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Hyperactivity in anorexia nervosa: A case study using experience sampling methodology

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Abstract

Hyperactivity is frequently observed in eating disorders, and several biopsychological mechanisms have been proposed to explain its pathogenetic role. In view of the lack of a reliable method to study hyperactive behavior, we did an experiment with experience sampling methodology (ESM). During 1 week, an anorexia nervosa (AN) patient was asked at nine random times a day to report her momentary tendency to be physically active, her emotions and several other variables including calorie expenditure, drive for thinness, attractiveness, obsessions, compulsions, and attitudes towards hyperactivity. Results indicate that the patient's tendency to be hyperactive was (a) positively related to her weight preoccupation and her negative emotions, and (b) negatively related to her positive emotions and the absence of depression. In this patient, obsessions and compulsions were not related to hyperactivity. The usefulness of ESM for studying the role of hyperactivity in AN is discussed.
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1. Introduction

Hyperactivity is frequently observed among patients with anorexia nervosa (AN) (Beumont, Arthur, Russell, & Touyz, 1994; Davis, 1997; Davis & Fox, 1993), and research indicates that the proportion of excessive exercisers among this group is substantially larger than in a nonclinical population (Kron, Katz, Gorzynski, & Weiner, 1978). Several biopsychological mechanisms have been proposed to explain

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the role of hyperactivity in AN. Three major ones can be summarized as follows: (1) By means of physical hyperactivity, AN patients burn calories and lose weight in order to feel more attractive. As such, undereating and overexercising may become mutually reinforcing behaviors that are resistant to change and cause "activity anorexia" (Davis, 1997; Davis, Kennedy, Ralevski, & Dionne, 1994; Epling & Pierce, 1996). (2) Obsessive–compulsive behavior may play an important role in the hyperactivity of AN patients, with physical hyperactivity being a ritualized or stereotyped obsessive–compulsive behavior (Davis, Kaptein, Kaplan, Olmsted, & Woodside, 1998; Davis et al., 1995). (3) Hyperactivity may act as a form of mood regulation or coping with stress; consequently, physical hyperactivity is a way of regulating negative emotions or affects (Casper, 1997; Davis & Fox, 1993; Davis, Katzman, & Kirsh, 1999; Markland & Ingledew, 1997).

But the research literature is still limited, probably in part because of the lack of a reliable methodology for the assessment of hyperactive behavior. Apart from animal experiments (see for example, Epling & Pierce, 1996) the majority of clinical–psychological research in eating disorders is based on retrospective self-reports of patients who are asked to report on their symptoms, emotions, behaviors, cognitions, and so forth. However, Shiffman and Stone (1998) convincingly argue that such self-reports are prone to serious errors and biases arising from the characteristics of autobiographical memory.

The experience sampling methodology (ESM) or ecologically momentary assessment (EMA) (Stone & Shiffman, 1994) is a method of data collection introduced by Csikszentmihali and Larson (1987) that tries to solve (at least partially) a number of problems related to traditional self-reporting. ESM essentially comes down to a collection of repeated momentary assessments by participants in their natural environments. Participants are provided with a wristwatch or palm top computer and are signaled or "beeped" at a number of random moments in a day for several days or weeks. At each signal, they have to report their momentary emotions, cognitions, and behaviors rather than being asked to summarize their emotions, cognitions, and behaviors. The advantages of ESM in comparison to traditional self-report can be summarized as follows (Shiffman & Stone, 1998): ESM data are less subject to bias introduced by recall and retrieval processes; ESM can claim strong ecological validity; and finally, ESM data are very well suited to explore the dynamic relationship between variables that interact over time, like eliciting factors, symptoms, emotions, cognitions, and behavior. Finally, ESM has been used in many areas of research including eating pathology (Smyth, Wonderlich, Crosby, Miltenberger, Mitchell, & Rorty, 2001) and its validity is well established (Stone et al., 1998).

The goal of the present study was to test the three biopsychological mechanisms concerning hyperactivity in AN as mentioned above by means of the ESM in a single case in order to find out whether the methodology could be useful and applicable in larger studies.

2. Method

2.1. Participant

The patient is an 18-year-old woman with AN of the restrictive type (DSM-IV) with a body mass index (BMI) of 15 kg/m^2 at the moment of the study; she stayed 4 weeks in the specialized inpatient eating disorders unit of the University Center St-Jozef in Kortenberg, Belgium. The patient gave informed consent and the Ethical Committee of the University Center in Kortenberg approved the research procedures.

2.2. Materials

An experience sampling questionnaire was developed including the following items.
Related to hyperactivity: "I feel the tendency to move"; "I am moving"; "I am exercising."
Related to the three hypothesized meanings or functions of hyperactivity (eliciting conditions):

1. With respect to burning calories and cognitions about losing weight: "I feel the tendency to burn calories" and "The thought of losing weight keeps me busy." The latter item stems from the Drive for Thinness Scale of the Dutch version of the Eating Disorder Inventory (EDI) (Garner, 1991; Van Strien, 2002). Furthermore, (lack of) attractiveness was represented by two items (from the Attractivity Scale of the EDI; Garner, 1991; Van Strien, 2002): "I feel ugly" and "I am feeling fat."
2. At a general level, obsessions and compulsions were represented by two items: "I am worrying and/or doubting all of the time" (obsessions) and "I am doing something slowly and/or several times until I am satisfied with the result" (compulsions). These items are both taken and slightly adapted from the Padua Inventory (Sanavio, 1988; Van Oppen, 1992; Van Oppen, Hoekstra, & Emmelkamp, 1995). At a more specific level, attitudes towards exercising are represented by two items: "I think that exercising is important to my general well-being" (obligatory) and "I am continuing to exercise although I feel tired or unwell" (pathological). Both items are taken (and slightly adapted) from, respectively, the obligatory and pathological attitudes to exercise scales of the Commitment to Exercise Scale (Davis, Brewer, & Ratsuny, 1993).
3. To test the relation between emotions and hyperactivity, a number of emotions were included in the questionnaire, inspired by the work of Diener, Smith, and Fujita (1995). These authors used a systematic screening method to sample emotions from the emotion domain, which resulted in six emotion categories: anger–disgust, fear, shame–guilt, sadness, joy, and love. We generated two emotion words for each category that were relevant for our patient (see Table 1).

All these items were presented in random order in the questionnaire.

Finally, our patient had to fill-out the exact time when she was filling out the questionnaire: "At this moment, it is. . .hour. . .minutes (e.g., 6:12 p.m.).

2.3. Procedure

The patient received a digital wristwatch, a pencil, and seven small booklets (one booklet a day) containing 10 experience sampling questionnaires (9 effective and 1 backup). From the next day on, she received nine beeps a day during 1 week (nine beeps × 7 days = 63 beeps). The beeps were programmed according to a stratified random interval time series (Delespaul, 1995) in order to avoid anticipation or actor observer phenomena. This means that a day was subdivided in nine successive blocks of 90 minutes starting from 9 a.m.; within each block of 90 minutes, one beep was generated with each minute of the time block having the same probability of being selected. After each beep, the participant had to indicate on a seven-point scale (0 = *not applicable at all* to 6 = *completely applicable*) to what extent the questions mentioned under the heading Materials were applicable to her at the moment of the beep.

Table 1
Principal components analysis on eliciting conditions (across time moments): principal components and loadings

Items: At this moment	Loadings on principal components					
	C1: Negative emotions	C2: Weight preoccupation	C3: Positive emotions—absence of depression	C4: Obsessions–compulsions	C5: Affection–anger–ambivalence	C6: Pathological attitudes towards exercising
I feel guilty (guilt–shame)	.80282	.20875	.01311	.24498	−.06211	−.28911
I feel irritated (anger–disgust)	.66975	.31002	−.00815	.13222	−.02131	.25160
I feel tense (anxiety)	.63342	.06298	−.26393	.20155	.20526	.21459
I feel anxious (anxiety)	.59076	.27256	−.34499	.17032	−.17857	.39450
I have the feeling that I have to burn calories	.16069	.87458	−.09199	.00621	.06281	−.06475
I feel fat (attractiveness)	.15925	.79843	−.16288	.31122	−.00124	.11426
I am thinking of losing weight (drive for thinness)	.29273	.77544	−.10828	−.05077	.35662	−.00894
I feel ugly (attractiveness)	.42193	.52410	−.17416	.35856	.34996	.17270
I feel cheerful (joy)	−.21094	−.03273	.80759	.12766	−.12327	.18702
I feel relaxed (joy)	−.08543	−.17028	.80153	−.09511	−.08795	−.09056
I feel appreciated (love)	.32188	.16880	.62758	−.20630	.17831	.37503
I feel sad (sadness)	.43054	.39752	−.59354	.02839	.31459	.08265
I feel lonely (sadness)	.02638	.14021	−.64778	−.23214	−.19021	.10118
Compulsions	.15738	.01022	−.00108	.80355	−.23715	−.07631
Obligatory aspects of commitment to exercise	.29428	.14174	.10101	.71407	.03096	.13100
Obsessions	−.00565	.51213	−.00371	.63754	.42551	.15421
I feel ashamed (guilt–shame)	.54338	.06563	.09349	.61350	.27159	.22862
I feel affection (love)	−.01374	.15969	.04788	−.08985	.76459	.11206
I feel angry (anger–disgust)	.52469	.25686	−.21687	.22969	.52950	−.15112
Pathological aspects of commitment to exercise	.10408	.00145	.05582	.12128	.10367	.89133

$N = 45$.

2.4. Analysis

An important rationale for the use of ESM is that the reliability of the assessment of an experience can be enhanced by reducing the time between the moment of observation and the moment of the report. For this reason, it is common in ESM to exclude assessments that are reported outside a 20-minute time reliability window (see Delespaul, 1995). By doing this, 50 out of the 63 data records were valid (79%), which is fairly good for an ESM study.

To test to which extent hyperactivity was related to the eliciting conditions, a multiple regression analysis was performed with ''feeling the tendency to move'' as a criterion variable and the eliciting conditions as predictors. However, inspection of the intrasubject correlations between the eliciting conditions (across time moments) revealed that these correlations were very high implying collinearity among the predictors. For this reason, a principal component analysis with Varimax rotation was performed on the eliciting conditions. The choice of the number of components was based on a scree test, Kaiser's criterion, and the interpretability of the results. Subsequently, the obtained component scores were used as predictors in a multiple regression analysis with feeling the tendency to move as a criterion variable.

3. Results

The principal components analysis on the responses to the questions concerning the eliciting conditions yielded six components explaining 74.2% of the variance. The loadings of the eliciting conditions of the six components of the principal components analysis are displayed in Table 1. The first component is labeled *negative emotions*, as emotions like guilt, irritation, tension, and anxiety have the highest positive loadings on this component. The second component is labeled *weight preoccupation*, as burning calories, drive for thinness, and physical attractiveness have high positive loadings on this component. The third component is labeled *positive emotions and absence of depression* since the positive emotions (with exception of affection) have high positive loadings on this component while the items from the sadness cluster have high negative loadings on this component. The fourth component is labeled *obsessions–compulsions* because the obsession and compulsion item and the item with respect to obligatory aspects of exercising have high positive loadings on this component. The fifth component is less clear; at first sight, two seemingly contradictory items have high positive loadings on this component: I feel affection and I feel angry. This may reflect the patient's ambivalence-feeling affection and anger at the same time-towards other people. Moreover, it should be noted that the item ''I feel angry'' has an almost identical positive loading on the negative emotion component (the first component). We labeled this component *affection–anger–ambivalence*. Finally, *pathological aspects of commitment to exercise* has a high positive loading on the sixth factor, which is labeled accordingly. It is striking that the three hypothesized biopsychological mechanisms appear as independent factors in the principal component analysis.

Next, a multiple regression analysis was performed with the tendency to move as criterion variable and the six components as predictors. This criterion variable was chosen because the results indicated that the other hyperactivity items (''At this moment, I am moving'' and ''At this moment, I am exercising'') had almost a zero score at each of the beep moments. This may be explained by the fact that the patient was already 4 weeks in a therapeutic program in which the amount of activity was restricted. Despite this fact, the patient reported that she still often felt the tendency to move. The null model was clearly rejected, $F(6,38) = 15.37$, $P < .0001$, with the regression explaining 71% of the variance (R^2 adjusted for the number of predictors=.66).

In Table 2, the raw and standardized regression weights for the six components together with t test results are presented. Our patient felt a significant increase in her momentary tendency to move when she was preoccupied with her weight (C2), when she experienced negative emotions (C1), and when she felt affection, anger, or ambivalence (C5). In contrast, the experience of positive emotions and the absence of

Table 2
Multiple regression with tendency to move as criterion and six principal components as predictors: regression weights, standardized regression weights, and *t* tests

	Regression weight	Standardized regression weight	S.E.	*t* value	*df*	Pr > |*t*|
Intercept	1.95556	0	0.14540	13.45	1	< .0001
C1: Negative emotions	0.55426	0.33028	0.14705	3.77	1	0.0006
C2: Weight preoccupation	1.13889	0.67866	0.14705	7.75	1	< .0001
C3: Positive emotions/absence of depression	− 0.43464	− 0.25900	0.14705	− 2.96	1	0.0053
C4: Obsessions–compulsions	0.06692	0.03988	0.14705	0.46	1	0.6516
C5: Affection–anger–ambivalence	0.41033	0.24452	0.14705	2.79	1	0.0082
C6: Pathological aspects of commitment to exercise	− 0.16867	− 0.10051	0.14705	− 1.15	1	0.2585

N = 45; df=degree of freedom.

depression (C3) predicted a significant decrease in her tendency to move (negative regression weight). For this patient, the results confirm the first and third hypothesis that her tendency to move was related to burning calories and to affect regulation. The second hypothesis that hyperactivity has become a ritualized obsessive–compulsive behavior was not confirmed for this patient as her momentary tendency to move was not related to obsessions and compulsions (C4). Finally, inspection of the standardized regression coefficients in Table 2 indicates that weight preoccupation was most strongly related to hyperactivity in this patient.

4. Discussion

We hope to have demonstrated the usefulness of ESM for studying hyperactivity in relation to important biopsychological factors. Nevertheless, we should keep in mind some methodological issues with respect to this study. First, a representative sample of experiences was sampled out of the daily life experiences of a single patient. Consequently, generalizations cannot be made to other subjects. Of course, this type of approach has to be applied now on larger samples in a systematic way, as we are preparing. Second, in this study, it should be noted that we have investigated intrasubject relations between variables (across time) in contrast to between-subject relations between variables (across subjects). Both kind of relations may reveal different results, and intrasubject relations cannot be used to make assertions about between-subjects relations and vice versa (see Snijders & Bosker, 2000). Third, although the (dynamic) relations between variables that interact over time can be studied by means of ESM, it is impossible to make conclusions about the causal or temporal relations between the different variables as might be suggested by the multiple regression approach.

Finally, we want to highlight some advantages of the use of ESM in clinical practice. At a diagnostic level, ESM may be used as an important tool because it allows the researcher to empirically examine the dynamic relations between target symptoms (e.g., hyperactivity) and different potentially relevant eliciting conditions (e.g., emotions) in a particular patient. In this way, it may be tested to what extent general theories of pathology apply to a particular patient. Moreover, on the basis of an interview with

the patient, it is also possible to include a number of rather idiographic eliciting conditions in the diagnostic assessment; subsequently, the relation between these specific conditions and the target symptoms can be tested in an empirical way. At a therapeutic level, the results of an ESM study may be discussed with the patient. In this way, the patient may gain insight and/or become aware of the relationships between target symptoms and their eliciting conditions. Furthermore, it is possible to search together with the patient for alternative behaviors in reaction to the crucial eliciting conditions or to start exposure to these elicitors. In this way, ESM may be a helpful tool to pave the floor for traditional therapeutic procedures such as exposure and response prevention.

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