid real or imagined abandonment, and therefore have a pattern of unstable and intense relationships. Under stress, borderline patients may also show dissociative episodes and symptoms. In addition, borderline patients possess a marked identity disturbance characterized by a persistent unstable self-image (American Psychiatric Association, 1994; Stone, 1990).

The co-occurrence of BN and BPD complicates the task of identifying features specific to BN. As previously mentioned, in addition to being found in BN, mood instability, impulsivity and dissociation are also defining symptoms of BPD. The fact that BPD is present in such a large number of BN patients therefore raises questions concerning whether features like impulsivity , dissociation and mood instability are characteristic of BN per se, or are instead related to comorbid borderline-spectrum pathology.

Numerous studies have investigated this issue and most of them have found BN and BPD to tend to be independent entities. For example, "borderline" and "nonborderline bulimics" have shown that eating symptoms tend to improve equally in both groups, whereas borderline bulimics' general-psychiatric symptoms remain clinically severe (Steiger, Thibaudeau, Leung, Houle, & Ghadirian, 1994; Steiger & Stotland, 1996,); and this even at a 5-year follow-up (Wonderlich, Fullerton, Swift, & Klein, 1994). Evidence also shows that personality symptomatology is independent of bulimic symptoms and that the borderline/ non-borderline distinction is better at predicting comorbid symptoms observed in bulimic patients than is severity of BN (Steiger, Leung, Thibaudeau, Houle, & Ghadirian, 1993). It is possible, for example, that impulsivity, dissociation and affective instability are not characteristic of all BN sufferers, but are instead features of those bulimics who show

comorbid BPD.

Psychosocial and biological vulnerabilities associated with BN

BN has usually been conceptualized as having a multidimensional (biopsychosocial) causality, which includes psychosocial vulnerabilities associated with developmental trauma or neglect, and biological vulnerabilities linked to abnormalities of serotonergic mechanisms (Connors & Morse, 1993; Waller, 1991; Kaye & Weltzin, 1991; Weltzin, Fernstrom, & Kaye, 1994).

Developmental abuse and BN

There is a well-documented association between reported history of childhood trauma and BN. For example, childhood physical (Rorty, Yager, & Rossotto, 1994), and sexual abuse (Connors & Morse, 1993) have been strongly associated with BN . The prevalence of reported sexual abuse among BN sufferers has been estimated to be around 40%, with rates of physical abuse being higher still (Connors & Morse, 1993; Waller, 1991; Calam & Slade, 1989). Suggesting that such tendencies are not attributable to selection biases acting in clinic populations, studies using community samples have also found childhood sexual abuse (CSA) to be more present in BN subjects than in normal-eater controls (Calam & Slade, 1989; Miller et al, 1993; Garfinkel et al., 1995).

The nature of the relationship between BN and CSA remains, however, ambiguous. As mentioned previously, CSA is more common in eating-disordered individuals than in the general population, but eating-disordered patients are not found to report more CSA than do

other psychiatric-female control groups (Stuart, Laraia, Ballenger, & Lydiard, 1990; Bushnell, Wells, & Oakley-Browne, 1992; Folsom, Krahn, Nairn, Gold, Demitrack, & Silk, 1993; Steiger & Zanko, 1990). These findings suggest that CSA is not specific to BN. Strengthening such an hypothesis is the fact that a history of sexual abuse is not predictive of more severe bulimic symptoms in BN sufferers (Folsom et al., 1993; Waller, 1993; Pope, Mangweth, Negrao, Hudson, & Cordas, 1994). Hence CSA does not seem to have a direct influence upon severity of eating symptomatology.

Relevant to the question of specificity, in eating-disordered samples it has seemed to be the case that CSA predicts comorbid psychiatric disturbance more strongly than it does eating symptoms. Increased comorbidity with other psychiatric illnesses has been reported among eating disordered patients with a history of CSA (McClelland, Mynors-Wallis, Fahy, & Treasure , 1991; Bushnell et al., 1992; Folsom et al., 1993; Vanderlinden et al., 1993; Rorty et al., 1994). Similarly, BPD has been reported to be more common in eating-disordered women who report abuse than in those who do not (Waller, 1993; Steiger et al., 1997). One recent study looking at bulimic patients with BPD, another form of personality disorder, or no personality disorder, found that there was a progressive decreasing likelihood of sexual abuse across these three classifications (Steiger, Jabalpurwala, & Champagne, 1996). In addition, CSA has been linked to characteristic features associated with BPD like dissociation and impulsivity (Everill & Waller, 1995; McCarthy, Goff, Baer, Cioffi, & Herzog, 1994; Vize & Cooper, 1995). These results suggest that in the case of BN sufferers, CSA may be more associated with borderline-spectrum disturbances than with Bulimia per se. Consequently, the association between developmental trauma and BN may be more

attributable to having a comorbid personality disorder (e.g., BPD). Therefore, it is possible that sexual abuse may be best construed as an indirect risk factor in the etiology of BN (Connors & Morse, 1993).

Abnormalities of serotonergic mechanisms and BN

The central nervous system neurotransmitter serotonin (5-hydroxytryptamine; 5-HT) is thought to be involved in BN. Serotonin is believed to play a role in the regulation of appetite and satiety responses (Brewerton, 1995). Pharmacological enhancement of 5-HT in animals and humans has led to increased satiety; and feeding behaviour is determinant in regulating 5-HT synthesis (Brewerton, 1995). Numerous studies have suggested that BN is associated with abnormalities of serotonergic mechanisms (Weltzin et al., 1994; Leibowitz, 1990; Kaye & Weltzin, 1991; Levitan et al., 1997): a) platelet re-uptake of serotonin is higher in bulimic subjects than in healthy controls (Goldbloom, Hicks, & Garfinkel, 1990), b) a decreased maximum binding of imipramine to the serotonin transporter in platelets of BN patients has been reported (Marazziti, Macchi, Rotondo, Placidi, & Cassano, 1988), c) cerebrospinal (CSF) 5- hydroxy indoleacetic (5-HIAA), a metabolite of 5-HT, is reduced in bulimic patients (Kaye, Ballenger, Lydiard, Stuart, Laraia, O'Neil, Fossey, Stevens, Lesser, & Hsu, 1990; Jimerson, Lesem, Kaye, & Brewerton, 1992), and d) several studies have observed blunted prolactin response to the serotonin agonist meta-chlorophenylpiperazine (m-CPP) in bulimic patients (Levitan et al., 1997; Jimerson, Wolfe, Metzger, Finkelstein, Cooper, & Levine, 1997). Finally, and consistent with these results, numerous studies confirm that serotonergic antidepressants are effective in relieving bulimic

symptoms in BN patients (Kennedy & Goldbloom, 1991; Pope, Hudson, & Jonas, 1983).

Serotonin is also thought to be involved in the regulation of other behaviours commonly observed in BN sufferers, like impulsivity, suicidality, and to some extent dissociation. Reduced 5-HT activity has been associated with impulsive and aggressive behaviour (Coccaro, Siever, Klar, & Maurer, 1989), and lower levels of CSF 5-HIAA have been associated with suicidality (Brown, Elbert, Goyer, Jimerson, Klein, Bunney, & Goodwin, 1982). Some evidence also demonstrates that the clinical expression of dissociation in eating disordered patients may be related to neurochemical changes in dopaminergic, serotonergic and opioid systems (Demitrack, Putnam, Rubinow, Pigott, Altemus, Krahn, & Gold, 1993). Moreover, it has been postulated that early traumatic events possibly interact in a complex neurodevelopmental fashion to produce long-term changes in brain systems (Brewerton, 1995). Since BN, mood problems, impulsivity, and to some extent dissociation have been associated with 5-HT dysfunction, the question remains as to how exactly BN and serotonergic systems are related.

BPD as a possible confound for causal model of BN

Complicating the task of determining which factors cause which symptoms in the context of BN, is the fact that BN and BPD share numerous characteristic features like impulsivity, dissociation and affective instability. In addition, BPD (just like BN) is also believed to be linked to developmental vulnerabilities (childhood trauma) and neurobiological abnormalities (5-HT dysfunction). In fact, a diagnosis of BPD is associated with a past history of sexual abuse (Waller, 1993; Everill & Waller, 1995; Brown &

Anderson, 1991), and it has been estimated that around 70-80% of BPD patients report a history of childhood sexual trauma (Paris, Zweig-Frank, & Guzder, 1994; Byrne, Velamoor, Cernovsky, & Cortese, 1990; Herman, Perry, & Van der Kolk, 1989). Consequently, the fact that childhood trauma is common in BN sufferers, and the fact that up to a third of BN sufferers are borderline, may suggest that childhood trauma seen in BN sufferers may be attributable to those bulimics who have BPD.

In addition, disturbances in 5-HT mechanisms have also been linked to BPD and to many of its characteristic features. For example, BPD patients show decreased levels of 5-HIAA (Gardner, Lucas, & Cowdry, 1990), and blunted prolactin responses to the 5-HT releaser/uptake inhibitor fenfluramine (de Vegvar, Siever, & Trestman, 1995; Martial, Paris, Leyton, Zweig-Krank, Schwartz, Teboul et al., 1997; Soloff et al., 1994), and to the partial 5-HT agonist meta-chlorophenylpiperazine (Hollander, Stein, DeCaria, & Cohen, 1994). Serotonergic mechanisms have also been associated with impulsivity (Brewerton, 1995; Coccaro et al., 1989), as well as affective instability and possibly dissociation (Brewerton, 1995; Demitrack et al., 1993). In order to eliminate the possible confounding effect of BPD on BN symptomatology, there is a need to clarify whether symptoms associated with BN like impulsivity, dissociation and affective instability, and postulated vulnerability factors like childhood trauma and serotonin dysfunction, are associated with BN or with borderline spectrum disturbances.

Measurement of serotonin status

Various techniques have been used to measure serotonin levels in human subjects. Measurements based on positron emission tomography (PET) are available, but are very expensive. Measurements of 5-HIAA in cerebrospinal fluid (CSF) are an alternative, but are quite invasive (Goldbloom & Garfinkel, 1990). Therefore, it has become common to infer central serotonin (5-HT) status using peripheral measurements, like the measurement of responses to administration of 5-HT agonists (e.g., measures of prolactin response) or platelet 5-HT (Mann, McBride, Brown, Linnoila, Leon, Demeo et al., 1992; Goldbloom & Garfinkel, 1990). Evidence suggests that there is good correspondence between platelet 5-HT contents and aspects of presynaptic reuptake (Mellerup et al., 1983) In addition, animal data supports the platelet model (Goldbloom et al., 1990).

Another technique involves the measurement of tricyclic antidepressant binding like [^{3}H] imipramine and [^{3} H] paroxetine, which investigates pre-synaptic 5-HT mechanisms (Mellerup, Plenge, & Engelstoft, 1983). Close relationships have been described between brain serotonin uptake sites and the sites of [^{3}H] imipramine and [^{3}H] paroxetine in blood platelets, and binding at the platelet level is believed to accurately reflect binding in the brain (Marazziti et al., 1988; Mellerup et al., 1983). Standard binding tests provide information on the number of binding sites (*Bmax*), as well as the binding affinity (*Kd*).

Imipramine and paroxetine binding tests have been used to measure 5-HT activity in patients suffering from various disorders. For example, results have shown that both imipramine and paroxetine *Bmax* values were lower in individuals suffering from Panic Disorder compared to controls (Pecknold, Luthe, Iny, & Ramdoyal, 1995). Paroxetine *Bmax*

and *Kd* values were also found to be lower than normal in individuals suffering from Post-Traumatic Stress Disorder (Arora, Fichtner, O'Connor, & Crayton, 1993), and a decrease in imipramine binding has been described for other disorders like Schizophrenia, Obsessive Compulsive Disorder, and Parkinson's disease (Weizman, Carmi, Hermish, Shahar, Apter, Tyano, & Rehavi, 1986; Cash, Ruberg, Raisman, & Agid, 1984). To our knowledge, the only study using binding (in this case imipramine) with BN patients found reduced *Bmax* levels for patients compared to controls, but normal *Kd* values (Marazziti et al., 1988). We selected paroxetine binding measures for our study, since some evidence suggests that paroxetine binding may be more selective for the serotonin pre-synaptic serotonin transporter (Mellerup et al., 1983; Pecknold et al., 1995).

Goals of this study

The major objective of this study was to compare clinical symptoms (e.g., Eating Disturbances, Impulsivity, Dissociation, and Affective Instability), prevalences of developmental trauma, and serotonin functions across BN sufferers with and without a comorbid BPD. We also included a normal-eater control group to provide reference values on comparisons of interest. Our main goal here was to examine which features were characteristics of BN in general, and which were typical only of cases with comorbid BPD.

Hypotheses

Based on previous findings, our specific expectations were:

1) Borderline bulimics will tend to show more severe general psychopathology (Impulsivity, Dissociation and Affective Instability) than non-borderline bulimics, 2) Borderline bulimics will not necessarily display signs of more severe eating pathology (Binge and Vomit frequency, Laxative/ Diuretic abuse and Intense Exercising) than non-borderline bulimics, 3) Experiences of Sexual and Physical Abuse will tend to be more strongly associated with personality pathology than with BN, and 4) In general findings suggest that 5-HT downregulation is involved in BN. This study explored if such effects would be obtained on paroxetine binding measures.

Method

Participants

Eating-Disordered Participants

Twenty-seven females were recruited through consecutive outpatient admissions at the Eating Disorders Unit (EDU) of the Douglas Hospital. An information letter was first given to patients by their primary therapist. If patients consented to being contacted by the principal investigator, they were then contacted by phone and they were given further explanations about the study. Eating-Disorder diagnoses and status were confirmed using the Eating Disorders Examination (EDE) Interview (Fairburn & Cooper, 1993), described below. All cases showed prominent bulimic symptoms according to DSM-IV *Diagnostic and statistical manual of mental disorders* criteria for BN (DSM-IV; American Psychiatric Association, 1994). Our sample included 21 (77.8%) cases who showed full BN, purging subtype, 2 (7.4%) cases who showed full BN, non-purging subtype, and 4 (14.8%) cases who showed an Eating Disorder Not Otherwise Specified (EDNOS) in the BN spectrum. This sample included 21 Francophones and 6 Anglophones.

Normal-Eater Controls

Twenty-five normal-weight females, according to the Body Mass Index (Beumont, Al-Alami, & Touyz, 1988), were recruited through a psychology introductory class at McGill University in Montreal. They were admitted to the study if they showed no past or present eating disorder upon EDE interview, and no overt psychiatric history upon inquiry. This sample included 9 Francophones and 16 Anglophones.

Interviews

Eating Disorder diagnoses were established using the Eating Disorders Examination (EDE: Fairburn & Cooper, 1993). The EDE is a standardized instrument that indicates the presence and severity of ED symptoms. Symptoms measured consist of Binge and Vomit Frequency, Laxative Abuse, Diuretic Abuse, and Intense Exercising. Reliability exceeds .90 on all but 3 of the 62 EDE items. It also has good internal consistency and discriminant validity.

Personality disorder diagnoses were established using the Structured Clinical Interview for DSM-IV Axis II (SCID-II: First, Spitzer, Gibbon, Williams, & Benjamin, 1994). For this study, the interview was used to establish the presence or absence of Borderline Personality Disorder. The SCID-II has good inter-rater reliability and yields good differentiation of main personality disorder classifications.

The Childhood Trauma Interview (CTI: Fink , 1993) was used to assess childhood experiences of physical and sexual abuse. The CTI is a 20-minute semi-structured interview that assesses elements like physical, sexual and emotional abuse, physical neglect, separation, and being a witness to domestic violence. The CTI also gives details on the nature, severity, frequency and duration of childhood traumatic experiences and additional information concerning the number and types of perpetrators, subject's age when abuse took place, etc. In the interview, each experience is rated on a 7-point scale reflecting frequency and severity of abuse in each category. Reported inter-rater reliabilities range from .92 to .99 for severity and frequency scores.

Self-Report Scales

To differentiate clinical from non-clinical disturbances, and to establish ED severity, the Eating Attitudes Test (EAT-26: Garner, Olmsted, Bohr, & Garfinkel, 1982) was used. The EAT-26 is composed of 26 items tapping attitudes and behaviours characteristic of anorexics and bulimics, and participants are asked to use a 6-point likert scale to report their various attitudes and behaviours. With an Alpha of .85, a cutoff score of 20 has been shown to differentiate clinical from non-clinical disturbances.

The Dissociative Experiences Scale (DES: Bernstein & Putnam, 1986) was used to measure dissociative tendencies. The DES is a 28-item Likert-type self-report questionnaire that measures central themes of dissociative pathology like disturbances in identity, memory, awareness, cognition, and feelings of derealization and depersonalization. Split-half reliability ranges from .71 to .96 and test-retest reliabilities are good. The scale also has good internal consistency.

The Barrat Impulsivity Scale (BIS, version 10: Barrat, 1985) was used to measure impulsivity. The BIS is a 34-item Likert scale that measures motor, cognitive and non-planning impulsivity. It has good internal consistency and reliability, and is shown to differentiate BN sufferers from normal-controls (Wolfe et al., 1994).

Measures of depression were obtained as part of a concurrent study, in which measures were changed part-way. Thirteen (13) subjects in the present sample received the Beck Depression Inventory (BDI: Beck & Beck, 1972), and 39 the Centre for Epidemiologic Studies Depression Scale (CES-D). The BDI is a 13-item scale measuring symptoms and features associated with depression. Correlation of BDI-13 scores to those of the longer BDI

form is reported to range from .89 to .97, and alpha reportedly exceeds .85. The CES-D is a 20-item self-report depression symptom scale. It is demonstrated to be sensitive to depressive symptoms and changes in symptoms over time in psychiatric populations. Since some subjects had been tested using the Beck Depression Inventory (BDI), and some using the Centre for Epidemiologic Studies Depression Scale (CES-D), a combined Z-score was computed to reflect overall depression level.

Mood lability was measured using the Affective Instability subscale from the Dimensional Assessment of Personality Pathology Basic Questionnaire (DAPP-BQ: Livesley, Jackson, & Schroeder, 1992). The DAPP-BQ is a well-constructed 290-item questionnaire that provides a comprehensive dimensional assessment of personality pathology. Content is derived from expert-based lists describing DSM-III and DSM-IIIR personality-disorder features, and content analysis of interviews with patients. The questionnaire contains 18 subscales (12-16 items each, with Alphas ranging from .87 to .94) that represent factor-based dimensions obtained in large, independent population samples. The Affective Instability subscale contains 16 items, and has previously been shown to differentiate eating disordered from non-eating disordered groups (Steiger et al., 1997).

Scale Translation

Given a bilingual sample, french forms of scales and interviews were required. Validated french versions for the EAT-26 (Leichner, Steiger, Puentes-Neuman, Perreault, & Gottheil, 1994), the BDI (Bourque & Beaudette, 1982), the DES (Bernstein & Putnam, 1986) and the DAPP-BQ (Steiger et al., 1996) were used. As for the SCID-II, the CTI, the

EDE, the BIS and the CES-D, french versions were generated (at the Eating Disorders Unit of the Douglas Hospital) using careful forward and backward translation techniques.

Procedure

All participants provided informed consent. Eating Disorder diagnoses were confirmed in all cases using the Eating Disorders Examination. Once the three semi-structured interviews were completed by the principal investigator, participants were then assigned to a desk in order to complete the self-report questionnaires, for which they were given a $10 monetary compensation. This first part of the study usually lasted from 2 to 3 hours. Participants who also agreed to the blood test were scheduled within 2 to 4 weeks of the testing session and were given relevant instructions. Participants were asked to fast overnight, and scheduling of the test was established so that none of the participants were having their menses at the time of the blood test. In addition, all participants were accompanied by the main investigator on the day of the blood test. For their participation to this part of the study, participants were given an additional $15 monetary compensation.

Paroxetine Binding

Preparation of blood platelets.

Whole blood (50 ml.) from an ante-cubital vein was collected between 8:00 and 10:00 a.m in Vacutainer tubes containing the anti-coagulant Ethylene Diamine Tetra acetic Acid (EDTA), following an overnight fast by the subjects. The blood samples were kept on ice and processed within 30 min for the isolation of platelets, by differential centrifugation,

as described by Wood, Suranyi-Cadotte, Nair, Lafaille, & Schwartz (1983). Platelet rich plasma (PRP) was first isolated at 280g for 15 min at 4^0 C, and the platelets subsequently isolated from the PRP at 18,000g for 15 min. The pellets were subsequently washed in a buffer containing EDTA/Tris/NaCl, pH 7.5, and homogenised using a Polytorn. The lysed membranes obtained were stored in a small volume of buffer at -80^0 C, until analysed.

[^{3}H] Paroxetine binding.

The binding experiment was performed as described by Langer, Schoemaker, & Segonac (1985). The lysed membranes (0.8 to 2.0 mg. proteins) were incubated in a tris/EDTA/NaCl/KCl buffer containing 0.05 to 10 nM [^{3}H] paroxetine (26.5 Ci/mmol, NEN) for 90 min at 20^0 C. The bound and free ligands were separated by filtration on GF/B Whatman filters. These were washed three times with the buffer and counted. The specific binding, determined by incubating [3H] paroxetine in the presence and absence of an excess amount of citalopram (3 microM), was between 70-90% of the total binding. The apparent Bmax (density) and Kd (affinity constant) were obtained by Scatchard analysis of binding curves for the 9 different concentrations of [3H] paroxetine.

Statistical analyses

Analyses were designed to explore differences in symptoms, prevalences of childhood abuse experiences, and results on paroxetine binding tests across borderline bulimics, nonborderline bulimics and normal-eater control groups. Where intercorrelations among measures existed, we applied multivariate analysis of variance (MANOVA), followed

by univariate ANOVAs and planned group comparisons (using Scheffe's tests). Frequency variables were analysed using Chi-Squared tests.

Results

Descriptive Variables

According to SCID-II criteria, none of the 25 Normal-Eater Controls (NEC) were identified as having Borderline Personality Disorder (BPD). However, we found a more sizable 10 (37.04%) of our 27 bulimic participants to meet BPD criteria. Whenever a BPD diagnosis was present, we assigned the participant to the Borderline-Bulimic group (BN/BPD, n = 10), and when not, to the Nonborderline Bulimic group (BN/noBPD, n = 17). A one-way ANOVA, followed by group comparisons (using Scheffe), revealed that BN/BPD and BN/noBPD groups did not differ on mean Age (27.4 ± 6.62; 27.35 ± 7.04), but both groups of BN sufferers did tend to differ significantly from normal-controls (20.8 ± 3.7) [$F(2, 49) = 9.08$, $p < .001$]. Given differences on age, group differences of interest were confirmed with age as a covariate (described in a later section). Mean Body Mass Index-BMI (20.6 ± 2.6; 22 ±4.5; 20.7 ± 1.9 for BN/BPD, BN/noBPD and NEC groups, respectively) did not differentiate any of the groups. As it was contraindicated to remove or delay pharmacotherapy in some cases, we included 7 participants in the BN/BPD group and 5 in the BN/noBPD group who were taking medication (all selective serotonin reuptake inhibitors-SSRIs). In 2 of the cases, additional medication was being administered- Chlorazil in one case, Xanax in the other. We reasoned that medication effects (if anything) would tend to normalize symptoms and serotonin indices, and hence bias against detection of differences between clinical and nonclinical groups. However, checks on effects of medication (described in a later section) suggested that this factor did not confound

differences obtained on 5-HT indices. Some participants across the BN/BPD (5), BN/noBPD (8), and NEC (11) groups were taking contraceptive medication, but we also verified the extent to which this factor might confound differences obtained on 5-HT indices (described in a later section).

Eating Symptoms

Table 1 shows means (± SDs) and frequencies for BN/BPD, BN/noBPD and NEC groups on Binge Frequency, Vomit Frequency, and the EAT-26 test. The table also shows numbers and proportions of cases who reported Laxative Abuse, Diuretic Abuse, and Intense Exercising. Results indicate both bulimic groups to show predictably elevated eating symptoms relative to the NEC group.

Given zero Binge/Vomit frequencies in the NEC group, we applied no statistical tests to clinical/nonclinical differences on these variables. We used t-tests to compare scores between "borderline" and "nonborderline" groups. These tests failed to differentiate BN/BPD from BN/noBPD groups. BPD cases tended to show, however, slightly higher scores on both variables. Due to small numbers of cases reporting Laxative Abuse, Diuretic Abuse, and Intense Exercising, no statistical tests were applied on these variables. Proportions seem comparable, however, across BN/BPD and BN/noBPD groups. These behaviours were absent in NEC participants. On EAT-26 scores, a significant group effect was obtained in a one-way ANOVA [$F(2, 49) = 50.51$, $p < .001$], and this group effect was confirmed, with age as a covariate, using ANCOVA [$F(2, 48) = 40.82$, $p < .001$]. Scheffe's test indicated reliable bulimic versus nonbulimic differences, but again, no

TABLE 1. Scores on eating symptoms for bulimics with BPD, bulimics without BPD and normal-controls

	Group			T-Test
Variable	**1 bulimic with BPD (n= 10)**	**2 bulimic no BPD (n= 17)**	**3 normal-control (n= 25)**	**df= 24 1 vs 2**
Binge Frequency	15.56 (± 9.06)	15.12 (± 10.40)	0.00 (± 0.00)	-0.107
Vomit Frequency	16.11 (± 12.39)	13.94 (± 11.68)	0.00 (± 0.00)	-0.44
				Univariate ANOVA
Eating Attitudes Test ***Total Score***	39.09[a] (± 13.35)	31.47[a] (± 15.42)	4.26[b] (± 4.31)	F (2, 49) 50.51**
	N %	**N %**	**N %**	
Laxative Abuse	4 40.0	3 17.7	0 0.0	
Diuretic Abuse	0 0.0	1 5.9	0 0.0	
Intense Exercising	4 40.0	11 64.7	0 0.0	

Means with different subscripts differ at the $p < .05$ level.
** $p < .001$

borderline/nonborderline differences. Mean scores in both bulimic groups were consistent with a clinical eating disorder, whereas the NEC mean score showed absence of clinical eating-disorder symptoms.

Psychiatric Symptoms

Table 2a shows mean (± SD) scores for BN/BPD, BN/noBPD and NEC groups on Impulsivity (Barrat Impulsivity Scale- BIS), and table 2b shows respective mean (± SD) scores for Dissociation (Dissociative Experiences Scale- DES), Affective Instability (DAPP-BQ) scales, and depression (BDI/CES-D). Means generally indicate a progressive decrease in symptoms across these groups.

Given statistical redundancies among measures of comorbid symptoms, one-way multivariate analysis of variance was used to test overall group effects on all measures of psychiatric symptoms. One-way MANOVA including the 3 indices of psychopathology (BIS Total Score, DES Total Score, and Affective Instability subscale of DAPP-BQ) and depression yielded a reliable omnibus effect [Wilks' Lambda (8, 92) = 62.38, $p < .001$]. We therefore proceeded to univariate ANOVAs. The Attention dimension [$F(2, 49) = 12.46$, $p < .001$], the Motor dimension [$F(2, 49) = 8.85$, $p < .01$] , the Non-Planning dimension [$F(2, 49) = 5.2$, $p < .01$], the BIS Total Score [$F(2, 49) = 12.08$, $p < .001$], Dissociation [$F(2, 49) = 7.79$, $p < .01$], Affective Instability [$F(2, 49) = 21.72$, $p < .001$], and depression scores [$F(2, 49) = 10.97$, $p < .001$] all yielded significant group effects (see Tables 2a and 2b). More importantly for the purpose of this study , ANCOVAs confirmed group effects for Impulsivity [$F(2, 48) = 8.07$, $p < .01$] , Dissociation [$F(2, 48) = 5.05$, $p < .05$] and

TABLE 2a. Scores on psychiatric symptoms for bulimics with BPD, bulimics without BPD and normal-controls

	Group			Univariate
	1	2	3	ANOVAs
Variable	**bulimic with BPD (n= 10)**	**bulimic no BPD (n= 17)**	**normal-control (n= 25)**	**F (2, 49)**
Barrat Impulsivity Scale *Attention Dimension*	21.79[a] (± 3.70)	19.29[a] (± 3.72)	16.30[b] (± 2.26)	12.46**
Barrat Impulsivity Scale *Motor Dimension*	27.04[a] (± 4.51)	23.19[ab] (± 3.56)	20.76[b] (± 4.12)	8.85*
Barrat Impulsivity Scale *Non-Planning Dimension*	30.73[a] (± 5.22)	24.76[b] (± 4.68)	25.27[b] (± 5.14)	5.20*
Barrat Impulsivity Scale *Total Score*	79.55[a] (± 9.97)	67.25[b] (± 9.35)	62.34[b] (± 9.12)	12.08**

Means with different superscripts differ at the $p < .05$ level. * $p < .01$ ** $p < .001$

TABLE 2b. Scores on psychiatric symptoms for bulimics with BPD, bulimics without BPD and normal-controls

	Group			Univariate
	1	2	3	ANOVAs
Variable	**bulimic with BPD (n= 10)**	**bulimic no BPD (n= 17)**	**normal-control (n= 25)**	**F (2, 49)**
Dissociative Experiences Scale ***Total Score***	27.07[a] (± 14.56)	12.84[b] (± 13.45)	9.90[b] (± 9.02)	7.79*
DAPP ***Affective Instability Subscale***	64.43[a] (± 10.08)	56.58[a] (± 13.33)	37.86[b] (± 12.23)	26.01**
Depression BDI/CES-D	0.62[a] (± 0.83)	0.47[a] (± 1.22)	-0.56[b] (± 0.44)	10.97**

Means with different superscripts differ at the $p < .05$ level. * $p < .01$ ** $p < .001$

Affective Instability [$F(2, 48) = 8.84$, $p < .01$], with Depression treated as a covariate. ANCOVAs also confirmed group effects for Impulsivity [$F(2, 48) = 14.12$, $p < .001$], Dissociation [$F(2, 49) = 6.4$, $p < .01$] and Affective Instability [$F(2, 49) = 16.82$, $p < .001$], with Age as a covariate.

Group comparisons (conducted with Scheffe's tests) indicated the following: on Impulsivity and Dissociation, differences between NEC and BN/noBPD groups, and then BN/noBPD and BN/BPD groups, were both reliable. On Affective Instability, the same trend emerged in scores, although in this case, both bulimic groups differed from controls, but the difference between BN/BPD and BN/noBPD groups was non-significant. On depression, both groups of bulimics did not significantly differ, but scored, as would be expected, significantly higher than normal-eater controls. Results suggest that dimensions believed to be pathognomonic of BPD (i.e., impulsivity and dissociation) were elevated only in borderline bulimics, and not in nonborderline bulimics. Conversely, depression and affective instability seemed to be characteristic of both bulimic groups, and not uniquely a "borderline" trait.

Measures of Childhood Abuse

Tables 3a and 3b respectively show numbers (and proportions) of participants in each group who reported sexual and physical abuse (prior to age 15) as having been *Absent*, as having been *Very isolated* (occurring less than or equal to 2 times/year), *Moderately frequent* (occurring 3-12 times/year), or *very frequent* (occurring more than 12 times/year). Values indicate that any form of abuse, and especially recurrent abuse, tended to be characteristic

TABLE 3a. Prevalence of Childhood Sexual Abuse in bulimics with BPD, bulimics without BPD and normal-controls

		Group					
		bulimic with BPD (n= 10)		bulimic no BPD (n= 17)		normal-control (n=25)	
	Type of Sexual Abuse	N	%	N	%	N	%
(1)	No sexual abuse	2	20.0	7	41.2	15	60.0
(2)	Very isolated events of sexual abuse	1	10.0	8	47.1	9	36.0
(3)	Moderately frequent sexual abuse	5	50.0	2	11.8	0	0.0
(4)	Very frequent sexual abuse	2	20.0	0	0.0	1	4.0
(5)	Any abuse	8	80.0	10	58.9	10	40.0

X^2 (2) = 17.98, $p < .001$ for categories 1 and 2 versus 3 and 4

TABLE 3b. Prevalence of Childhood Physical Abuse in bulimics with BPD, bulimics without BPD and normal-controls

		Group					
		bulimic with BPD (n= 10)		bulimic no BPD (n= 17)		normal-control (n=25)	
	Type of Physical Abuse	N	%	N	%	N	%
(1)	No physical abuse	0	0.0	5	29.4	10	40.0
(2)	Very isolated events of physical abuse	2	20.0	5	29.4	7	28.0
(3)	Moderately frequent physical abuse	3	30.0	5	29.4	7	28.0
(4)	Very frequent physical abuse	5	50.0	2	11.8	1	4.0
(5)	Any abuse	10	100.0	12	70.6	15	60.0

X^2 (2) = 7.01, $p < .01$ for categories 1 and 2 versus 3 and 4

of BN/BPD patients.

A 3 X 2 chi-square test comparing proportions of cases in each of the 3 groups who reported Sexual Abuse to have been absent or isolated (categories 1-2), versus moderately frequent or very frequent (categories 3-4), yielded a reliable group effect, [X^2 (2) = 17.98, $p < .01$]. In the case of Sexual Abuse, the percentage of participants in each group for the two combined categories respectively were: 30% and 70% for bulimics with BPD, 88.3% and 11.8% for bulimics without BPD, and 96% and 4%for normal-controls. A parallel analysis of Physical Abuse values also indicated significant results, [X^2 (2) = 7.01, $p < .01$]. In the case of Physical Abuse, the percentage of participants in the two combined categories respectively were: 20% and 80% for bulimics with BPD, 58.8% and 41.2% for bulimics without BPD, and 68% and 32% for normal-controls. In both types of abuse, results imply that the more severe forms of abuse were more frequent among borderline bulimics than among nonborderline bulimics, and hence that childhood abuse seems more strongly linked to BPD than to BN, in general.

Serotonin Function

Results on paroxetine binding measurements, reflecting Receptor Density (Bmax) and Binding Affinity (Kd), are shown for the three groups in Table 4. Note that these measurements were obtained in only a subset of cases, and reflect findings in 7 BN/BPD, 7 BN/noBPD, and 16 NEC participants. Mean Bmax scores in both bulimics groups were distinctively lower than in the NEC group, while mean Kd scores were lower in the nonborderline bulimic group only, compared to the borderline bulimic and NEC groups.

Univariate ANOVAs yielded reliable group differences on Bmax [$F(2, 27) = 12.12$, $p < .001$] and Kd [$F(2, 27) = 5.84$, $< .01$] scores. Group contrasts (Scheffe) indicated that for Bmax , both bulimic groups (BN/BPD and BN/noBPD) scored reliably lower than did the NEC group, and for Kd, only the BN/noBPD group scored lower (indicating higher affinity) than the NEC group. There appears to be somewhat of a tendency for the BN/BPD group to have higher density (Bmax) than the BN/noBPD group. We acknowledge this apparent difference, despite the fact that it did not emerge as significant in the 3-group ANOVA performed on the groups' respective means. We assume spurious variation due to the small number of subjects to be responsible for the apparent difference. Moreover, recently available data comparing participants from BN/BPD and BN/noBPD groups on paroxetine binding measurement in a larger sample, has shown the absence of such differences between the two groups (Steiger, Léonard, Ying Kin, Ramdoyal, Lehoux & Lageix, 1998). ANCOVAs with age as a covariate confirmed group effects for both Bmax [$F (2, 26) = 8.09$, $p <.01$] and Kd [$F (2, 26) = 5.84$, $p < .01$] scores. Similarly, ANCOVAs also confirmed group effects for Bmax [$F (2, 26) = 8.24$, $p < .01$] and Kd [$F (2, 26) = 4.37$, $p < .05$] scores, with depression as a covariate. Therefore, unlike other results, which tended to associate most severe disturbances with the BN/BPD group, reduced receptor density seemed to be broadly characteristic of BN sufferers, independently of Axis-II comorbidity. On the measures of binding affinity (Kd), results were less consistent. Results suggest that nonborderline bulimics showed higher binding affinity, but the same tendency was not observed in borderline bulimics. Since we did not observe consistent effects on affinity across both bulimic groups, we reserve interpretation of this result. We suspect the

TABLE 4. Scores on paroxetine binding for bulimics with BPD, bulimics without BPD and normal-controls

	Group			Univariate
	1	2	3	ANOVAs
Variable	**bulimic with BPD (n= 7)**	**bulimic no BPD (n= 7)**	**normal-control (n= 16)**	**F**
Bmax (number of binding sites)	528.71[a] (± 192.82)	292.14[a] (± 117.57)	1047.25[b] (± 467.95)	F (2, 27) 12.12**
Kd (binding affinity)	2.09[ab] (± 0.68)	1.13[a] (± 0.47)	2.39[b] (± 0.96)	F (2, 26) 5.84*

Means with different superscripts differ at the $p < .05$ level.
* $p < .01$
** $p < .001$

possibility of spurious effects, related to small sample size on paroxetine binding.

To examine the extent to which medication effects might have influenced findings, we computed mean Bmax and Kd scores for medicated and non-medicated cases. Resulting values (±SDs) for Bmax scores were 467.67 ± 195.82 and 367.5 ± 198.49 respectively. For Kd scores, corresponding values were 1.98 ± 0.8 and 1.33 ± 0.62. T-tests were used to compare each pair of means, and results were nonsignificant. Respective *t* and *p* values were [T(12) = -0.94, p = .37] and [T(12) = -1.72, p = .11]. Based on these indices, there seems to have been no striking effect of medication on Bmax and Kd scores. Given ns involved, we acknowledge limitations of this verification, and we note that future replication of findings is required. There was a similar concern that contraceptive medication may have affected blood-test results, since some studies (done with rats) have suggested that hormones like progesterone and oestrogen upregulate 5-HT receptors (Ladisich, 1977; Bigon, Bercovitz, & Samuel, 1980). However, other studies indicate no such effects (Ortiz, Artigas, & Gelpi, 1988). We found no differences on t-tests comparing Bmax and Kd scores between subjects taking contraceptive medication (n = 13- Bmax: 662.46 ± 324.46; Kd: 1.98 ± 0.99) and those that were not (n = 15- Bmax: 877.4 ± 588.99; Kd: 2.19 ± 0.87). Respective *t* and *p* values were [T(26) = -1.17, p = .25] and [T(26) = -0.58, p = .57]. This implies that blood test results were not largely influenced by contraceptive medication. A final concern was that the observed 5-HT dysfunction in bulimic groups might have been a consequence of active BN. However, there was no significant correlation between (a) Body Mass Index and either Bmax [Pearson r = .149, p > .05] or Kd [Pearson r = .079, p > .05], and between (b) Binge Frequency and either Bmax [Pearson r = -.228, p > .05] or Kd [Pearson r = -.268, p > .05].

Therefore, results do not seem to have been influenced by restrictive eating or binge eating, and imply that the observed 5-HT abnormalities are not a consequence of disturbed eating habits.

Discussion

The main goal of this study was to specify whether dissociation, affective instability, impulsivity, childhood trauma and serotonin dysfunction were generally linked to BN, or perhaps more specifically associated with borderline personality pathology.

Group Comparisons on Clinical Indices

On various clinical indices, our findings show expected differences between "borderline bulimics", "nonborderline bulimics" and "normal-eater controls". Relative to normal-eaters, bulimics displayed more severe eating symptoms (Binge and Purge frequencies, EAT-26 scores) and more severe general psychopathology (Impulsivity, Dissociation, Affective Instability and Depression). More importantly for the purpose of this study, borderline bulimics displayed distinctively more Impulsivity, Dissociation, and somewhat greater Affective Instability and Depression, than did nonborderline bulimics. In contrast, borderline bulimics did not display more severe eating symptoms (with only small tendencies toward elevated scores) relative to non-borderline bulimics. These findings are consistent with previous studies reporting the absence of borderline/nonborderline differences on eating symptoms in bulimic populations (Johnson, Tobin, & Dennis, 1990; Steiger et al., 1993; Steiger et al., 1994).

Dissociation (Chandarana & Malla, 1989; Miller et al., 1993; Covino et al., 1994), Impulsivity (Mitchell et al., 1986; Fahy & Eisler, 1993) and Affective Instability (Herzog et al., 1992; Lehoux et al., in press; Steiger et al., 1997) are features that have been repeatedly associated with BN. However, since in this study such features were found to

occur more extensively in BN sufferers with a comorbid BPD, results suggest that these symptoms may be more characteristic of BPD (in some sufferers), than of BN in general. Given that the borderline subgroup shows a distinctly more severe psychopathology, but only marginally more severe eating disturbances, our findings are consistent with previous evidence supporting the idea that severity of eating symptomatology is independent of Axis-II comorbidity (Steiger et al., 1993; Steiger & Stotland, 1996; Wonderlich et al., 1994).

Childhood Trauma

Consistent with the notion that BN and personality pathology may be independent entities, our results suggest possible differences as to causal processes linked to each form of disturbance. BN sufferers with a comorbid BPD experienced distinctively more severe and more frequent physical and sexual abuse, than did bulimic participants without BPD. Our findings here replicate those of previous studies, which report prevalences of childhood abuse to increase, in BN sufferers, in function of personality pathology, and in particular, of BPD comorbidity (Fullerton, Wonderlich, & Gosnell, 1995; Steiger et al., 1996; Waller et al., 1993). Also consistent with proportions reported in previous studies (Brown & Anderson, 1991; Everill & Waller, 1995; Waller, 1993), our results reveal a distinctively more severe pattern of abuse for the BN/BPD group, where up to 60% of participants have reported severe childhood abuse. Therefore, we infer from such findings that childhood abuse is more strongly associated with borderline personality pathology, than with BN in general.

Paroxetine Binding

Results on paroxetine binding must be regarded as being preliminary, since they were obtained in a small subset of cases, some of whom were medicated at the time of the study. However, we did take precautions to ensure reliability of the results: (a) our testing procedure involved careful washing of platelet membranes, to ensure the absence of other drugs which could compete with paroxetine in the binding process, (b) the binding was found to be specific to paroxetine at 70-80% of the total binding capacity, and (c) no differences were detected in Bmax or Kd values across medicated and non-medicated participants. Since such measures were taken, we are inclined to interpret group effects found on paroxetine binding measures as reflecting true differences in 5-HT function. We acknowledge, at the same time, that interpretation must be reserved, and that future replication of results is needed.

In a prior study using imipramine binding, it was noted that BN sufferers have significantly lower receptor density (Bmax) than normal-eater controls, but no abnormalities linked to binding affinity (Kd) (Marazziti et al., 1988). Consistent with these findings, our results imply reduced pre-synaptic 5-HT receptor density (Bmax) in bulimics alike, relative to normal-eater controls. Furthermore our findings indicate no borderline/nonborderline differences on this measure of receptor density, suggesting that pre-synaptic 5-HT dysfunction is generally characteristic of BN, independently of Axis-II comorbidity. Such findings are relevant to treatment used with BN sufferers, since SSRIs (which are believed to act on the pre-synaptic region) have been shown to improve bulimic symptoms (Kennedy & Goldbloom, 1991; Pope et al., 1983). We await further data (currently being obtained in

our research group), before ruling out the possibility that other 5-HT irregularities, consistent with post-synaptic effects, may yield borderline/non-borderline differences in BN.

Our results revealed higher binding affinity (Kd) for the non-borderline bulimics only, compared to normal-eater controls. Increased binding affinity is consistent with reduced receptor density (Bmax). Elevated pre-synaptic binding affinity might result in an increased 5-HT uptake, and might have as a consequence to downregulate the serotonin transporter, and therefore decrease levels of circulating 5-HT. Failure to detect a similar pattern in the borderline bulimics may be due to a small n or to medication effects.

Our findings do not allow us to determine whether effects observed on paroxetine binding measures reflect causal processes, or consequences of active BN. However, to address this issue, we tested associations between Bmax/Kd levels and each of (a) Frequency of Binge Episodes, and (b) Body Mass Index. Resulting correlations (shown in results section) were weak and nonsignificant, suggesting that the observed 5-HT abnormalities may not be a consequence of the eating disorder.

Nature of the Relationship between BN and BPD

Our results suggest that bulimic eating symptoms and BPD are, in some ways, independent entities with different causal factors. Borderline bulimics showed distinctively more generalized psychopathology (Impulsivity, Dissociation, and Affective Instability) compared to nonborderline bulimics, but similar eating-symptom severity. Moreover, the prominence of childhood abuse in borderline bulimics, compared to nonborderline bulimics, suggests that childhood abuse is more specifically associated with BPD, than with BN in

general. If BN and BPD are independent in the fashion suggested, then the question arises: "Why do BN and BPD co-occur so strongly?"

A common link between BN and BPD may be 5-HT dysfunction. In fact, our results on paroxetine binding show that BN sufferers in general tend to display pre-synaptic 5-HT dysfunction, independently of Axis-II comorbidity. Moreover, both BN and BPD have been repeatedly associated with 5-HT abnormalities (Weltzin et al., 1994; Levitan et al., 1997; Gardner et al., 1990; Martial et al., 1997), and more precisely with pre-synaptic 5-HT dysfunctions (Goldbloom et al., 1990; Marazziti et al., 1988; Coccaro, Kavoussi, Sheline, & Lish, 1996).

Pre-synaptic 5-HT dysfunction may explain the co-occurrence of BN and a variety of other psychiatric disorders, but especially in this case, the co-occurrence of BN and BPD. However, not all BN sufferers have a comorbid BPD, suggesting that there may be different pathways leading to the development of BN. On one hand, 5-HT abnormalities observed in certain BN sufferers (without a comorbid BPD) may be secondary to disturbed eating behaviours like undereating. The resulting 5-HT abnormalities could in turn increase the risks of developing BN. On the other hand, 5-HT dysfunctions observed in BN patients with a comorbid BPD may exist prior to the development of any kind of pathological behaviours related to BN, or to the development of BN per se. In that sense, pre-synaptic abnormalities observed in BPD patients may make them more vulnerable to developing a disorder like BN.

In addition to sharing pre-synaptic 5-HT abnormalities with BN (Coccaro et al., 1996), BPD has also been associated with post-synaptic abnormalities (Martial et al., 1997; Hollander et al., 1994; Soloff et al., 1994). The fact that BPD patients may have post-

synaptic 5-HT disturbances, in addition to pre-synaptic ones, may explain the absence of borderline/non borderline differences in 5-HT functioning in our findings. BPD may therefore involve both pre and post-synaptic disturbances, while BN may be more linked to pre-synaptic dysfunction only. In this study we have used paroxetine binding, from which we can only infer 5-HT pre-synaptic functioning, and we may have missed some existing differences at the post-synaptic level. We await further data (currently being obtained in our research group) measuring post-synaptic activity in BN sufferers with and without BPD.

Limitations

In assessing these findings, some possible methodological issues should be considered. First, our results on paroxetine binding should be interpreted carefully for the following reasons: (a) Paroxetine binding is a peripheral method used to infer, from blood platelets, 5-HT activity in the brain, and therefore does not assess 5-HT functioning at its source , (b) Only a subset of participants agreed to the blood test, resulting in a relatively small n, (c) We used medicated subjects, which may have contaminated results, and (d) We only measured pre-synaptic 5-HT activity, and may therefore have failed to detect existing post-synaptic differences between borderline and non-borderline bulimics.

Conclusion

This study has compared BN sufferers with and without a comorbid BPD on several clinical symptoms and vulnerability factors. Borderline bulimics display more severe general psychopathology (Impulsivity, Dissociation, and somewhat Affective Instability) than nonborderline bulimics, but not characteristically more severe eating symptoms. Childhood trauma seems to be more associated with BPD than with BN, while pre-synaptic 5-HT dysfunction seems to be linked to BN in general, independent of Axis II comorbidity.

Despite such evidence suggesting important clinical distinctions between BN and BPD, BPD remains a comorbid disorder in up to a third of BN sufferers (Vitousek & Manke, 1994; Johnson & Wonderlich, 1992; Steiger & Seguin, in press). According to our findings, one possible basis for convergence may be 5-HT disturbance. The co-occurrence of BN and BPD may therefore be explained by a pre-synaptic serotonergic dysfunction shared by both disorders. While pre-synaptic 5-HT abnormalities constitute a vulnerability for BN in itself, it is possible that BPD is also linked to post-synaptic abnormalities; which could explain the absence of borderline/non-borderline differences in this study. Future studies focusing on post-synaptic 5-HT functioning should provide new evidence on serotonergic functioning in BN sufferers with and without a comorbid BPD.

Our findings may be relevant to treatment of BN in the following sense: results from this study are consistent with the observed therapeutic effect of selective serotonin reuptake inhibitors-SSRIs (which are believed to act on the pre-synaptic region) in relieving eating symptoms in BN sufferers. Concerning psychotherapy, our results suggest that BN sufferers

as a group may not require identical treatment plans. In fact, this study provides evidence for important clinical distinctions between BN sufferers with and without a comorbid BPD. In the case of borderline bulimics, they could be given specific treatment for their psychiatric symptoms (e.g., impulsivity, dissociation) in addition to treatment for their eating disorder, or they could also be referred elsewhere for the treatment of their personality disorder. In another sense and in the optic of treating BN only, our results also imply that treating BN in borderline bulimics is similar to treating BN in nonborderline bulimics, since BPD is independent of BN. Therefore, one clinical implication of this study is that treatment of BN is beneficial for bulimic patients in general, even thought in the case of borderline bulimics the personality disorder may not be addressed or resolved.

Reference List

American Psychiatric Association. (1994).Diagnostic and statistical manual for mental disorders. Washington, APA Washington.

Arora, R.C., Fichtner, C.G., O'Connor, F., & Crayton, J.W. (1993). Paroxetine binding in the blood platelets of post-traumatic stress disorder patients. Life Sciences, 53, 919-928.

Barrat, E. (1985). Impulsive subtraits: Arousal and information processing. In JT Spence & CE Izard (Eds.). Motivation, emotion and personality (pp. 137-146). New-York: Elsevier.

Beck, A.T. & Beck, R.W. (1972). Screening depressed patients in family practice: a rapid technique. Postgraduate Medicine, December: 81-85.

Bernstein, E.M. & Putnam, F.W. (1986). Development, reliability and validity of a dissociation scale. Journal of Nerv Mental Disease, 174, 727-735.

Beumont, P., Al-Alami, M., & Touyz, S. (1988). Relevance of a standard measurement of undernutrition to the diagnosis of Anorexia Nervosa: use of Quetelet's Body Mass Index. International Journal of Eating Disorders, 7, 399-405.

Bigon, A., Bercovitz, H., & Samuel, D. (1980). Serotonin receptor concentration during estrus cycle of the rat. Brain Research, 187, 221-225.

Bourque, P. & Beaudette, D. (1982). Etude psychometrique du questionnaire de depression Beck aupres d'un echantillion d'etudiants universitaires francophines. Revue Canadienne des Sciences du Comportement, 14, 211-218.

Brewerton, T.D. (1995). Toward a unified theory of serotonin dysregulation in eating and related disorders. Psychoneuroendocrinology, 20:6, 561-590.

Brown, G.L., Elbert, M.H., Goyer, P.F., Jimerson, D., Klein, W.J., Bunney, W.E., & Goodwin, F.K. (1982). Aggression, suicide, and serotonin: relationships to CSF amine metabolites. American Jounal of Psychiatry, 139, 741-746.

Brown, G.R. & Anderson, B. (1991). Psychiatric morbidity in adult inpatients with childhood histories of sexual and physical abuse. American Journal of Psychiatry, 148:1, 55-61.

Bulik, C.M., Sullivan, P.F., Carter, F.A., & Joyce, P.R. (1996). Lifetime anxiety disorders in women with Bulimia Nervosa. Comprehensive Psychiatry, 37:5, 368-374.

Bushnell, J. A., Wells, J.E., & Oakley-Browne, M.A. (1992). Long term effects of intrafamilial sexual abuse in childhood. Acta Psychiatrica Scandinavica, 85, 136-142.

Bushnell, J.A., Wells, J.E., & Oakley-Browne, M.A. (1996). Impulsivity in disordered eating, affective disorder and substance use disorder. British Journal of Psychiatry, 169, 329-333.

Byrne, C.P., Velamoor, V.R., Cernovsky, Z.Z., & Cortese, L. (1990). A comparison of borderline and schizophrenic patients for childhood life events and parent-child relationships. Canadian Journal of Psychiatry, 35, 590-595.

Calam, R.M. & Slade, P.D. (1989). Sexual experience and eating problems in female undergraduates. International Journal of Eating Disorders, 8:4, 391-397.

Cash, R., Ruberg, M. , Raisman, R., & Agid, M. (1984). Adrenergic receptors in Parkinsons' disease. Brain Research, 322:2, 269-275.

Chandarana, P. & Malla, A. (1989). Bulimia and dissociative states: a case report. Journal of Psychiatry, 34, 137-139.

Coccaro, E.F., Siever, L.J., Klar, H.M., & Maurer, G. (1989). Central serotonin and impulsive aggression. British Journal of Psychiatry, 155:8, S52-62.

Coccaro, E.F. et al. (1989). Serotonergic studies in patients with affective and personality disorders. Archives of General Psychiatry, 46, 587-599.

Coccaro, E.F., Kavoussi, R.J., Sheline, Y.I., & Lish, J.D. (1996). Impulsive aggression and personality disorder correlates tritiated paroxetine binding in platelets, Archives of General Psychiatry, 53:6, 531-536.

Connors, M.E. & Morse, W. (1993). Sexual abuse and eating disorders: a review. International Journal of Eating Disorders, 13:1, 1-11.

Covino, N.A., Jimerson, D.C., Wolfe, B.E., Franko, D.L., & Frankel, F.H. (1994). Hypnotizability, dissociation and Bulimia Nervosa. Journal of Abnormal Psychology, 103:3, 455-459.

Crago, M., Shisslak, C.M., & Estes L.S. (1996). Eating Disturbances among American minority groups. International Journal of Eating Disorders, 19, 239-248.

Demitrack, M.A., Putnam, F.W., Brewerton, T.D., Brandt, H.A., & Gold, P.W. (1990). Relation of clinical variables to dissociative phenomena in eating disorders. American Journal of Psychiatry, 147, 1184-1188.

Demitrack, M.A., Putnam, F.W., Rubinow, D.R., Pigott, T.A., Altemus, M., Krahn, D.D., & Gold, P.W. (1993). Relation of dissociative phenomena to levels of cerebrospinal fluid monoamine metabolites and beta-endorphin in patients with eating disorders: a pilot study. Psychiatry Research, 49, 1-10.

de Vegvar, M.L., Siever, L.J., & Trestman, R.L. (1995). Impulsivity and serotonin in borderline personality disorder. In K.R. Silk (ed). Biological and Neurobehavioral Studies of Borderline Personality Disorder. Washington: American Psychiatric Press, pp. 23-40.

Everill, J.T. & Waller, G. (1995). Reported sexual abuse and eating psychopathology: a review of the evidence for a causal link. International Journal of Eating Disorders, 18:1, 1-11.

Fahy, T. & Eisler, I. (1993). Impulsivity and eating disorders. British Journal of Psychiatry, 162, 193-197.

Fairburn, C.G. & Beglin, S.J. (1990). Studies of the epidemiology of bulimia nervosa. American Journal of Psychiatry, 147:4, 401-408.

Fairburn, C.G. & Cooper, P. (1993). The Eating Disorders Examination (12th Ed.). In C. Fairburn, G. Wilson (eds.). Binge eating: nature, assessment and treatment. New-York, NY: Guilford Press.

Fink, L. (1993). The Childhood Trauma Interview: Reliability, validity and relationship to personality disorders, in Proceedings of the Third International Congress on the Disorders of Personality. Roskilde, Denmark, International Society for the Study of Personality Disorders.

First, M.B., Spitzer, R.L., Gibbon, M., Williams, J.B.W., & Benjamin, L. (1994). Structured Clinical Interview for DSM-IV Axis-II Personality Disorders (SCID-II). New-York State Psychiatric Institute and American Psychiatric Association.

Folsom, V., Krahn, D., Nairn, K., Gold, L., Demitrack, M.A., & Silk, K.R. (1993). The impact of sexual and physical abuse on eating disordered and psychiatric symptoms: a comparison of eating disordered and psychiatric inpatients. International Journal of Eating Disorders, 13, 249-257.

Fullerton, D.T., Wonderlich, S.A., & Gosnell, B.A. (1995). Clinical characteristics of eating disorder patients who report sexual or physical abuse. International Journal of Eating Disorders, 17, 243-254.

Gard, M.C.E. & Freeman, C.P. (1996). The dismantling of a myth: a review of eating disorders and socioeconomic status. International Journal of Eating Disorders, 20, 1-12.

Gardner, Lucas, P.B., & Cowdry, R.W. (1990). CSF metabolites in borderline personality disorder compared with normal controls. Biological Psychiatry, 28, 247-254.

Garfinkel, P.E., Lin, E., Goering, P., Spegg, C., Goldbloom, D.S., Kennedy, S., Kaplan, A., & Woodside, D.B. (1995). Bulimia nervosa in a canadian community sample: prevalence and comparison of subgroups. American Journal of Psychiatry, 152:7, 1052-1058.

Garner, D.M., Olmsted, M.P., Bohr, Y., & Garfinkel, P.E. (1982). The EAT: Psychomatrix features and clinical correlates. Psychological Medicine, 12, 871-878.

Goldbloom, D.S., Hicks, L.K., & Garfinkel, P.E. (1990). Platelet serotonin uptake in bulimia nervosa. Biological Psychiatry, 28, 644-647.

Goldbloom, D.S. & Garfinkel, P.E. (1990). The serotonin hypothesis of bulimia nervosa: theory and evidence. Canadian Journal of Psychiatry, 35, 741-744.

Herman, J.L., Perry, J.C., & Van der Kolk, B. (1989). Childhood trauma in borderline personality disorder. American Journal of Psychiatry, 145:4, 490-494.

Herzog, D.B., Keller, M.B., Sacks, N.R., & Yeh, C.J. (1992). Psychiatric comorbidity in treatment-seeking anorexics and bulimics. Journal of American Academy of Child and Adolescent Psychiatry, 31, 810-818.

Herzog, D. B., Keller, M.B., Lavori, P.W., & Kenny, G.M.(1992). The prevalence of personality disorders in 210 women with eating disorders. Journal of Clinical Psychiatry, 53:5, 147-152.

Hollander, E., Stein, D.J., DeCaria, C.M., & Cohen, L.J. (1994). Serotonergic sensitivity in borderline personality disorder: preliminary findings. American Journal of Psychiatry, 151, 277-280.

Jimerson, D.C., Lesem, M.D., Kaye, W.H., & Brewerton, T.D. (1992). Low serotonin and dopamine metabolite concentrations in cerebrospinal fluid from bulimic patients with frequent binge episodes. Archives of General Psychiatry, 49, 132-138.

Jimerson, D.C., Wolfe, B.E., Metzger, E.D., Finkelstein, D.M., Cooper, T.B., & Levine, J.M. (1997). Decreased serotonin dysfunction in bulimia nervosa. Archives of General Psychiatry, 54, 529-534.

Johnson, C., Tobin, D.L., & Dennis, A. (1990). Differences in treatment outcome between borderline and nonborderline bulimics at one-year follow-up. International Journal of Eating Disorders, 9:6, 617-627.

Johnson, C. & Wonderlich, S. (1992). Personality characteristics as a risk factor in the development of Eating Disorders. In Crowter, J.H. et al. (Eds). The Etiology of Bulimia Nervosa: the individual and family context. Hemisphere Publishing: Ohio.

Kaye, W.H. & Weltzin, T.E. (1991). Neurochemistry of bulimia nervosa. Journal of Clinical Psychiatry, 52 (suppl), 21-28.

Kaye, W.H., Ballenger, J.C., Lydiard, R.B., Stuart, G.W., Laraia, M.T., O'Neil, P., Fossey, M.D., Stevens, U., Lesser, S., & Hsu, G. (1990). CSF monoamine levels in normal-weight bulimia: evidence for abnormal noradrenergic activity. American Journal of Psychiatry, 147, 225-229.

Kennedy, S.H. & Goldbloom, D.S. (1991). Current perspectives on drug therapies for anorexia nervosa and bulimia nervosa. Drugs 41, 367-377.

Lacey & Evans. (1986). The impulsivist: a multi-impulsive personality disorder. British Journalof Addiction, 81, 641-649.

Ladisich, W. (1977). Influence of progesteron on serotonin metabolism: a possible causal factor for mood changes. Psychoneuroendocrinology, 2, 257-266.

Langer, S.Z., Schoemaker, H., & Segonac, A. (1985). [^{3}H]- Paroxetine binding to human platelets: clues to a selectivity paradox from temperature studies. British Journal of Pharmacology, 96, 303-309.

Lehoux, P., Steiger, H., & Jabalpurwala, S. (in press). State/ trait distinctions in bulimic syndromes. International Journal of Eating Disorders.

Leibowitz, S.F. (1990). The role of serotonin in eating disorders. Drugs 39, suppl.3, 33-48.

Leichner, P., Steiger, H., Puentes-Neuman, G., Perreault, M., & Gottheil, N. (1994). Validation d'une échelle d'attitudes alimentaire auprès d'une population québécoise francophone. Canadian Journal of Psychiatry, 39, 49-54.

Levitan R.D., Kaplan, A.S., Joffe, R.T., Levitt, A.J., & Brown, G.M. (1997). Hormonal and subjective responses to intravenous meta-chlorophenylpiperazine in bulimia nervosa. Archives of General Psychiatry, 54, 521-527.

Livesley, W.J., Jackson, D.N., & Schroeder, M.L. (1992). Factorial structure of traits delineating personality disorders in clinical and general population samples. Journal of Abnormal Psychology, 101, 432-440.

Mann, J.J., McBride, P.A., Brown, R.P., Linnoila, M., Leon, A.C., Demeo, M., Mieckowski, T., Myers, J.E., & Stanley, M. (1992). Relationship between central and peripheral serotonin indexes in depressed and suicidal psychiatric inpatients. Archives of General Psychiatry, 49, 442-446.

Marazziti, D., Macchi, E., Rotondo, A., Placidi, G.F., & Cassano, G.B. (1988). Involvement of serotonin system in bulimia. Life Sciences, 43, 2123-2126.

Martial, J., Paris, J., Leyton, M., & Zweig-Frank, H., Schwartz, G., Teboul, E., Thavun dayil, J., Larue, S., Ying Kin NMK, & Vasa van Nair, N.P. (1997). Neuroendocrine study of serotonergic sensitivity in female borderline personality disorder patients. Biological Psychiatry, 42:8, 737-739.

McCarthy M.K., Goff, D.C., Baer, L., Cioffi, J., & Herzog, D.B. (1994). Dissociation, childhood trauma, and the response to fluoxetine in bulimic patients. International Journal of Eating Disorders, 15:3, 219-226.

McClelland, L., Mynors-Wallis, L., Fahy, T., & Treasure, J. (1991). Sexual abuse, disordered personality, and eating disorders. BritishJournal of Psychiatry, 158, 63-68.

Mellerup, E.T., Plenge, P., & Englestoft, M. (1983). High affinity binding of [^{3}H] paroxetine and [^{3}H] imipramine to human platelet membranes. European Journal of Pharmacology, 96, 303-309.

Miller, D.A.F., McCluskey-Fawcett, K., & Irving, L.M. (1993). The relationship between childhood sexual abuse and subsequent onset of bulimia nervosa. Child Abuse and Neglect, 17, 305-314.

Mitchell, J.E., Hatsukami, D., Pyle, R.L., & Eckert, E.D. (1986). The bulimia syndrome: the course of the illness and its associated problems. Comprehensive Psychiatry, 27, 165-170.

Newton, J.R., Freeman, CP., & Munro, J. (1993). Impulsivity and dyscontrol in Bulimia Nervosa: is an impulsivity independent phenomenon or a marker of severity ?. Acta Psychiatrica Scandinavica, 87, 389-394.

Ortiz, J., Artigas, F., & Gelpi, E. (1988). Serotonin status in human blood. Life Sciences, 43, 983-990.

Paris, J., Zweig-Frank, H., & Guzder, J. (1994). Psychological risk factors for BPD in female patients. Comprehensive Psychiatry, 35:4, 301-305.

Pecknold, J.C., Luthe, L., Iny, L., & Ramdoyal, D. (1995). Fluoxetine in panic disorder: pharmacologic and tritiated platelet imipramine and paroxetine binding study. Journal of Psychiatry Neurosciences, 20:3, 193-198.

Pope Jr, H.G., Hudson, J.I., & Jonas, J.M. (1983). Antidrepressant treatment of bulimia: preliminary experience and practical recommendations. Journal of Clinical Pharmacology, 3, 274-281.

Pope,H.G. & Hudson, J.I. (1986). Antidepressant drug therapy for bulimia: current status. Journal of Clinical Psychiatry, 47, 339-345.

Pope, E.F., Mangweth, B., Negrao, A.B., Hudson, J.I., & Cordas, T.A. (1994). Childhood sexual abuse and bulimia nervosa: a comparison of american, austrian and brazilian women.American Journal of Psychiatry, 151, 732-737.

Putnam, F.W. (1985). Dissociation as a response to extreme trauma. In: Kluft, R.P , ed. Childhood antecedents of multiple personality. Washington, DC: American Psychiatric Press, 66-97.

Rorty, M., Yager, J., & Rossotto, E. (1994). Childhood sexual, physical and psychological abuse in bulimia nervosa. American Journal of Psychiatry, 151, 1122-1126.

Rossiter, E. M., Agras, W.S., Telch, C.F., & Schneider, J.A. et al. (1993). Cluster B personality disorder characteristics predict outcome in the treatment of bulimia nervosa. International Journal of Eating Disorders, 13:4, 349-357.

Skodol, E., Oldham, J.M., Hyler, S.E., Kellman, H.D., Doidge, N., & Davies, M. (1993). Comorbidity of DSM-III-R eating disorders and personality disorders. International Journal of Eating Disorders, 14:4, 403-416.

Soloff, P.H. et al. (1994). Serotonin and impulsive-aggression in major depression and Cluster B personality disorders. Neuropsychophamacology, 10, 827S.

Steiger, H., Thibaudeau, J., Ghadirian, A.M., & Houle, L. (1992). Psychopathological features in bulimics as a function of Axis-II comorbidity: Isolation of mood-independent differences. International Journal of Eating Disorders, 12, 383-395.

Steiger, H., Leung, F., Thibaudeau, J., Houle, L., & Ghadirian, A.M. (1993). Comorbid features in bulimics before and after therapy: are they explained by Axis-II diagnoses, secondary effects of bulimia, or both ?. Comprehensive Psychiatry, 34:1, 45-53.

Steiger, H., Thibaudeau, J., Leung, F., Houle, L., & Ghadirian, A.M. (1994). Eating and psychiatric symptoms as a function of Axis-II comorbidity in bulimic patients. Psychosomatics, 35, 41-49.

Steiger, H., Jabalpurwala, S., & Champagne, S. (1996). Axis-II comorbidity and developmental adversity in bulimia nervosa. Journal of Nervous and Mental Disease, 184, 555-560.

Steiger, H., Jabapurwala, S., Champagne, J., & Stotland, S. (1997). A controlled study of trait narcissism in anorexia and bulimia nervosa. International Journal of Eating Disorders, 22, 173-178.

Steiger, H., Léonard, S., Ng Yin Kin, Ramdoyal, D., Lehoux, P., & Lageix, P. (1998). Childhood Abuse and Serotonin Abnormality in Bulimia Nervosa: Mediating Effects of Borderline Personality Disorder. Eating Disorders Research Society Meeting.

Steiger, H. & Stotland, S. (1996). Prospective study of outcome in bulimics as a function of Axis-II comorbidity: long-term responses on eating and psychiatric symptoms. International Journal of Eating Disorders, 20:2, 149-161.

Steiger, H. & Seguin, J. (in press). Eating Disorders: Anorexia Nervosa and Bulimia Nervosa. In T. Millon, P.H. Blaney, & R.D. Davis (Eds.). Oxford Textbook of Psychopathology. Oxford University Press.

Steiger, H. & Zanko, M. (1990). Sexual traumata in eating-disordered, psychiatric and normal female groups: Comparison of prevalences and defense styles. Journal of Interpersonal Violence, 5, 74-86.

Stone, M.H. The fate of borderline patients-successful outcome and psychiatric practice. Guilford Press, New-York-London, 1990.

Stuart, G., Laraia, M.T., Ballenger, J.C., & Lydiard, R.B. (1990). Early family experiences of women with bulimia and depression. Archives of Psychiatric Nursing, 4, 43-52.

Vanderlinden, J., Vandereycken, W., van Dyck, R., & Vertommen, H. (1993). Dissociative experiences and trauma in eating disorders. International Journal of Eating Disorders, 13:2, 187-193.

Vitousek, K. & Manke, F. (1994). Personality variables and disorders in anorexia nervosa and bulimia nervosa. Journal of Abnormal Psychology, 103, 137-147.

Vize, C.M. & Cooper, P.J. (1995). Sexual abuse in patients with eating disorders, patients with depression, and normal-controls- A comparative study. British Journal of Psychiatry, 167, 80-85.

Waller, G. (1991). Sexual abuse as a factor in eating disorders. British Journal of Psychiatry, 159, 664-671.

Waller, G. (1993). Sexual abuse and eating disorders. British Journal of Psychiatry, 162, 771-775.

Wiederman, M.W. & Pryor, T. (1996). Multi-impulsivity among women with Bulimia Nervosa. International Journal of Eating Disorders, 20:4, 359-365.

Weizman, A., Carmi, M., Hermish, H., Shahar, A., Apter, A., Tyano, S., & Rehavi, M. (1986). High affinity imipramine binding and serotonin uptake in platelets of eight adolescent and ten adult pbsessive compulsive patients. American Journal of Psychiatry, 143, 335-339.

Weltzin, T.E., Fernstrom, M.H., & Kaye, W.H. (1994). Serotonin and BN. Nutrition Reviews, 52:12, 399-408.

Wolfe, B.E., Jimerson, D.C., & Levine, J.M. (1994). Impulsivity ratings in bulimia nervosa: relationship to binge eating behaviors. International Journal of Eating Disorders, 15:3, 289-292.

Wonderlich, S.A., Fullerton, D., Swift, W.J., & Klein, M.H. (1994). Five-year outcome from eating disorders: relevance of personality disorders. International Journal of Eating Disorders, 15:3, 233-243.

Wonderlich, S.A., Brewerton, D., Jocic, Z., & Dansky, B.S. (1997). Relationship of childhood sexual abuse and eating disorders. Journal of American Academy of Child and Adolescent Psychiatry, 36:8, 1107-1115.

Wood, P., Suranyi-Cadotte, B.E., Nair, N.P., Lafaille, F., & Schwartz, G. (1983). Lack of association between [^{3}H] imipramine binding sites and uptake of serotonin in control, depressed and schizophrenic patients. Neuropharmacology, 22: 1211-1214.