Introduction

Anorexia nervosa (AN) is a severe psychiatric disorder characterized by unrelenting self-starvation and life-threatening weight loss with concomitant brain anomalies as a consequence of malnutrition [1]. This relentless pursuit of starvation is associated with negative physical, emotional, and social consequences [2]. It has been found, that negative affect was increased significantly before loss of control eating, purging, the combination of loss of control eating/and purging, and weighing behavior in a sample of 118 adult females presenting AN. Furthermore, negative affect decreased significantly after the occurrence of these behaviors [3]. Some studies imply that negative affect may offer a critical maintenance mechanism of some AN symptoms. For example, in a study of 116 anorexic women measuring personality, clinical variables, and eating disorder symptoms [4], three subtypes, under-regulated (1), over-regulated (2), and low psychopathology (3), emerged. Under-regulated subtypes (1), characterized by high Stimulus-Seeking, Self-Harm, and Oppositional behavior presented higher baseline eating disorder symptoms, lower positive affect, higher negative affect, self-discrepancy, and binge eating. Over-regulated subtypes (2), characterized by high Compulsivity and low Stimulus-Seeking were more likely to have a lifetime obsessive-compulsive disorder diagnosis and showed higher levels of perfectionism, whereas negative affect, positive affect, and self-discrepancy in this group were intermediary between the other subtypes. Low psychopathology subtypes (3), characterized by normal personality, and presented the lowest levels of baseline eating disorder symptoms, co-occurring disorders, and eating disorder behaviors. Nevertheless, in a group of clinically diagnosed Estonian patients presenting eating disorders, compared with healthy volunteers, assessed on Estonian versions of the Eating Disorder Inventory-2, positive affect and negative affect (measured by the Positive Affect and Negative Affect Schedule and the Emotional Well-Being Scale) was significantly lower in AN patients compared with healthy controls. Despite their negative self-report, on the variables pertaining to affect, sleep, and pain, the AN patients reported a higher frequency of physical exercise. Regression analysis indicated that the difference in pain, sleep, and exercise frequency between AN patients and healthy controls was predicted from negative affect, greater sleep problems, and use of mood-enhancing drugs and exercise frequency. Hence, suggesting that excessive exercise together with depression, anxiety, obsessive-compulsive, addictive behaviors and sleep problems represent AN from a perspective of multiple comorbidities.

Emotional Well-Being in Anorexia Nervosa: Negative Affect, Sleeping Problems, Use of Mood-enhancing Drugs and Exercise Frequency

Abstract

The purpose of this study was to ascertain emotional well-being among patients presenting ninety anorexia nervosa (AN) and healthy age-matched controls using the Positive Affect and Negative Affect Schedule and the Emotional Well-Being Scale together with background health information. The results indicated that AN patients displayed higher levels of negative affect and negative emotions, more stress and depression, greater sleeping problems, pain, and use of analgesics and mood-enhancing drugs, as well as lower levels of positive affect and positive emotions, compared to the age-matched healthy controls. Despite their negative self-report, on the variables pertaining to affect, sleep, and pain, the AN patients reported a higher frequency of physical exercise. Regression analysis indicated that the AN condition, from diagnosis, was predicted from negative affect, sleeping problems, use of mood-enhancing drugs and exercise frequency. Hence, suggesting that excessive exercise together with depression, anxiety, obsessive-compulsive, addictive behaviors and sleep problems represent AN from a perspective of multiple comorbidities.

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Affect is suggested to be composed of two systems, positive affect and negative affect, which reflect relatively stable cognitive emotional profiles as dispositions or signal sensitivity systems [19,20]. Negative affect and emotion among individuals presents a trait associated with both anxiety [21] and depression [22-24]. Conversely, positive affect is negatively associated with depression [24]. Attachment anxiety was associated with eating disorder symptom severity, and this relationship may be mediated by perfectionism and affect regulation strategies [25]. Affective profiles expressing high negative affect have been shown to report a higher degree of stress and a lower degree of coping and control than those with high positive affect [26-28]. Moreover, both adolescents and young and older adults with “Self-destructive” affective profile, i.e. high negative affect and low positive affect, typically report a higher degree of depression than people with any of the other profiles, i.e. “self-fulfilling”, “high affective” and “low affective” [19,26]. Negative affect has also been associated with pessimism [29]. Negative affect predicted stress, which in turn predicted general and situational depressiveness [30]. In this context, [24], suggest that positive affect is a dimension that varies from pleasant engagement (e.g., enthusiastic and active) to unpleasant disengagement (e.g., sad and bored), while the negative affect dimension moves from unpleasant engagement (e.g., angry and fearful) to pleasant disengagement (e.g., calm and serene). However, there is evidence that rather than being completely independent, the two affective dimensions might be interrelated in a two-dimensional circumplex model containing not only arousal (vertical axis), but also a valence dimension (horizontal axis). In other words, in order to get a full range of a persons’ emotional well-being we need to assess not only high arousal affect, but also to assess the whole range of emotions we humans can experience.

Several implications of decreased emotional well-being are related to mental health concerns such as stress, depression and anxiety which may in turn lead to expressions of physical ill-health. Deterioration in health status, for instance, is associated with reduced levels of emotional and physical well-being [31]. The notion of affectivity presents a confluence of emotions and attributes – psychological, biological and social – that determine individuals’ perceptions and experiences of situations [32]. Thus, the purpose of the present study was to examine AN patients’ emotional well-being and background health information in comparison to age-matched healthy control subjects.

Materials and Methods

Participants and procedure

Ninety female patients (age range: 24 to 42 years) presenting eating disorders at diagnosis but here exclusively AN, with a history of unsuccessful treatment and referred from the Department of General Psychiatry, Sahlgrenska University Hospital (Gothenburg, Sweden) participated in the study. All the patients were ethnic Scandinavians from higher socioeconomic groups and well-educated. They had all undergone further education, following high-school graduation, for at least three years, had affluent-level economic status and upper-middle social-familial backgrounds. They had all been affected with the symptoms for over five on arrival at the Anorexia & Bulimia Clinic for Adults (Sahlgrenska University Hospital), and described themselves as “well-behaved girls”. The healthy volunteer participants (i.e., 114 Controls) were selected from a larger sample collected in another study using the same instruments to measure affect [32].

The ethics protocol of the University Hospital Sahlgrenska was applied and maintained. All the patients who were contacted agreed to participate (N = 90). On arrival at the clinic, each patient described her type of eating disorder and completed the Eating Disorder Inventory-2 to measure symptoms of eating disorder and was then given their diagnosis by the presiding staff. Thereafter, were allowed to complete the questionnaire. Specifically, on arrival each patient was met by the respective professional workers, nurse, psychologist, physician, and after a preliminary discussion was asked whether or not she would be willing to complete a questionnaire in order for the health staff to obtain further insights into the AN condition. Following this, each patient received instructions and was allowed 30–45 min to respond to the instruments.

Instruments

Background health information. Background variables, such as age, years of education, smoking and drinking habits, pain, use of mood-enhancing drugs and analgesics, and frequency and duration of exercise, etc., were completed according to the description and procedure outlined in [33].

Positive Affect Negative Affect Schedule. This is one of the most commonly used instruments to measure high arousal affect and was developed on the premise that positive affect and negative affect represent two orthogonal independent dimensions: high positive affect versus low positive affect and high negative affect versus low negative affect. The instrument instructs participants to rate to what extent they generally have experienced 20 different feelings or emotions (10 positive affect and 10 negative affect) during the last 30 days, using a 5-point Likert scale (1 = very slightly, 5 = extremely). The 10–item positive affect scale includes adjectives such as strong, proud, and interested. The 10–item negative affect scale includes adjectives such as afraid, ashamed, and nervous. In their study [30], reported a Cronbach’s alpha of .88 for the positive affect scale and .83 for the negative affect scale.
for the negative affect scale. In the present study the scales had similar internal reliability (.93 for positive affect and .91 for negative affect).

Emotional Well-Being Scale. This a 16-item questionnaire includes eight items to assess positive feelings and eight items to assess negative feelings. For both the positive and negative items, three of the items are general (e.g., positive, negative) and three per subscale are more specific (e.g., joyful, sad). In contrast to the Positive Affect Negative Affect Schedule, this instrument includes low arousal emotions [34]. In the present study the Cronbach’s alpha were .90 for the positive emotion scale and .92 for the negative emotion scale. Two single items form these scales were also used to assess depression and stress.

Results

AN patients displayed higher levels of negative affect and negative emotions, more stress and depression, greater sleeping problems, pain, and use of analgesics and mood-enhancing drugs, as well as lower levels of positive affect and positive emotions, than the age-matched healthy controls to which they were compared. Nevertheless, the AN patients reported a higher frequency of physical exercise (Table 1).

In order to assess the extent to which the AN condition (as opposed to healthy control condition) may be predicted from participants’ emotional well-being (i.e., positive and negative affect, positive and negative emotions, stress, and depression), sleeping problems, pain analgesics, mood-enhancing drugs, and exercise frequency, a regression analysis was performed with the former as dependent variable and the latter as independent (predictor) variables. The analysis indicated that the AN condition could be predicted (F (9, 176) = 21.33, p < 0.001, adjusted R² = 0.512). The significant predictors were negative affect, sleep problems, mood-enhancing drugs and increased exercise frequency (Table 2). Positive affect, positive and negative emotions, stress and depression, sleeping problems, pain, and analgesics were non-significant.

Table 1: Means and SD (±)Self-reported positive and negative affect, positive and negative emotions, stress and depression levels, sleeping problems, pain, use of analgesics and mood-affecting drugs, and exercise frequency by AN patients (90) and healthy controls (n = 114).

| Factor                  | AN Patients | Healthy Age-Matched Controls |
|-------------------------|-------------|-------------------------------|
| Positive affect         | 2.81 ± 0.82 | 3.63 ± 0.71                   |
| Negative affect         | 3.14 ± 0.74 | 2.08 ± 0.62                   |
| Positive emotions       | 2.98 ± 1.08 | 3.71 ± 0.89                   |
| Negative emotions       | 3.60 ± 1.00 | 2.76 ± 0.93                   |
| Stress                  | 4.23 ± 0.88 | 2.95 ± 1.05                   |
| Depression              | 3.25 ± 1.36 | 2.07 ± 1.25                   |
| Sleeping problems       | 3.84 ± 1.10 | 2.39 ± 0.96                   |
| Pain                    | 3.69 ± 1.07 | 2.45 ± 1.11                   |
| Analgesics              | 3.28 ± 1.22 | 1.58 ± 0.78                   |
| Mood-enhancing drugs    | 2.66 ± 1.97 | 1.28 ± 1.00                   |
| Exercise frequency      | 3.92 ± 1.18 | 3.59 ± 1.07                   |

*p < 0.001, **p < 0.05. Bonferroni comparisons.

Table 2: Standardized weights from linear regression analysis with AN condition as dependent variable and positive and negative affect, positive and negative emotions, stress, depression, sleeping problems, pain, analgesics, mood-enhancing drugs and exercise frequency as independent variables.

| Predictor variable       | Standardized β | Significance |
|--------------------------|----------------|-------------|
| Negative affect          | 0.289          | P < 0.01    |
| Sleeping problems        | 0.208          | P < 0.01    |
| Exercise frequency       | 0.137          | P < 0.03    |
| Mood-enhancing drugs     | 0.129          | P < 0.03    |

Discussion

The purpose of the present study was to examine AN patients’ emotional well-being and background information in comparison to age-matched healthy control subjects. The present results were straightforward: AN patients expressed lower levels of positive affect and positive emotions and higher levels of negative affect and negative emotions, together with more stress and depression, greater problems with sleeping and more pain, as well as a higher usage of analgesics and mood-enhancing drug (but not drugs of abuse). The high levels of negative affect and emotions, stress and depression accompanied by low levels of positive affect and emotions are in agreement with previous findings of alexithymia [15]. Nevertheless, the AN patients reported also higher levels of physical exercise frequency, which is contradictory to recent research suggesting that exercise compliance is associated to high levels of positive affect rather than high, or low for that matter, levels of negative affect [35]. Moreover, the regression analysis indicated that the AN condition, i.e. patients having received the diagnosis on the basis of clinic staff interviews and Eating Disorder Inventory-2 responses, was predicted by high levels of negative affect, frequent sleeping problems, higher use of mood-enhancing drugs and high exercise frequency. Taken together, this constellation of harbingers of ill-health implies that, at least in this group of AN patients, the habit of frequently exercising is associated to some degree of comorbidity. In other words, the presence of higher exercise levels is normally linked to health, well-being and positive affect [33,35], however, in the present circumstances it may be likely that elevated exercise contributes an element of ‘behavior pathology’ to the comorbidity of AN. For instance, the Swedish expression, “well-behaved girl” (“duktig flicka” in Swedish), that the patients used to describe themselves, implies that these individuals probably hid much of their emotional upheaval and problems from their social environment. Nevertheless, these individuals were highly functional despite their condition. These patients tended to handle their emotional upheaval by performing a plethora of ‘compensatory’ behaviors, such as washing the floor, vacuuming, tidying the apartment, etc.

Although increased levels of physical exercise are associated with better health and well-being [35-38], and better prognosis in psychiatric conditions, the observation of greater exercise frequency in the present study may not necessarily be an entirely positive manifestation. On the one hand, it has been observed that female patients with AN engaged in caloric restriction and excessive exercising prior to clinical treatment had larger hippocampal volumes than healthy comparison women. Following restoration

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of body weight after treatment, AN patients who had engaged in food restriction and excessive exercise prior to treatment had hippocampal volumes similar to that of women with AN who only engaged in caloric restriction. On the other hand, there seems to be a subgroup of high-level AN-exercisers (66%) with consecutive increased energy requirements [39], contributing to that group of AN ‘excessive exercisers’. Groups of AN patients tend to report 57-92% higher levels of total activity than healthy controls [40], outpatients report more walking and moderate exercise than healthy controls, and inpatients report more walking but less moderate and vigorous activity than all other groups. It has been shown that AN groups had significantly higher drive to exercise and assessed “improving tone” as important whereas health and enjoyment were less important reasons to exercise [40,41]. Furthermore, [42] found that the normalization of body weight in patients with AN is associated with a preferential distribution of body fat in central regions, which does not, however, seem to influence either eating disorder psychopathology or psychological distress scores. Extent of physical exercise was correlated with trait reward sensitivity, engagement and attentional orienting. However, the finding, in AN patients, of a positive relationship between excessive exercise and obsessive compulsive disorder is unsettling [43,44], have implied that excessive habit formation, the exercise habit, may be construed as a mechanism through which initially rewarding weight loss behavior in AN may develop a compulsiveness over time, with supervised exercise training deemed as ‘safe’ [45]. AN has been shown to co-occur with obsessive-compulsive disorder and depression [46]. Both Current and lifetime comorbidity of anxiety and depressive disorders with AN has been observed with social phobia, panic disorders, and obsessive-compulsive disorder (OCD) frequently present in AN groups [47].

Limitations of the study

Whether or not the evidence for a pathological aspect of the excessive exercise shown by AN patients needs to be addressed in further studies that present a specific rationale and assessment. Particular quantitative data is required to demonstrate an eventual pathological aspect to the increased exercise. Similarly, the issue of whether or not AN patients show abnormalities in hedonic and motivational systems requires attention. In the present case, there may be evidence only for simple compulsive behavior. Finally, the present study fails to account for the possibility that increased exercise frequency reflects a compensatory behavior to alleviate anxiety, which is consistent with an anxiousytic action of exercise [48], given the high co-morbidity between AN and anxiety disorders [17].

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