DISSERTATIONES PSYCHOLOGICAE UNIVERSITATIS TARTUENSIS
27

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Eating disorders, personality, and cultural differences

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LIST OF ORIGINAL PUBLICATIONS

This dissertation is based on the following publications and an unpublished manuscript which will be referred to in the text by their representative Roman numerals:

I **Podar, I.**, Hannus, A., & Allik, J. (1999). Personality and affectivity characteristics associated with eating disorders: A comparison of eating disordered, weight-preoccupied, and normal samples. *Journal of Personality Assessment, 73*, 133–147.

II **Podar, I.**, Jaanisk, M., Allik, J., & Harro, J. (2007). Psychological traits and platelet monoamine oxidase activity in eating disorder patients: their relationship and stability. *Progress in Neuropsychopharmacology & Biological Psychiatry, 31*, 248–253.

III **Podar, I.** & Allik, J. (2009). A cross-cultural comparison of the Eating Disorder Inventory. *International Journal of Eating Disorders, 42*, 346–355. [Additional Supporting Information]

IV **Podar, I.** & Hannus, A. (2010). Personality characteristics associated with body weight and weight cycling. Manuscript under review.

V Podar, T., Solntsev, A., Väli, M., Vinogradova, T., & **Podar, I.** (1996). No deterioration of glucose tolerance in weight cycling obese. *International Journal of Obesity, 20*, 921–924.

VI Fetissov, S.O., Harro, J., Jaanisk, M., Järv, A., **Podar, I.**, Allik, J., Nilsson, I., Sakthivel, P., Lefvert, A.K., & Hökfelt, T. (2005). Autoantibodies against neuropeptides are associated with psychological traits in eating disorders. *Proceedings of the National Academy of Sciences of the United States of America, 102*, 14865–14870.

The author of the dissertation contributed to these publications as follows:

- in Studies I, II, III, IV: formulating the research question, designing the studies, carrying out data collection and analyses, conducting literature searches, providing summaries of previous research studies, and writing the manuscript;
- in Study V: coordinating the research project, organizing data collection and participating in writing the manuscript;
- in Study VI: organizing the data collection.

Principal aims of the studies:

- adapting and validating the Eating Disorder Inventory-2 (EDI-2) into Estonian and investigating the relative contribution of personality and emotional experience to self-reported eating attitudes between eating disorder patients, weight-watchers and normal controls (Study I);
- investigating in parallel the influence and stability of personality dispositions and the activity of the serotonin system on eating behavior and attitudes (Study II);
- finding out the universality of the pattern of the intercorrelation between EDI subscales, differences between Western and non-Western cultures and associations with age (Study III);
- examining associations between personality and weight cycling behavior, also associations between three different weight categories (obese, overweight, and normal weight) and personality traits (Study IV);
- evaluating whether weight cycling deteriorates glucose tolerance in obese individuals without overt non-insulin-dependent diabetes mellitus, and if the outcome is dependent on the amplitude of cycles (Study V);
- investigating correlations between levels of autoantibodies and psychological characteristics in *Anorexia Nervosa* and *Bulimia Nervosa* patients (Study VI).

INTRODUCTION

Eating disorders and their aetiology

The estimated number of subjects in the general European Union population (age 18–65) affected by eating disorders within past 12 months was 1,2 million (Wittchen & Jacobi, 2005). Taking into account the considerable degree of co-morbidity, especially depression, anxiety, (Green et al., 2009; Silberg & Bulik, 2005; Wilksch & Wade, 2004) and personality disorders (Levin, Kahan, Lamm, & Spauster, 1993), the number of patients might be even bigger.

According to the Classification of Mental and Behavioral Disorders: Diagnostic criteria for research (World Health Organization [WHO], 1993) *Anorexia Nervosa* (AN) (F50.0) is characterized by five clinical features. The first is weight loss or, in children, a lack of weight gain, leading to a body weight at least 15% below the normal or expected weight for age and height. Secondly, weight loss is self-induced by avoidance of "fattening foods". The third feature is self-perception of being too fat, with an intrusive dread of fatness, which leads to a self-imposed low weight threshold. The fourth feature is a widespread endocrine disorder involving the hypothalamic-pituitary-gonadal axis which manifests in women as amenorrhoea and in men as a loss of sexual interest and potency. (An apparent exception is the persistence of vaginal bleeds in anorexic women who are on replacement hormonal therapy, most commonly taken as a contraceptive pill.) Fifthly, the disorder does not meet the first and the second criteria for *Bulimia Nervosa* (F50.2).

Two subtypes of AN exist: (1) *Anorexia Nervosa Restricting* (AN-R) and (2) *Anorexia Nervosa Bulimic* (AN-B). AN-R patients lose weight by rigidly restricting food intake, AN-B patients attempt to limit intake but are interrupted by episodes of binge eating.

There are four behavioral symptoms associated with *Bulimia Nervosa* (BN). First, there are recurrent episodes of overeating (at least twice a week over a period of three months) in which large amounts of food are consumed in short periods of time. The second is persistent preoccupation with eating, and a strong desire or a sense of compulsion to eat (craving). Thirdly, the patient attempts to counteract the "fattening" effects of food by one or more of the following: (1) self-induced vomiting; (2) self-induced purging; (3) alternative periods of starvation; (4) use of drugs such as appetite suppressants, thyroid preparations, or diuretics; when bulimia occurs in diabetic patients they may choose to neglect their insulin treatment. The fourth symptom is self-perception of being too fat, with an intrusive dread of fatness (usually leading to being underweight). *Bulimia Nervosa* also has two subtypes: (1) purging type and (2) non-purging type.

Atypical AN (F50.1) and atypical BN (F50.3) are categories which embrace individuals who have an eating disorder of clinical severity but do not meet formal diagnostic criteria for either *Anorexia Nervosa* or *Bulimia Nervosa*.

Another category, *Eating Disorder Not Otherwise Specified* (EDNOS), exists for patients who do not meet the above-mentioned criteria for more specific eating disorders.

The pathology of eating disorders is very diverse. Some authors have divided eating disorder patients by different features into subgroups: AN patients who do or do not use laxatives (Kovacs & Palmer, 2004), who are or are not fat phobic (Lee, Lee, & Leung, 1998), AN-R patients with purging (Behar, Arriagada, & Casanova, 2005; Nagata, McConaha, Rao, Sokol, & Kaye, 1997), AN patients with binging/purging (Mizuta et al., 2002; Pike & Mizushima, 2005; Tachikawa et al., 2004), severe AN-R patients (Cassano et al., 2003), AN who have recovered from amenorrhoea (Brambilla et al., 2003; Garner, Olmsted, & Polivy, 1983), AN patients severely depressed, less depressed and non-depressed (Bizeul, Brun, & Rigaud, 2003), eating-disordered patients with and without self-injurious behaviors (Claes, Vandereycken, & Vertommen, 2004), subclinical eating disordered patients and patients with partial eating disorder (Cotrufo, Gnisci, & Caputo, 2005).

Several researchers indicate that disordered eating behaviors are more accurately conceptualized on a continuum as opposed to the all-or-nothing diagnostic categories offered by ICD-10 or DSM-IV (Dancyger & Garfinkel, 1995; Gleaves, Lowe, Green, Cororve, & Williams, 2000; Stice, Killen, Hayward, & Taylor, 1998). *Anorexia Nervosa*, binge-eating and purging type, occurs on a continuum with *Bulimia Nervosa* (both purging and nonpurging types) and the two types of *Bulimia Nervosa* differ in degree rather than in kind (Gleaves et al., 2000). The pattern of eating disorders development is that *Anorexia Nervosa* can lead to bulimia (Hsu, 1996). Bulimic symptoms differ in severity and many women have bulimic behavior without meeting the diagnostic criteria for the disease.

Anorexia Nervosa and *Bulimia Nervosa* are multidetermined disorders. The cause of eating disorders is complex and not clearly understood. Biological, genetical, psychological, familial, and sociocultural factors are relevant to the development of eating disorders.

Several researches indicate that personality factors play the most important role in the development of eating disorders (Garner, 1991). Researches (Claes et al., 2006), using Big Five scales, have found three personality prototypes in eating disorders sample: undercontrolled/emotionally dysregulated, resilient/high-functioning, and overcontrollers/restricted, whereas the resilient group showed less clinical symptoms compared to over- and undercontrollers.

For the development of disordered eating or eating disorders the personality or temperamental trait of negative affect, rather than family process or lifestyle behaviors, appear to be a predisposition. The negative affect may induce a more generalized vulnerability to psychopathology (Leon, Keel, Klump, & Fulkerson, 1997).

Although eating disorders were previously thought to be culture bound to Western population, the increasing number of reports of *Anorexia Nervosa* and *Bulimia Nervosa* from Chinese and other non-Western societies have placed

that under doubt (Behar, de la Barrera, & Michelotti, 2003; Edwards, d'Agrela, & Geach, 2003; Garcia-Grau, Fuste, Miro, Saldana, & Bados, 2002; Jennings, Forbes, McDermott, Hulse, & Juniper, 2006; Kusano-Schwarz & von Wietersheim, 2005; Lee, Lee, Leung, & Yu, 1997; Leung, Wang, & Tang, 2004; Mizuta et al., 2002; Nishizono-Maher, Miyake, & Nakane, 2004; Pike & Mizushima, 2005; Tachikawa et al., 2004).

A reliable measure of symptoms associated with eating disorders

The main purpose of the first study (**Study I**) was to translate Eating Disorder Inventory-2 (EDI-2) (Garner, 1991) into Estonian language, and adapt and validate the inventory. In 1996, when we began this study, there was no such kind of questionnaire available in Estonian. We asked permission from *Psychological Assessment Resources Inc.* and did a forward and back translation. One hundred fourteen women from three different groups (eating disordered patients, weight-watchers and normal controls) participated in this study.

The Eating Disorder Inventory is perhaps the most widely used self-report measure of symptoms commonly associated with AN and BN and has been translated into many languages: German (Steinhausen, Neumarker, Vollrath, Dudeck, & Neumarker, 1992), Russian (O'Keefe & Lovell, 1999), Dutch (van Strien & Ouwens, 2003), Chinese (Lee et al., 1998), Hebrew (Niv, Zeev, Mitrani, & Shiang, 1998), Swedish (Norring & Sohlberg, 1988), Spanish (Lameiras, Calado, Rodríguez, & Fernández, 2002), Japanese (Pike & Mizushima, 2005), Korean (Ryu, Lyle, Galer-Unti, & Black, 1999), Italian (Fassino, Leombruni, Piero, Abbate-Daga, & Rovera, 2003), French (Bizeul et al., 2003), Arabic (Al-Subaie et al., 1996), Portuguese (Machado, Goncalves, Martins, & Soares, 2001), Norwegian (Engelsen & Laberg, 2001), Polish (Zechowski, 2008), Hungarian (Lukács, Murányi, & Túry, 2007), Czech (Milos, Spindler, & Schnyder, 2004), and Estonian (Podar, Hannus, & Allik, 1999).

EDI was developed and validated by Garner and his colleagues (Garner et al., 1983) to assess psychological characteristics relevant to *Anorexia Nervosa* and *Bulimia Nervosa* and it consists of 8 subscales. As most of the EDI items were generated by experienced clinicians, it was more relying on personality measures than other conventional tests. EDI is one of the very few tests for *Anorexia Nervosa* and *Bulimia Nervosa* that measures not only symptoms but also psychological characteristics.

The EDI-2 (Garner, 1991) is a 91-item, self-report measure of psychological characteristics and behaviors associated with eating disorders and has 3 additional subscales. The items are presented in a 6-point forced choice scale (“never”, “rarely”, “sometimes”, “often”, “usually” and “always”). Reliability was established for all subscales.

EDI-2 subscales: *Drive for Thinness* (DT) assesses excessive concern with dieting, preoccupation with weight, and fear of weight gain; *Bulimia* (B) as-

sesses the tendencies to think about and to engage in bouts of uncontrollable overeating (bingeing); *Body Dissatisfaction* (BD) measures dissatisfaction with the overall shape and with the size of those parts of the body that are of greatest concern to those with eating disorders (i.e., stomach, hips, thighs, buttocks); *Ineffectiveness* (I) assesses feelings of general inadequacy, insecurity, worthlessness, emptiness, and lack of control over one's life; *Perfectionism* (P) measures the extent to which one believes that personal achievements should be superior, the belief that only the highest standards of personal performance are acceptable and the belief that outstanding achievement is expected by others; *Interpersonal Distrust* (ID) subscale assesses an individual's general feeling of alienation and reluctance to form close relationships, reluctance to express thoughts or feelings to others and the need to keep others at a distance; *Interoceptive Awareness* (IA) measures confusion and apprehension in recognizing and accurately responding to emotional states, uncertainty in the identification of certain visceral sensations related to hunger and satiety; *Maturity Fears* (MF) assesses the desire to retreat to the security of childhood. Starvation becomes the mechanism for avoiding psychobiological maturity. This regression is thought to provide relief from adolescent turmoil and conflicts within the family; *Asceticism* (A) measures the tendency to seek virtue through the pursuit of spiritual ideals such as self-discipline, self-denial, self-restraint, and control of bodily urges; *Impulse Regulation* (IR) assesses the tendency towards impulsivity, substance abuse, recklessness, hostility, and self-destructiveness; *Social Insecurity* (SI) measures the belief that social relationships are tense, insecure, disappointing, unrewarding, and generally of poor quality. The first three subscales concern eating, weight and body shape (DT, B, BD), and eight subscales concern psychological traits thought to be clinically relevant to eating disorders (I, P, ID, IA, MF, A, IR, SI).

Recently, the latest edition, EDI-3, was released. It retains the same number of items but groups them differently, using 12 primary scales, consisting of three eating disorder-specific scales and nine general psychological scales that are not specific to eating disorders. In addition, six composites are calculated: one that is eating disorder-specific and five that are general integrative psychological constructs (Garner, 2004). Since the EDI-3 was published only recently, there are just a few dissertations based on it (Mastria, 2009; Visser, 2009).

The second aim of this study was to assess the relative contribution of personality to self-reported eating attitudes. The adapted Estonian version (Pulver, Allik, Pulkkinen, & Hämäläinen, 1995) of NEO Personality Inventory (NEO-PI) (Costa & McCrae, 1989) was used to measure five personality factors (*Neuroticism, Extraversion, Openness to Experience, Agreeableness,* and *Conscientiousness*) in three different groups.

The five-factor model (FFM) of personality is a hierarchical organization of personality traits of five basic dimensions: *Extraversion, Neuroticism, Agreeableness, Openness to Experience* and *Conscientiousness*. It also provides a set of tools that can be used by psychologists in many different areas e.g. in clinical psychology and psychotherapy (Costa, 1991; T. R. Miller, 1991). The FFM has

been used to assess personality disorders and their correlates (J. D. Miller, Pilkonis, & Morse, 2004; Verardi, Nicastro, McQuíllan, Keizer, & Rossier, 2008) and identify a new personality disorder domain (Piedmont, Sherman, Sherman, Dy-Liacco, & Williams, 2009). It has also been used to assess and examine mood and anxiety states (Cuijpers, van Straten, & Donker, 2005), specific personality factors and styles among college students who binge eat and drink (Rush, Becker, & Curry, 2009).

At the same time McCrae (McCrae & John, 1992) has concluded that "the model will certainly not explain everything that psychologists want to know about personality, but it does provide a useful starting point, and, indeed, a challenge" (p. 207).

Five-Factor Theory (FFT) was created in an effort to understand the extraordinary stability of personality traits throughout many years. FFT asserts that traits are basic tendencies, rooted in biology, so deeply grounded in the organism that they can resist the influences of the environment (Allik & McCrae, 2002). They also interact with the environment in changing those psychological characteristics that directly guide human behavior: habits, values, plans, skills, scripts, schemas, and relationships. The most studied aspect of characteristic adaptations is the Self-Concept, an acquired learning from life experience and social feedback.

The third purpose of this study was to assess the difference of emotional experience in eating disorder patients, weight-watchers and normal controls. The Estonian version (Allik & Realo, 1997) of the Positive and Negative Affect Schedule, Expanded Form (PANAS-X) (Watson & Clark, 1994; Watson, Clark, & Tellegen, 1988) was used to assess experienced emotions on seven Specific Affect Scales and two General Affect Scales. Participants report to what extent they have felt 81 affects during the past few weeks on a 5-point scale. The negative affect scales are: *General Negative Affect* (GNA), *Hostility* (NA1), *Sadness* (NA2), *Fatigue* (NA3), *Shyness* (NA4). The positive affect scales are: *General Positive Affect* (GPA), *Joviality* (PA1), *Pertinacity* (PA2), and *Affection* (PA3).

Comparison of eating disordered patients, weight-watchers and controls indicated that the Estonian version of EDI-2 is a reliable and valid questionnaire for detecting and assessing problems related with eating disorders. The average profile of ED patients was very similar to what was obtained in other countries. Also, personality dispositions played a greater role in the etiology of eating disorders compared to emotional experience. Of the five personality dimensions, Neuroticism made the largest contribution to EDI-2 subscales. The correlation between EDI-2 subscales and Neuroticism was generally so strong that it is possible to consider eating disorder symptoms an aspect of neurotic personality dispositions.

Eating disorders, personality characteristics and biological markers: their relationship and stability

In the next study (**Study II**) we studied in parallel the influence of personality dispositions and the activity of the serotonin system on the eating behavior and attitudes. Estonian version of EDI-2 (Podar et al., 1999), Estonian version of Revised NEO Personality Inventory (NEO-PI-R) (Kallasmaa, Allik, Realo, & McCrae, 2000), and the activity of platelet monoamine oxidase (MAO) was studied in 11 patients with *Anorexia Nervosa* (AN), 43 patients with *Bulimia Nervosa* (BN) and a healthy control group (n=138). Also, this study was a longitudinal observation of self-reported behavior and attitudes towards eating in parallel with MAO activity in order to investigate their relationship and stability. Nineteen patients filled in the EDI-2 questionnaire three times and donated blood samples three times with three month intervals in order to determine platelet MAO activity.

NEO-PI-R (Costa & McCrae, 1992) is a 240-item measure of the Five Factor Model of personality. It contains 30 8-item facet scales, six for each of the five basic personality factors: *Neuroticism* (N), *Extraversion* (E), *Openness to Experience* (O), *Agreeableness* (A), and *Conscientiousness* (C). Each of the five domains of the NEO-PI-R is represented by six more specific scales that measure facets of the domain. Neuroticism facets are: *Anxiety* (N1), *Angry Hostility* (N2), *Depression* (N3), *Self-Consciousness* (N4), *Impulsiveness* (N5), and *Vulnerability* (N6). Extraversion facets are: *Warmth* (E1), *Gregariousness* (E2), *Assertiveness* (E3), *Activity* (E4), *Excitement-Seeking* (E5), and *Positive Emotions* (E6). Openness facets: "open to..." *Fantasy* (O1), *Aesthetics* (O2), *Feelings* (O3), *Actions* (O4), *Ideas* (O5), and *Values* (O6). Agreeableness facets are: *Trust* (A1), *Straightforwardness* (A2), *Altruism* (A3), *Compliance* (A4), *Modesty* (A5), and *Tender-Mindedness* (A6). Conscientiousness facets: *Competence* (C1), *Order* (C2), *Dutifulness* (C3), *Achievement Striving* (C4), *Self-Discipline* (C5), and *Deliberation* (C6). Estonian NEO-PI-R data have repeatedly been reported in different publications and demonstrate an acceptable validity (Allik, 2005).

MAO activity was measured as previously described (J. Harro, Fischer, Vansteelandt, & Harro, 2004; M. Harro et al., 2001) and expressed as nanomoles of β-phenylethylamine oxidized per 1010 platelets/min.

We did not find correlations between EDI-2 subscales and MAO activity. The lack of correlations between personality dispositions and biological markers such as MAO activity indicates that they have independent influence on eating disorders. As expected, eating disorder patients scored higher on the Neuroticism domain, but lower on the Extraversion, Openness, and Conscientiousness domains compared to the control group. The average test–retest correlation of the EDI-2 total scores was surprisingly higher than the MAO test–retest correlation. It is also remarkable that the six-month stability indices were not significantly lower than the three month stability indices. It indicates

that self-reported eating attitudes are very stable in time despite psychological and pharmacological intervention.

Cross cultural comparison of Eating Disorder Inventory

Culture has been assumed to be one of the major factors in the etiology of eating disorders. *Anorexia Nervosa* (AN) and *Bulimia Nervosa* (BN) are more common among females than males, particularly, during the last decades, among younger females and it is believed that these syndromes reflect Western cultural beauty ideals for women. Despite recognition of the key role of culture in the eating-disordered behavior, the number of cross-cultural comparisons is quite modest (Kayano et al., 2008; McArthur, Holbert, & Pena, 2005; Wardle, Haase, & Steptoe, 2006). There has been no systematic attempt to analyze cross-cultural data obtained with standard questionnaires as EDI or EDI-2, either in ordinary population or eating-disordered samples.

In this study (**Study III**) a systematic analysis of data collected with the Eating Disorder Inventory (EDI) and Eating Disorder Inventory-2 (EDI-2) from around the world was carried out. We searched for answers to several questions: Are eating-related attitudes generalizable across different cultures? Are there major differences between Western and non-Western attitudes toward eating? Is the distinction between eating disordered and normal behavior identical in different cultures?

We found 94 studies in which the mean values of the EDI or EDI-2 subscales were reported, comprising 310 samples differing by sex, age, diagnosis, language, ethnicity, or some other relevant attribute. The total number of respondents was 43,722, from 25 different countries, in 16 languages. In the largest number of samples, the EDI or EDI-2 had been administered in English (100 samples), followed by Spanish (42), and German (34). Of the total 310 samples, 136 had been drawn from the general population, 159 had been diagnosed with eating disorders, and 15 had been taken from special populations (weight-watchers, athletes, etc.). From the total samples 39 (12.6%) were Asian, 21 (6.8%) Arabic, 8 (2.6%) Latin-American, and 5 (1.6%) African. There were 59 samples with diagnosed AN and 64 samples with diagnosed BN. All samples were classified into either Western (261) or non-Western (49).

The first question was the universality of the pattern of intercorrelation between EDI subscales. In eating disorders sample we found a clear two-factor solution. Three personality subscales (ID, MF, and IR) loaded strongly on the first factor and three body/weight subscales (DT, B, and BD) on the second factor. When we repeated the same procedure in the normative sample, two-factor structure was similar to the eating disorder structure, suggesting that the meaning of the EDI subscales is comparable among both general and eating-disordered populations. In addition, the two-factor solution of samples classified as non-Western was very similar to the two-factor structure recovered from

Western samples. That suggested that two-factor structure of the EDI is generalizable across different languages and cultures. The similarity of factorial structures derived from clinical and non-clinical populations seems to favor a dimensional model of eating disorders.

Next, we wanted to know, how successful EDI is in differentiating eating-disordered patients in a total sample. As expected, EDI subscales were successful in differentiating the eating-disordered patients from the general population. Samples diagnosed as eating-disordered scored higher than normal samples on 9 of the EDI subscales (DT, B, BD, IE, ID, IA, A, IR, SI).

Then we asked the question, where the symptoms of eating disorders are more pronounced: in non-Western or in Western countries. Surprisingly in both, normal and eating disorders sample, the non-Western group scored higher than the Western group on almost all EDI subscales. Contrary to the widely held belief that symptoms of eating disorders are more pronounced in samples influenced by Western ideals of body shape, results of our meta-analyses proved that symptoms of eating disorders are more pronounced in non-Western samples. Several non-Western cultures such as the Japanese, Koreans, and the Chinese score very high on the dimension related to Neuroticism (Allik & McCrae, 2004), therefore it seems very likely that the high scores of non-Western cultures on EDI subscales are determined by their greater level of Neuroticism.

Finally we wanted to know how eating disorders symptoms are associated with age. In eating-disordered samples, the correlation between three eating disorder-specific scales (DT, B, and BD) and the participants' mean age was positive. Two more general EDI subscales, IE and IA, also demonstrated a tendency to increase with the patient's mean age. A relatively early onset of eating disorders, especially AN, seems to implicate young age as a risk factor. Our analysis provided the paradoxical finding that disordered eating behaviors and attitudes became more pronounced with age in clinically diagnosed groups. For example, body dissatisfaction was systematically higher in older rather than younger samples. Only maturity fears (MF) seemed to diminish as eating disordered patients grew older. Among normal sample, the mean scores of 9 out of 11 subscales (DT, B, IE, ID, IA, MF, A, IR, SI) had the tendency to decrease with respondents' age. In the general population, older age reduces the probability of eating disorders. Thus, age is a risk factor when someone is already diagnosed with an eating disorder, but in the general population it decreases the likelihood of being afflicted by one.

Weigh, weight cycling and personality

Dramatic changes in diets and lifestyles in developed and developing countries are leading to weight gain and obesity. Higher body mass index (BMI) has been found to predict more restrained eating. Weight cycling and weight reduction behaviors are strongly related to health risks.

Food consumption and daily activities have important associations with the BMI. Affluent lifestyle patterns appear to contribute to higher BMI, while a more prudent lifestyle seems to protect from such increases (Kent & Worsley, 2009). Important associations have been found between sleeping and BMI in both men and women: longer sleeping hours and shorter working hours might decrease BMI (Ko et al., 2007).

Successful weight maintenance has been found to be associated with reaching a self-determined goal weight, having a physically active lifestyle, a regular eating regime, self-weighing regularly at least once a week and overall more psychological strength and stability (Elfhag & Rossner, 2005; Linde, Jeffery, French, Pronk, & Boyle, 2005).

Women who report loss of control over eating (Elder, Paris, Añez, & Grilo, 2008) or eat in response to negative emotions and stress have significantly more frequent weight cycling (Elfhag & Rossner, 2005). Frequent cyclers' body-esteem has been found to be considerably lower compared to non-cyclers (Strychar et al., 2009) and they preferred to change their diet or use diet pills rather than to exercise (Field, Manson, Taylor, Willett, & Colditz, 2004; Reba-Harrelson et al., 2008).

Obese subjects have higher scores in novelty seeking and lower scores in persistence and self-directedness compared to the lean subjects (Sullivan, Cloninger, Przybeck, & Klein, 2007). It has been determined that in both men and women, extraversion and psychoticism have positive associations with being overweight (Kakizaki et al., 2008). Of the Big Five personality traits high neuroticism has been found to be associated with being underweight and low conscientiousness with being obese (Chapman, Fiscella, Duberstein, Coletta, & Kawachi, 2009), while high impulsiveness and low order are associated with being overweight and obese (Terracciano et al., 2009).

Purposes of **Study IV** were: 1) examine associations between personality and weight cycling behavior, 2) examine three weight categories (obese, over-weight, and normal weight) and their personality, and 3) assess prevalence of healthy and unhealthy weight control behaviors and information sources for healthier nutrition. The novelty of this study was the investigation of the relations between personality characteristics and weight cycling.

Two hundred three volunteers were recruited by the Internet (192 women with the mean age 35.2 ± 10.9 years and 11 men with the mean age 33.6 ± 9.1 years). Inclusion criteria were age ≥ 20 years and never diagnosed eating disorder. The sample consisted of 128 normal weight (BMI < 25 kg / m^2), 46 overweight (BMI ≥ 25 kg / m^2) and 29 obese (BMI ≥ 30 kg / m^2) subjects. Participants were divided into three groups: severe weight-cyclers (weight loss > 9 kg at least three times, N = 30), mild weight-cyclers (weight loss > 5 kg at least three times, N = 16), non-weight-cyclers who did not intentionally lose weight or their weight reduction was 5 kg or less (N = 157) (Field, Malspeis, & Willett, 2009). Weight Cycling Index (WCI; the difference between the BMI of each subject at her/his highest and lowest weight during the last five years) was calculated (Jeffery, Wing, & French, 1992).

Data on intentional weight loss and regain during the last 5 years were collected by questionnaire. Estonian version of the National Character Survey (NCS) (Terracciano et al., 2005) was used to assess personality traits. NCS consists of 30 bipolar facets that comprehensively cover the five major dimensions of personality. Each of the bipolar scales measures one of the 30 facets assessed by the NEO-PI-R (Costa & McCrae, 1992), with six items for each of the five major dimension of personality traits.

A negative correlation between weight reduction frequency and personality domain of general Conscientiousness was found. Self-weighing frequency as behavioral expression of weight control was significantly correlated with general Conscientiousness as well as with Self Discipline. Mild weight-cyclers showed higher mean Anxiety compared to both non-weight cyclers and severe weight-cyclers. In addition, mild weight-cyclers had significantly higher Neuroticism scores compared to non-weight-cyclers. Severe weight-cyclers demonstrated a significantly higher score of Positive Emotions compared to mild weight-cyclers and had significantly higher score of Extraversion compared to non-weight-cyclers subjects.

Overweight subjects showed higher mean Anxiety compared to both normal weight subjects and obese subjects, and showed significantly higher Depression compared to normal weight subjects. Obese subjects had significantly higher Impulsiveness scores and significantly lower scores in Feelings compared to normal weight subjects. Normal weight group demonstrated significantly higher Dutifulness compared to overweight group and showed significantly higher rate on the Self-Discipline facet compared to obese group.

The mean amount of using Healthy Weight Control Behaviors (HWCB) did not differ between three BMI groups, but the mean amount of using Unhealthy Weight Control Behaviors (UHWCB) was significantly lower in normal weight group compared to overweight or obese groups. Diet pill users (N = 35) had significantly higher mean BMI and WCI compared to the non-users. We also found that BMI was highly positively correlated with WCI, and WCI showed significant negative relation with self-weighing frequency and positive correlation with self-reported illnesses. The most popular information source for searching information about healthier eating behavior was the Internet and the most unpopular was a medical doctor.

One possible limitation of this study might be that the majority of participants were female, thus leaving open the generalizability of the results on male population. Another limitation might be a relatively small sample of obese individuals and severe weight cyclers.

In conclusion we found that the most significant correlate of weight gain and weight cycling is the personality predisposition of Organization Persistence and Self-Discipline. A high degree of Conscientiousness predicts more stable body weight and could therefore decrease health risks.

Eating disorders and biological markers

Despite clear association between personality disposition and eating disorders, biological markers might play important role in developing eating disorders and obesity. A few recent studies have found that not all obese people are necessarily unhappy (Carr, Friedman, & Jaffe, 2007; Jansen, Havermans, Nederkoorn, & Roefs, 2008). Excessive body weight and severe weight cycling is not necessarily depressing.

In two last studies (**Study V** and **Study VI**) we investigated biological markers associated with eating disorders: AN, BN and obesity.

In collaboration with the Hospital of Endocrinology in Tartu (**Study V**) we evaluated whether weight cycling is detrimental to glucose tolerance in obese individuals without overt non-insulin-dependent diabetes mellitus (NIDDM), and if the outcome is dependent on the amplitude of weight cycling. We found weight cycling is not detrimental to glucose tolerance in non-diabetic obese individuals. Weight reduction may be recommended to obese individuals for the prevention of NIDDM.

In co-operation with Swedish colleagues Tomas Hökfelt and Serguei Fetissov from the Karolinska Institute we studied (**Study VI**) the relevance of identified autoantibodies (autoAbs) reacting with neuropeptides to the symptoms of eating disorders using a patient sample from Estonia. We also tested the hypothesis that levels of such autoAbs may correlate with cognitive and behavioral characteristics measured by EDI-2. We found that psychobehavioral characteristics of eating disorders (EDI-2 subscales) correlated with the levels of autoAbs against α-melanocyte-stimulating hormone (α-MSH), suggesting that AN and BN might be associated with autoAb-mediated dysfunctions of primarily the melanocortin system. We also found that autoAbs reacting with adrenocorticotropic hormone (ACTH), oxytocin (OT) and vasopressin (VP) correlated with fewer EDI-2 subscales. We concluded that autoAb-mediated dysfunctions of primarily the melanocortin system may contribute to the development of AN and BN.

SUMMARY AND CONCLUSIONS

To sum up, the main results and conclusions of this dissertation are as follows:

- Eating Disorder Inventory-2 was adapted into Estonian. Comparison of eating disordered patients, weight-watchers and controls indicated that the Estonian version of EDI-2 is a reliable and valid questionnaire for detecting and assessing problems related with eating disorders. The average profile of ED patients was very similar to what was obtained in other countries. (**Study I, II**).
- Personality dispositions revealed a larger relevancy in etiology of eating disorders than emotional experience. Of the five personality dimensions, Neuroticism made the largest contribution to EDI-2 subscales (**Study I, II**).
- Self-reported symptoms and problems are very stable in time despite psychological and pharmacological intervention. The average test–retest correlation of the EDI-2 total scores was surprisingly higher than the MAO test–retest correlation. It is also remarkable that the six-month stability indices were not significantly lower than the three month stability indices. The lack of correlations between personality dispositions and biological markers such as MAO activity indicates that they have independent influence on eating disorders (**Study II**).
- A systematic meta-analysis of data collected from 25 different countries with the Eating Disorder Inventory showed that the factorial structure of the aggregate means of the EDI subscales, for both clinical versus non-clinical and Western versus non-Western samples, was almost identical, suggesting generalizability across languages and cultures (**Study III**).
- A surprising result of the meta-analysis was that symptoms of eating disorders were found to be more pronounced in non-Western than in Western samples. Non-Western participants scored higher than Western participants on virtually all EDI subscales, both in normal and eating-disordered samples (**Study III**).
- Higher frequency of weight reduction was related to lower Personal Organization and general degree of persistence, control, and motivation in goal-directed behavior. Also, self-weighing frequency as behavioral expression of weight control was significantly positively related with general Conscientiousness as well as with Self-Discipline. People with low Conscientiousness gain weight more easily and show a severe pattern of weight cycling (**Study IV**).

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SUMMARY IN ESTONIAN

Söömishäired, isiksus ja kultuurilised erinevused

Väitekiri käsitleb söömishäireid ja söömiskäitumist ning -hoiakuid mitmest erinevast aspektist. Esmalt kirjeldatakse *Eating Disorder Inventory-2* (EDI-2) adapteerimist eesti keelde ja selle abil uuritud isiksuse dispositsiooni ja emotsionaalse kogemuse osatähtsust söömiskäitumises ja -patoloogias (**I ja II uuring**). Sellele järgneb uurimus, kus käsitletakse paralleelselt isiksuseomaduste ja bioloogiliste markerite mõju söömispatoloogiaga seonduvatele sümptomitele, samuti uuritakse isiksuseomaduste ja bioloogilise markerite omavahelist seost ning stabiilsust (**II uuring**). Järgneb uurimus, kus võrreldakse erinevaid kultuure, analüüsides EDI andmeid 25 erinevast riigist, kokku 43,722 vastajalt, selgitamaks välja kultuuri mõju söömishoiakutele ja -patoloogiale (**III uuring**). Viimasena võetakse vaatluse alla kaalukõikumine ja selle seos isiksuseomadustega (**IV uuring**).

Väitekirja peamised tulemused ja järeldused on järgmised:

- Küsimustik *Eating Disorder Inventory-2* (EDI-2) adapteeriti eesti keelde. Söömishäiretega patsientide, kaalujälgijate ja kontrollgrupi testi tulemuste võrdlus kinnitas EDI-2 eestikeelse versiooni reliaablust ja valiidsust. EDI-2 võimaldab varakult eristada söömishäiretele omaseid hoiakuid ja käitumisi normpopulatsioonist, mistõttu on see asendamatu instrument söömishäirete preventsioonis. Kaks uurimust näitasid, kuivõrd sarnane on EDI-2 eestikeelse versiooni keskmine profiil teistes maades saadud tulemustega (**I ja II uuring**).
- Isiksuse ja emotsionaalse kogemuse osatähtsuse hindamisel söömisega seonduvas käitumises ja hoiakutes ilmnes, et isiksuse dispositsioonid osutusid söömishäirete etioloogias olulisemaks kui emotsionaalne kogemus. Neurotism korreleerus EDI-2 alaskaaladega kõige enam (**I ja II uuring**).
- Uuriti üheaegselt nii isiksuse dispositsiooni kui ka bioloogiliste markerite, nagu monoamiinoksüdaas-B (MAO-B) aktiivsuse stabiilsust ning mõju söömiskäitumisele ja -hoiakutele. Leiti, et söömispatoloogiaga seonduvad sümptomid ja hoiakud on psühholoogilisest ja/või farmakoloogilisest sekkumisest hoolimata ajas väga püsivad. Tulemused, mis saadi kolme ja kuue kuuse intervalli järel, ei erinenud oluliselt. Kolmekuuste intervallidega tehtud kolme katse tulemused näitasid EDI-2 skooride kõrgemaid korrelatsioone ehk stabiilsust ajas võrreldes MAO-B korrelatsioonidega. Kuna ei ilmnenud olulisi korrelatsioone isiksuse dispositsiooni ja MAO aktiivsuse vahel, võib järeldada, et nad mõjutavad söömiskäitumist teineteisest sõltumatult (**II uuring**).
- Süsteemne meta-analüüs 25 riigist kogutud EDI ja EDI-2 andmete põhjal näitas, et küsimustiku alaskaalade koondkeskmiste faktorstruktuur oli peaaegu identne mõlemas valimis: nii kliiniline *versus* mittekliiniline valim kui

ka Lääne *versus* mitte-Lääne kultuur. Saadud tulemuste põhjal võib järeldada, et sõltumata keelest ja kultuurist, on söömiskäitumises ja -hoiakutes pigem midagi üldist ja universaalset kui erinevat (**III uuring**).

- Üllatuslik tulemus, mis saadi 25 riigi EDI andmete meta-analüüsi põhjal, oli asjaolu, et söömishäirete sümptomid väljendusid märgatavalt tugevamini mitte-Lääne kultuuris, võrreldes Lääne kultuuriga. Mitte-Lääne kultuuris saadud skoorid EDI alaskaaladel olid kõrgemad nii normpopulatsioonis kui ka söömishäiretega patsientidel (**III uuring**).
- Kaalukõikumise uurimuse tulemustest ilmnes, et sage kaalu langetamine on seotud selliste isiksuseomadustega nagu vähene organiseeritus ja vähene üldine motiveeritus eesmärgipäraseks käitumiseks. Kaalumise sagedus, mida võib pidada kaalu kontrollimise käitumuslikuks väljundiks, korreleerus positiivselt meelkindluse ja enesedistsipliiniga. Madala meelekindlusega inimesed võtavad kergesti kaalus juurde ja nende kaal kõigub sageli ja suurel määral (**IV uuring**).

PUBLICATIONS

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Main Research Interests

Eating disorders; disordered eating; cultural differences; personality predispositions

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