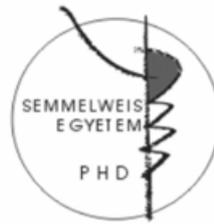


**Correlates of Orthorexia nervosa, with special focus on eating disorders
and obsessive compulsive disorders**

Doctoral theses

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Budapest

2014

Introduction

Eating disorders are considered fashionable disorders, since newer types keep emerging due to their quick patomorphose. Eating disorders and other disorders often overlap, and the subclinical forms are most frequent. Beside the ideal of beauty and thinness, the ideal of health showed up as a desirable condition. The eating disorders are diseases of the civilization. The changes of the symptomatology are following the changes of social background in time, so accordingly orthorexia (ON) fit into this system, since it appeared at a time when the healthy lifestyle emerged as an ideal in the society as opposed to obesity and its serious health related consequences. It seems that paying close attention to healthy nutrition can turn pathological and get into the focus of overconcerns, resulting in health related consequences and social isolation.

ON is a much debated phenomenon among experts, and there is a growing interest in this issue. The idea of its inclusion in the diagnostical system emerged during the preparatory work for DMS-5 (American Psychiatric Association, 2013), however, it has not been realized. The scientific and clinical establishment of ON is doubtful. The number of the Hungarian and international researches investigating ON are scarce, and have low sample sizes, less varied samples, groups, and variables. The Hungarian adaptation of the assessment instrument for measuring ON fills a niche. The precise place of the phenomenon is not clarified, the criteria are unclear. However, the existence of symptomatology is undoubtful, its acceptance as an independent diagnostic category is debated. New explorative researches can help clarify how and in which way ON can have a place in the classification of the behavioral disorders. The healthy eating dependence, ON described by Bratman in 1997 (Bratman, 1997; Bratman and Knight, 2000) turn up not only in the international literature but in the Hungarian as well (Dudás and Túry, 2008; Varga et al., 2010; Dudás and Varga, 2011). There is no review which would summarize the research data of the background factors of ON or would investigate their shortcomings in the Hungarian literature. The present theses give an extensive insight into the background factors of ON and research data, emphasizing the relationship with eating disorders and obsessive compulsive symptoms. The Hungarian adaptation of an assessment tool measuring ON and the examination of psychometric properties are part of the dissertation.

Aims

The focal point of my dissertation is the Hungarian adaptation of the assessment instrument of ON, ORTO-15 used in the international researches (Donini et al., 2005). Investigating the psychometric properties and the construct validity of ON is another focus of my work beside the attempt to find a cut-off score distinguishing individuals with low and high tendency towards ON.

Validity-test: operationalization of facts in the literature on ON which are not the part of ORTO-15; we supposed that these show strong relationship with construct measuring ORTO-15. We hypothesized that individuals with high and low tendency to ON have different lifestyle and habits of nutrition, thus higher tendency to ON is associated not only with healthier nutrition but healthier lifestyle. The correlates of ON were explored in the thesis. We hypothesized that tendency towards ON shows a relationship with classic disordered eating and obsessive compulsive symptoms and depression. Further on, we hypothesized that individuals with eating disorders have higher tendency towards ON. Tendency towards ON can appear as a cover symptom or part of other eating disorders, as a compensation behavior, or can be an alternative way of recovery.

We examined the role of age, sex, education and a past experience of eating disorder symptoms in the development of ON tendency. The examination of healthcare professionals is also included in the thesis, since previous studies found this group to be at high risk for ON.

Since ON is a new and debated concept on the eating and obsessive compulsive spectrum, these are explorative studies.

Methods

In total, 810 individuals participated in the cross-sectional, online study (724 women, 86 men; 89.4%, 10.6%). The participants were recruited from several universities in Hungary.

Participants completed an informed consent form, entered demographic data, filled in the Hungarian version of ORTO-15 questionnaire and a checklist of food choices via online. They also answered several ON-specific questions developed for the purpose of this study (based on former descriptions and clinical experiences). Finally, participants were asked about their lifestyle (sports activity, dieting), food consumption and other habits (nutritional supplements, medicine, alcohol, drugs, and smoking).

Ethical approval for the studies was obtained from the Semmelweis University Regional and Institutional Committee of Science and Research Ethics (registration number: 4498–0/2011-EKU; 410/PI/11).

Measuring instruments

Beside the sociodemographic and anthropometric data questions related to eating disorders, lifestyle and food choices were administrated. Eating Disorder Inventory (EDI), Maudsley Obsessive Compulsive Inventory (MOCI), ORTO-15 and supplemental ON related questions were used in the study.

Results

There were significant sex differences in the following variables: Female participants had higher scores on MOCI (7.64 ± 4.80 vs. 6.36 ± 4.39 ; $t = -2.356$; $p < 0.5$) and more eating disorder symptoms ($30,57 \pm 27,02$ vs. $20,97 \pm 15,15$; $t = -5,010$; $p < 0,001$). According to the Eating Disorder Inventory female individuals reported higher drive for thinness ($3,91 \pm 5,31$ vs. $0,94 \pm 0,61$; $t = -11,308$; $p < 0,001$), more bulimic symptoms ($1,34 \pm 3,26$ vs. $0,49 \pm 1,25$ $t = -4,711$; $p > 0,001$), higher body dissatisfaction ($7,74 \pm 7,44$ vs. $3,74 \pm 4,47$; $t = -7,185$; $p < 0,001$), and lower interoceptive awareness ($1,47 \pm 2,17$ vs. $2,44 \pm 3,03$; $-3,439$; $p < 0,01$) compared to male individuals. Regarding the obsessive compulsive features women showed significantly higher overconcerns related to cleaning ($2,46 \pm 2,16$ vs. $1,65 \pm 1,63$; $t = -4,174$; $p < 0,001$) and more depressive symptoms ($13,48 \pm 4,65$ vs. $12,51 \pm 4,03$; $t = -2,076$; $p < 0,05$) compared to men.

Hungarian adaptation of ORTO-15

Confirmatory factor analysis (CFA) was used to test whether our data fitted well any factor structure. Four CFA were performed.

The confirmatory factor analytic investigation revealed that the three-factor solution (Model 1), suggested by Donini and colleagues, should be rejected ($\chi^2 = 931.2$; $p < 0.001$; $\text{CMIN/DF} = 10.7$; $\text{CFI} = 0.72$; $\text{TLI} = 0.66$; $\text{RMSEA} = 0.11$; $\text{PCLOSE} < 0.001$). The single-factor solution (Model 2) showed slightly worse goodness-of-fit indices ($\chi^2 = 1080.8$; $p < 0.001$; $\text{CMIN/DF} = 12.0$; $\text{CFI} = 0.67$; $\text{TLI} = 0.62$; $\text{RMSEA} = 0.12$; $\text{PCLOSE} < 0.001$); therefore, this model had to be rejected as well.

Because of the poor fit indices of the first two models, an item analysis was conducted to evaluate the appropriateness of each item. Based on the particularly low item-total

correlations and factor loadings from the second Confirmatory Factor Analytic Model (CFA), we decided to omit item numbers 5, 6, 8, and 14. A further CFA was conducted to examine the goodness of fit of the shortened version's single-factor structure. Although this solution showed better fit indices ($\chi^2=530.8$; $p<0.001$; CMIN/DF=12.1; CFI=0.81; TLI=0.76; RMSEA=0.12; PCLOSE<0.001) compared to the previous two models, the indicators still remained unsatisfactory. Therefore the variances of the error terms were analyzed through modification indices. Following the cut-off criteria of modification indices equal to or higher than 50, three covariances between error terms were incorporated into a fourth model generating a new single-factor structure. The error terms correlated were those of items (modification indices between parenthesis) 10/11 (116.5), 10/12 (107.0), and 11/12 (96.4). The fit indices of this fourth model proved to be acceptable ($\chi^2=230.8$; $p<0.001$; CMIN/DF=5.63; CFI=0.92; TLI=0.90; RMSEA= 0.076; PCLOSE<0.001).

Internal consistency of the original 15-item and the shortened 11-item version proved to be adequate (Cronbach's alpha=0.78 and 0.82, respectively).

Cut-off score of orthorectic tendency

First, the theoretical and empirical distribution of ORTO-15 was examined (logistic distribution: $p>0,05$), which resulted in a cut-off point ca. 35. This divided the sample to a ratio of 25-75 (25% with ON tendency). On this base, the cut-off score 26 was derived from the 11 item long ORTO-11-Hu (values between 11-44). This corresponds to the score one standard deviation from the mean ($28,83\pm 3,15$), thus supports this cut-off, since the variable ORTO-11-Hu did not diverge widely from normal distribution.

Internal consistency and validity

One of the aims of this study was to check characteristics that could be external criteria for ON, or at least could independent of the items of the ON scale. A 10-statement list was developed based on the literature of ON, mostly on the descriptions of Bratman (Bratman 1997, Bratman and Knight 2000), and on case studies. The data confirmed the link between ORTO-11-Hu scores and the scores on the supplemental questions from the ON clinical literature. Tendency towards ON was significantly associated with the consumption of health food, and eating according to a fixed schedule, indicating that respondents consuming mainly health food ($Z=-4,193$; $p<0,001$) are more likely to follow their eating schedule ($Z=-3,702$; $p<0,001$); more often tend to find overweight as a sign of weakness ($Z=-5,266$; $p<0,001$), avoid food with specific colors ($Z=-3,235$; $p<0,001$), more often judge negatively people who

cannot overcome their desires ($Z=-2,580$; $p<0,001$) and those who do not follow the rules of healthy nutrition ($Z=-4,091$; $p<0,001$). Individuals with ON tendency more often tend to find true the statement 'people can be blamed for their own diseases' ($Z=-5,428$; $p<0,001$). They had higher tendency to eat the same food every day ($Z=-4,177$; $p<0,001$), and to spend a huge amount of time preparing meals ($Z=-7,135$; $p<0,001$).

These results were found in the group of women, while among male individuals only the statement 'consuming health food' was confirmed ($p<0,001$).

Principle component (PC) analysis of the ten items led to the next two PC's: Self-denial and Excessive focus on eating PC.

Lifestyle characteristics, life threatening behaviors and food choices

Results support the validity of ORTO-11-Hu. Individuals with higher sport activity had higher ON tendency compared to participants with no sport activity ($\chi^2=17,083$; $p<0,001$). There were no significant differences between higher and lower scorers on ORTO-11-Hu with respect to frequency of smoking, substance use, caffeine consumption, medicine and nutrition supplement intake. Participants who never drink alcohol had higher tendency towards ON compared to others who drink alcohol on a monthly or weekly basis ($\chi^2=13,016$; $p<0,05$). Individuals on special diets showed significantly lower scores on ORTO-11-Hu ($Z=4,175$; $p<0,001$) than non-dieting individuals.

Individuals with a greater tendency to encourage relatives and friends to follow their supposedly healthy diet reported a higher tendency towards ON compared to individuals who did not try to convince others ($Z=3,036$; $p<0,001$).

Individuals eating whole wheat cereals more frequently reported higher ON tendency compared to others eating whole wheat cereals less ($\chi^2=8,206$; $p<0,05$). These results contradicted the results related to white wheat cereals. Participants eating white wheat cereals with higher frequency had lower tendency towards ON than others who eat white wheat cereals occasionally ($\chi^2=17,411$; $p<0,001$). ON tendency was higher among the participants eating fruit regularly compared to those eating fruit rarely ($\chi^2=9,486$; $p<0,1$). Regular consumption of vegetables was also associated with higher tendency to ON than lower frequency of vegetable consumption ($\chi^2=9,407$; $p<0,1$). ON tendency was higher in the groups of individuals who more regularly visit health food shops compared to those who do not shop at such stores ($\chi^2=9,325$; $p<0,01$).

Female individuals in the group with higher ON tendency showed more frequent consumption of whole wheat cereals ($\chi^2=6,964$; $p<0,05$); less frequent consumption of white wheat cereals ($\chi^2=10,424$; $p<0,05$) compared to women in the group without ON tendency. In the group of men, there were higher consumption of fruit in the group with ON tendency compared to individuals without tendency towards ON ($\chi^2=7,570$; $p<0,05$).

Compared to women with no ON tendency, among female individuals with higher tendency towards ON significantly more women do sport regularly ($\chi^2=8,923$; $p<0,05$), follow a diet ($\chi^2=16,544$; $p<0,05$), and have a tendency to encourage relatives and friends to follow their supposedly healthy diet ($\chi^2=4,438$; $p<0,05$).

Constructs related to orthorexia nervosa

Tendency towards ON showed weak but positive correlation with four subscales of EDI: Drive for thinness ($r=-0,3$; $p<0,01$), Bulimia ($r=-0,23$; $p<0,01$), Ineffectiveness ($r=-0,21$; $p<0,01$), Interoceptive awareness ($r=-0,25$; $p<0,01$). Investigating the gender differences, we found correlations ($p<0,001$) between EDI subscales and ORTO-Hu-11 among women participants, while in the group of men higher Drive for thinness ($r=-0,224$; $p<0,05$) and perfectionism showed association with ON tendency ($r=-0,456$; $p<0,01$). ORTO-11-Hu correlated weakly with the subscales of MOCI: „Checking” ($r=-0,255$; $p<0,001$) and „Doubting” ($r=-0,262$; $p<0,001$) subscales. MOCI subscales correlated with ORTO-11-Hu only in the group of women ($p<0,01$). Higher tendency towards ON go hand in hand with significantly more obsessive and compulsive features on all of the four subscales.

There were no significant differences in the sociodemographic and anthropometric characteristics between the groups with and without ON tendency (cut-off point= 26). Higher ON tendency was showed in 21,82% of women and 20,93% of male individuals. There were significant differences between men and women on the Eating Disorder Inventory ($t=5,975$; $p<0,001$), the Maudsley Obsessive Compulsive Inventory ($t=-6,637$; $p<0,001$), and the Beck Depression Inventory ($t=-5,544$; $p<0,001$). Individuals with higher tendency towards ON had more disordered eating related, more obsessive compulsive and more depressive symptoms, compared to individuals without ON tendency. This difference is found on all of the subscale of EDI and MOCI.

All these results were confirmed in the group of female individuals ($p<0,001$). However, in the group of male participants, individuals with higher ON tendency had higher scores on MOCI

($t=-2,124$; $p<0,05$), scored higher on the subscale Doubting ($t=-2,204$; $p<0,05$) and on the Perfectionism subscale of EDI ($t=-4,500$; $p<0,001$) compared to males without ON tendency.

Predictors of orthorectic tendency

First, the hierarchical linear regression model was carried out to predict the values of ORTO-11-Hu, given a set of explanatory variables: self-reported eating disorders (subjective), the categories of BMI, healthcare profession, sex, gender, education and age. Younger age ($B=0,13$; $p<0,01$), former eating disorder ($B=-0,18$; $p<0,001$), obesity ($B=-0,09$; $p<0,05$) showed statistical significant predictors of ON tendency ($R^2=5,5\%$). The second model included EDI, MOCI, BDI variables, thus beside the younger age ($B=0,10$; $p<0,05$) and a former eating disorder ($B=-0,09$; $p<0,001$) the obesity as a predictor disappeared, the disordered eating ($B=-0,17$; $p<0,001$), and the obsessive compulsive features ($B=-0,13$; $p<0,001$) became significant predictors of tendency towards ON ($R^2=12\%$). Investigating the subscales of EDI and MOCI, it turns out that only one subscale of both EDI and MOCI were responsible for the predictive value of these variables. On the EDI Drive for thinness ($B=-0,29$; $p<0,001$), and the body dissatisfaction ($B=0,34$; $p<0,05$), on the MOCI Checking ($B=-0,11$; $p<0,05$) and Doubting ($B=-0,11$; $p<0,05$) seemed to be predictors of ON tendency. Including the subscale the effect of BDI became statistically significant ($B=-0,10$; $p<0,05$) ($R^2=15,8\%$).

The previously developed Principle Components, Excessive focus to eating PC and Self-denial PC were included into the multiple linear model of ORTO-11-Hu increasing the R^2 to 19,2%.

Younger age ($B=0,11$; $p<0,01$), obesity ($B=-0,07$; $p<0,05$), disordered eating symptoms ($B=-0,15$; $p<0,001$) and obsession, compulsion ($B=-0,09$; $p<0,0001$) emerged as predictors of ORTO-11-Hu beside the two PCs ($B=-0,21$; $p<0,001$ and $B=-0,14$; $p<0,001$) ($R^2=19,2\%$). Investigating the subscales in the model, apart from the two PC's ($B=-0,20$; $p<0,001$ and $B=-0,14$; $p<0,001$) younger age ($B=0,12$; $p<0,001$), obesity ($B=-0,08$; $p<0,05$), Drive for thinness ($B=-0,23$; $p<0,001$) and Checking subscales ($B=-0,14$; $p<0,01$) proved to be predictors of ORTO-11-Hu explaining 22,1% of the heterogeneity. Including the Drive for thinness factor ($B=-0,19$; $p<0,001$) to the model, EDI as a predictor of ON tendency disappeared.

Binary logistic regression model of ORTO-11-Hu was carried out resulting in the following predictors of ON tendency: Excessive focus on eating PC ($B=0,358$; $p<0,001$), Self-denial

PC ($B=0,407$. $p<0,001$), Obsessivity and Compulsivity ($B=0,052$; $p<0,05$) and tendency towards disordered eating ($B=0,015$; $p<0,001$).

Self-reported eating disorders

There were significantly higher tendency towards ON in the group with current eating disorders among female individuals ($\chi^2=46,235$; $p<0,001$). Women who reported present experience of eating disorders had higher tendency towards ON compared to those with past experience of eating disorders, and those without eating disorders ($\chi^2=42,726$; $p<0,001$).

Prevalence of eating disorders according to objective criteria

No man in the sample had a diagnosis of AN, BN, and their subclinical form according to the diagnostical criteria by the DSM 5. The prevalence of eating disorders among women was 0,41% for AN, 1,8% for BN, 10,08% for subclinical AN, and 3,31% for subclinical BN. Women showed association with higher ON tendency (lower ORTO-11-Hu scores) in the group of both AN and BN and their subclinical forms, and these individuals were significantly more likely part of the group with tendency towards ON.

High risk group for orthorectic tendency

We supposed that individuals with healthcare profession differ from individuals with non-healthcare profession regarding ON tendency, eating disorder and obsessive compulsive symptoms. Health care professionals had significantly more eating disorder ($t=2,799$; $p<0,01$) and obsessive compulsive characteristics ($t=2,801$; $p<0,01$) compared to non-healthcare professionals. There were no statistically significant differences between the two groups regarding to ON tendency.

Conclusions

This is the first explorative study measuring tendency towards orthorexia nervosa (ON) and its correlates on a large sample in Hungary. Confirmatory factor analysis including 810 participants suggested a single factor structure for the 11-item shortened version of the instrument ORTO-15 (Donini et al, 2005), which led to the Hungarian adaptation of it, called ORTO-11-Hu. Internal consistency of the measure and its validity were adequate, lifestyle and eating habits theoretically associated to tendency towards ON were also examined. As we expected, the participants with ON tendency showed healthier lifestyle and eating behaviors

compared to participants without ON tendency. A new cut-off score distinguishing between individuals with or without ON tendency was established. According to the new cut-off point (ON tendency below 26) 21.7% (n=176) of the total sample (N=810), 20.93% of men and 21.82% of women proved to have ON tendency. The characteristics of the group with ON tendency were examined: more eating disturbances (according to Eating Disorder Inventory), more obsessive and compulsive features (according to Maudsley Obsessive Compulsive Inventory) and more depressive symptoms (according to Beck Depression Inventory) were found in this group.

Based on the subjective self-reports and objective criteria of eating disorders (according to DSM 5), individuals with eating disorders had higher ON tendency.

Background factors and correlates of tendency to ON were revealed by the multivariate regression analysis, showing that younger age, overweight, drive for thinness, compulsive checking and focus on nutrition, and self-restraint are the explanatory factors of ON tendency. Comparing groups of healthcare and non-healthcare professionals differences were found. Besides the focus on nutrition and self-restraint, eating disorder symptoms emerged as explanatory factors of ON tendency in the group of individuals with healthcare profession, while in the group of non-healthcare professionals obsessive and compulsive features proved to be factors explaining ON tendency.

There were significantly more women with ON tendency among individuals with past or present experience of eating disorders. Women with both AN, BN and their subclinical forms had significantly higher tendency towards ON (lower ORTO-11-Hu scores) and were significantly more likely to be part of the group of individuals with ON tendency according to the cut-off score of 26. Since men were underrepresented in the sample, these results do not represent reliably the gender differences occurring in eating disorders.

The newly developed questionnaire ORTO-11-Hu is the third foreign language adaptation of ORTO-15, with proper and deep psychometric analysis. This is the first research in Central-Eastern Europe investigating correlates of ON tendency on a large and varied sample size, concentrating particularly on its relation with eating disorders and obsessive compulsive disorders.

Further research on ON is needed with representative samples involving different groups of professionals to improve the knowledge related to ON tendency and to make the results generalizable. Further international and comparative studies are needed in order to explore the cultural differences of ON tendency which can help us develop better assessment instruments and make the results comparable, and could help us clarify the ON phenomenon in a more accurate way and may lead to the adequate diagnostic criteria of ON.

List of publications

Publications related to this thesis:

Book chapters

1. **Varga M**, Túry F. Az evészavarok és a kényszerbetegség kapcsolata. In: Túry F, Pászthy B. (szerk.) Evészavarok és testképzavarok. Pro Die, Budapest, 2008: 273-285.
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1. **Varga M**, Túry F. (2008) Obsessionality and compulsivity in eating disorders. Rev Med Chir Soc Med Nat, 112(3): 181-188.
2. **Varga M**, Túry F. (2008) Az evészavarok és a kényszerbetegség kapcsolata. Házi orvos Továbbképző Szemle, 8(10).
3. Túry F, Babusa B, Dukay-Szabó Sz, **Varga M**. (2010) Az evés- és a testképzavarok újabb típusai a modern civilizációs ártalmak között. Magy Tud, 171(11): 1306-1315.
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1. Túry F, Babusa B, **Varga M.** (2010) History of eating disorders in Hungary. *Psihijatan*, 42(1): 73-84.
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