

ANALYZING THE CORRELATES OF ORTHOREXIA NERVOSA AMONG HUNGARIAN GYM ATTENDEES

PhD thesis

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1. Introduction

Orthorexia nervosa is a new type of eating disorder, in which the individual is compelled to adhere to a healthy diet. Similarly to anorexia and bulimia nervosa, obsessive, ritualized and immobilizing eating habits dominate their daily lives, although diagnostic systems do not count them as an eating disorder yet. Over the years, several attempts have been made to describe the phenomenon by constructing different diagnostic criteria lists (1–5) which agreed or differed on numerous points. These are the following:

- The common terms that appear in all proposals are “obsessive”, “purity”, “fixation”, “impairing”, “rigid”, “preoccupation”, “health”, “restrictive”. These imply that strict patterns of ON cause difficulty because the habits take over the control over one’s life and are detrimental to mental or physical health, primarily because of the loss of control that can also lead to extreme nutrient deficiencies.
- Malnutrition and severe weight loss are mentioned in four places (not listed by Setnick).
- Impairment of social life and the preoccupation with weight and figure is also a cause for concern, but it does not appear on Moroze’s list, however, only Moroze brings up spending excessive amounts of time and money as a criterion.
- Setnick and Moroze point out that it is not ON when food exclusion happens due to cultural reasons or other reasons like medically prescribed diets or food unavailability. This aspect is referred to in the lists of Barthels and Dunn & Bratman by calling orthorexic food avoidance “self-imposed” and “subjective”.
- Dunn and Bratman raise the possibility that becoming addicted to health food is pathological only if further progression takes place over time. Obsessive thinking about food, compulsive and self-punishing behavior must be escalating in order to call this condition abnormal.

Based on studies from recent years, the main psychological correlates of ON are *compulsiveness and perfectionism* (6–8), but body image disorder and drive for thinness are also in parallel with the symptoms of ON; in addition, anorexia nervosa and bulimia nervosa also occur in significant proportions in the presence of ON tendencies (9–11). The results of several studies have shown that malnutrition amplifies the severity of anxiety and depressive symptoms (12).

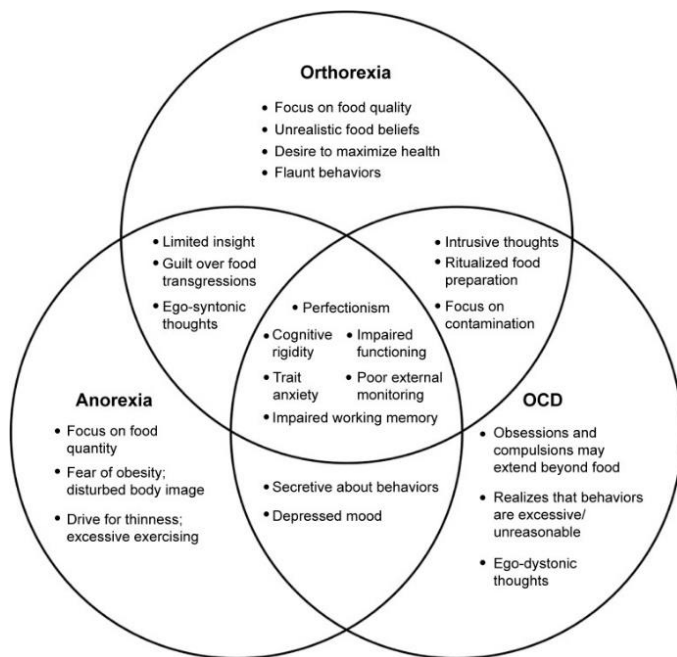


Figure 1. Overlapping characteristics in ON, OCD and AN

The relationship between **self-esteem and ON** is mentioned in Renee McGregor's book *Orthorexia - When Healthy Eating Goes Bad*. The author describes the patterns of the behavior she observed as a practicing dietitian on her clientele and explains orthorexic tendencies originating from people pushing their potentials to their limits in order to gain self-esteem. However, she stresses that what has started as self-care, often turns into self-harm (13). Chasing self-esteem by following a perfectly planned diet is not possible, as it is a flawed approach to find inner peace.

Several questionnaires were developed to measure ON. One of the objectives of the dissertation is methodological development: to improve the availability of effective ON questionnaires in Hungarian. The best known measuring instrument is the ORTO-15 and its translated versions. These measure the features of ON along three aspects, such as cognitive-rational, clinical, and emotional domains. However, the ORTO-questionnaires became less and less valued in the academic community as the dimensions have not been elaborated or psychometrically tested, and the use of these tools shows an extremely varied ON prevalence (8). The Teruel Orthorexia Scale places great emphasis on distinguishing between two types of orthorexic behaviors ("healthy orthorexia" and "orthorexia nervosa"): the 15-item questionnaire is constructed from these two dimensions (14). The Düsseldorf Orthorexia Skala, which measures overly healthy eating habits, is a ten-item, one-dimensional tool (15). In 2013, Gleaves et al. Developed the 21-item Eating Habits Questionnaire (EHQ; Eating Habits Questionnaire), a widely used tool

with good psychometric indicators (16–19). We contacted the author of the questionnaire, and based on his suggestion we adapted an improved 30-item version called Eating Habits Questionnaire-Revised (EHQ-R) into Hungarian, which will be presented in detail in this dissertation.

The main topic of this thesis is to analyze the correlates of ON on the sample of Hungarian adults who are exercising regularly. Choosing recreational athletes occurred because several studies have treated them as a risk group in assessing the symptoms of ON and relationship has been shown between overtraining syndrome and ON (20). The growth of the fitness industry and the number of gyms is undoubtedly for promoting health. However, in these communities, the ideal of health appears as an expectation, often based on misleading and unfounded information, or even dogmatic belief systems about diets. Forced compliance with these diet regimes can affect psychological wellbeing, lead to anxiety and several mental disturbances.

2. Objectives

The aim of the dissertation is to investigate the symptoms and correlations of ON in a high-risk population, among frequent recreational exerciser adults in Hungary.

Two cross-sectional studies were carried out for this dissertation with two years apart. After publishing the results of the first study (the “2017 study”), I recognized the importance to conduct a second study on a sample with the same sample characteristics (“2019 study”). One reason for doing so was that I sought out to find and translate a new questionnaire and validate it in Hungarian, so that researchers will be able to use it in the future. Another reason for a second study was the intention to investigate new constructs that may relate to ON, besides variables that point to psychiatric clinical diagnoses used in the 2017 study. Instead, I measured traits that are more connected to the participant’s personality or their outlook of life. Hence, the scope of the 2019 study was to explore further psychological traits through variables such as self-esteem and contentedness.

2.1. Common goals and hypotheses for both studies

My first aim was to explore in what distribution is ON present among the participants who chose to fill out the questionnaire.

Regarding sociodemographics and training habits, the hypotheses are the same in both surveys. The following assumptions were made, considering the population of fitness participants:

H1: There have been mixed results so far regarding the gender differences in orthorexic tendencies among fitness participants. The fact that also male athletes might get into disordered eating habits point to the assumption that over time, ED and/or ON would be affecting both genders equally. Therefore, I hypothesize that there is no significant difference between genders in their ON tendencies.

H2: There have been ambivalent results so far regarding age as well. However, among recreational exercisers, it was more likely to measure ON tendencies amongst those who are younger. H2 predicts a negative correlation between ON and age: the younger the participants, the more orthorexic they are.

H3: Due to the relationship between overtraining syndrome and ON deriving from perfectionist standards, a positive correlation between ON tendencies and the frequency of exercise is assumed.

H4: A negative correlation between the years of training and ON is presumed, because the years spent getting to know the fitness industry's communication may cause less difficulties in coping with the perfectionist standards of wanting to keep a "perfect" diet (21).

2.2. Objectives and hypotheses for the 2017 study only

In the first study, two possible comorbid psychiatric illnesses are in focus: eating disorders and OC traits. It is hypothesized that other DSM-registered eating disorders and OCD would have a relationship with ON, in the following way:

H5: It is assumed that those with ON would display more eating disorder related psychopathological characteristics: the higher they score on Perfectionism, Drive for thinness and Interpersonal Distrust – the three subscales of the Eating Disorders Inventory (EDI) (22), the more orthorexic they are.

H6: OCD features are expected to show a correlation with orthorexic tendencies: the higher they score on showing OC traits, the more orthorexic they are.

2.3. Objectives and hypotheses for the 2019 study only

The second survey utilizes EHQ-R, a new questionnaire that was translated from English and validated for this study on this sample. The goal of the 2019 study is to examine its psychometric properties, therefore, the factor structure, scale score reliability, test–retest reliability and construct validity are investigated.

Besides the confirmatory factor analysis (CFA), self-esteem and contentedness were tested as psychological correlates. The aim was also to find out whether being contented with one's own

life could work as a mediator between higher self-esteem and less orthorexic tendencies among fitness participants:

H7: There is a link expected between self-esteem and ON, awaiting that lower self-esteem would predict orthorexic tendencies.

H8: It is assumed that this connection is mediated by contentedness in a way that higher levels of dissatisfaction with one's life predicts orthorexic tendencies.

3. Methods

3.1. Sample and design

In the case of both cross-sectional studies, I recruited adults who regularly performed recreational exercise multiple times a week, via accessibility sampling. I distributed the questionnaire using the Google Forms application mainly in social media, in closed, thematic groups, and also sent it to the mailing list of a fitness school in Budapest. In the data collection conducted in 2019, I indicated that some of the research will be repeated - to participate in this, they could optionally enter their email address, providing an opportunity to test the temporal consistency of the EHQ-R. My final sample was 207 in 2017 and 175 in 2019.

3.2. Measuring demographics and training habits; tools to detect ON and its correlates

Both in 2017 and 2019, I asked the respondents' gender, age, education, and place of residence in the first part of the questionnaire. BMI was calculated based on height and weight. I asked about exercising habits: the frequency per week (optional answers: 3-6 times per week, daily, more than once per day. Training "At least three times per week" was already a prerequisite at the start the questionnaire, thus, there was no option for less frequent options than three times per week); number of the years the respondent has been practicing training in a gym regularly (optional answers: 0-5 years, 6-10 years, more than 11 years), what type of training they have been practicing (optional answers: body building, functional training, yoga, cardio exercise, group classes).

The questionnaire then continued with measuring ON tendencies and their possible psychiatric and psychological correlates.

The Orto-11-Hu is the Hungarian translation of ORTO-15 created by Varga and colleagues in 2014 using 11 items. Each item is scored on a 4-point Likert scale (always, often, sometimes, never) to reflect their agreement with the statements in the scale: those who present an

orthorexic tendency are scored as 4, and items that reflect “normal” eating behavior are scored as 1; the cutpoint of this tool is 23. Next, I used three subscales of the EDI (Perfectionism, Drive for Thinness, and Interpersonal Distrust) to measure the properties of the eating disorders that are also recorded in the DSM. Finally, compulsive traits were tested using the Maudsley Obsessive Compulsive Inventory (MOCI) questionnaire by calculating the overall score (and not dividing it to its subscales).

In the 2019 research, the EHQ-R questionnaire developed by Gleaves and colleagues consists of 30 straight-line items and measures the characteristics of ON identified so far. The validation and introducing its psychometric properties (23) is also part of this dissertation. The instrument has five subscales. The seven-item “Rigidity” subscale assesses the rigor of compliance level to self-prescribed dietary rules. The six-item “Healthy body appearance” subscale is aimed to measure anxiety regarding superficial signifiers of health and how participants connect healthy external signs and outward appearance to dieting. “Violation of dietary rules” focuses on how the individual can handle the consequences of possible violations of their own dietary rules, using seven items. The six questions of the “Negative emotionality” dimension assess the presence of stress, anxiety, guilt, shame and self-hatred which can occur after an ‘impure eating’. Finally, the four-item “Time impairment” subscale aims to measure whether one devotes an excessive amount of time to the implementation of a healthy diet. The EHQ-R scale can also be used by summarizing the scores of the subscales. The higher the global score is, the more disordered the set of dietary rules are followed by the individual. The answers range on a Likert-type scale (1= strongly disagree, 4 = strongly agree).

In the 2019 study, I used two further questionnaires to measure psychological correlates: the Rosenberg self-esteem scale (RSES) (24) and the Contentedness subscale taken from the Spiritual Awareness Questionnaire (25). RSES is a one-dimensional questionnaire, which is most commonly used for examining self-esteem as a psychological construct. As for the Contentedness scale, it has one dimension, and higher scores mean that the individual does not depend on external feedback, as they are satisfied with their current state, aware of their values and take responsibility of their own thoughts and emotions.

3.3. Statistical analyses

3.2.1. The 2017 study

In the 2017 study, first, a univariate linear regression was completed to assess the relationship between the dependent variable (Orto-11-Hu), EDI’s three subscales (Drive for thinness,

Perfectionism, Interpersonal Distrust) and MOCI. Subsequently, a mediation analysis was performed to analyze various paths between these variables using PROCESS's *Model 4*. PROCESS is a plugin that can be inserted to SPSS and uses a bias-corrected bootstrap confidence interval approach when providing estimates of indirect effects (26). The paths are visualized on the schematic figure on *Figure 2*.

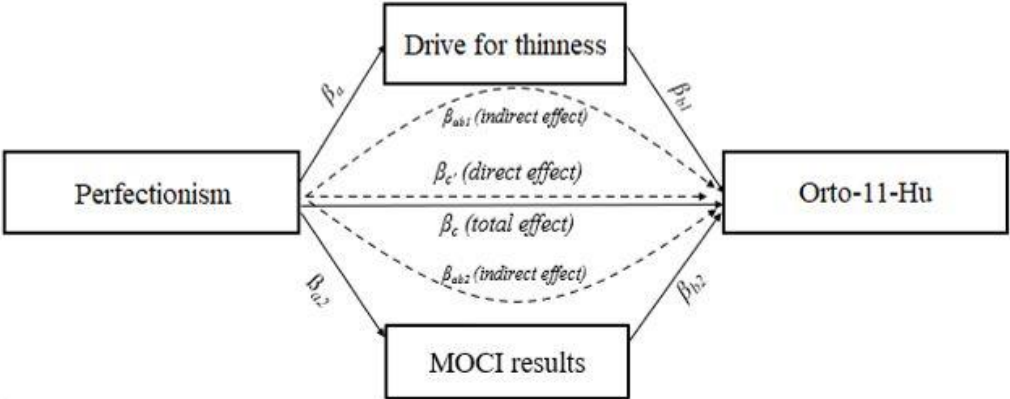


Figure 2: Mediation paths between perfectionism and orthorexic tendencies

This was followed by a second regression, as I found it important to control for further variables. This analysis had three steps: first, age and gender were added, then training habits (how long have they been attending the gym, and frequency of exercising) were entered, finally, the psychological correlates, again. After this, yet another mediation was carried out (this time, a mediated one), to analyze the paths between these variables, using *Model 6* of PROCESS. The paths are visualized on the schematic figure on *Figure 3*.

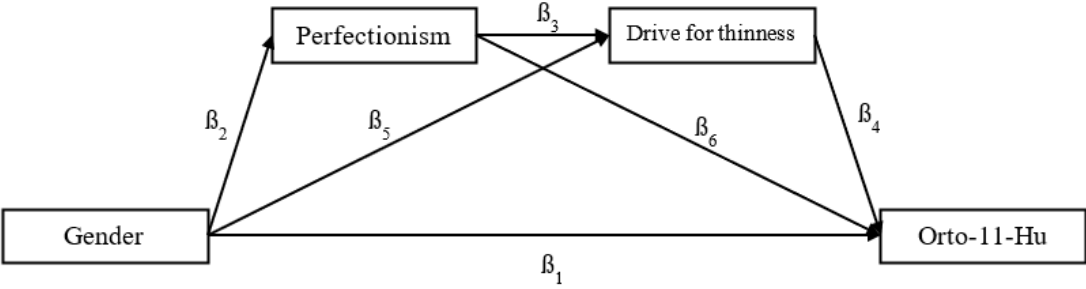


Figure 3: Mediated mediation between gender and orthorexic tendencies

3.1.2. The 2019 study

The 2019 study started with a confirmatory factor analysis to validate the theoretical factor structure of the EHQR. The goodness of fit of the model was examined checking the following

indicators: χ^2 -test, RMSEA, CFI and TLI. A Cronbach's alpha-index was calculated estimate the internal reliability of the scales, together with their 95% confidence interval. Test-retest reliability was done by correlation analysis of the data recorded over a five-week time interval with 48 participants (by calculating Pearson's correlation and Spearman's rank correlation coefficients). To check the scales' construct validity, I also calculated a correlation coefficient with the Orto-11-Hu questionnaire.

For testing the hypotheses, I also used mediation pathway analysis. The paths between self-esteem and orthorexic tendencies are visualized on a schematic way on *Figure 4*. The box on the right ("Orthorexic tendencies") means that EHQ-R's sum score and all five subscales (representing separate problematic orthorexic behaviors) were tested separately in this way: assuming that self-esteem influences these eating behaviors through contentedness.

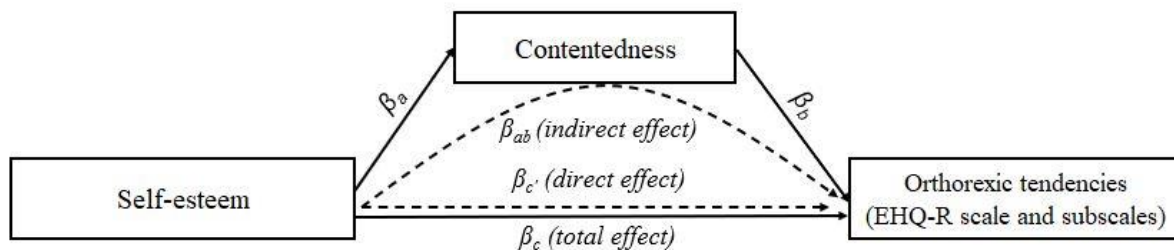


Figure 4: Mediation between self-esteem and orthorexic tendencies

4. Results

4.1. Demographic patterns and exercise habits in both studies

In the 2017 study, the mean age of the 207 participants (67 men and 140 women) was 31.9 years (SD 8.7; range: 18–59 years); the mean body mass index was 23.4 (SD 3.7, 17.2–37.6). The majority were graduates with higher education, and about half of the participants lived in the capital. Of these, 76.8% trained 3-6 times a week, 19.3% reported daily gym visits, and 3.8% exercised more than one time per day. Most of them (57.4%) have only been training regularly for five years or less. The highest proportion of participants reported practicing functional training (41%), followed by bodybuilding (36.2%), aerobics (16%) and yoga (6.8%).

In the 2019 study, the final sample consisted of 175 individuals (50 men and 125 women). Their mean age was 35.4 years (SD = 7.59 years; range: 18–57 years). The mean BMI was 24.8 (SD = 4.94 kg, range: 17.4-47.8). 2% of participants have a primary education, 20% have a secondary education and 78% have a higher education. In terms of place of residence, 55% of respondents live in Budapest, 29% in cities, 9% in small towns and 7% in villages. 44.6% of

study participants have been training regularly for less than 5 years, 26.3% for 5–10 years, and 29.1% for at least 11 years. In terms of training frequency, 89.7% of respondents train several times per week, 7.4% daily, and 2.9% multiple times per day. Among the exercise forms, functional training dominates (36.0%), a quarter of the participants does aerobic exercise (28%), followed by bodybuilding (14.3%), music-dance group classes (11.4%) and yoga (10.3%).

4.2. The main results of the 2017 study

The occurrence of ON in the 2017 study, based on the 23-point cut-off of Ortho-11-Hu, was 13%. Age was negatively correlated with orthorexic tendencies ($r = -0.201$, $p < 0.05$) and women were more orthorexic than men ($r = 0.233$, $p < 0.0001$).

Drive for thinness ($r = 0.636$, $p < 0.0001$), perfectionism ($r = 0.287$, $p < 0.0001$), interpersonal distrust ($r = 0.302$, $p < 0.0001$) and compulsive traits ($r = 0.425$, $p < 0.0001$) were all positively correlated with Ortho-11-Hu results. These four variables explain 46.5% of the orthorexic tendencies in my sample, but it can be seen in the regression model that perfectionism loses its significance in the shadow of the other variables ($\beta = 0.042$, $p = 0.487$)

In the model where drive for thinness and OC traits are treated as possible mediator variables between perfectionism and ON, the analysis (see *Figure 2*) revealed the following relationships: the relationship between perfectionism and ON can be influenced through OC traits (effect: $\beta_{ab2} = 0.0694$. LLCI: 0.0245. ULCI: 0.1214, significant), but it is more prominent through the drive for thinness ($\beta_{ab1} = 0.2244$. LLCI: 0.1485. ULCI: 0.3053, significant).

In the model in which other variables were controlled (age, gender, training habits), it is visible that although women were more orthorexic than men, gender has lost its significant effect in this regression ($\beta = 0.064$, $p = 0.239$). Consequently, I implemented another, mediated mediation model (for the schematic figure, see *Figure 3*). This has shown that women are more prone to become orthorexic, partly because they score higher on perfectionism than men ($\beta = 0.3085$, $p = 0.0375$), and perfectionist norms are easily revealed through a drive for thinness ($\beta = 0.3678$, $p < 0.0001$) - and this desire to be thinner is closely related to orthorexic tendencies ($\beta = 0.6388$, $p < 0.0001$).

4.3. Results of the 2019 research

4.3.1. Adaptation of the Eating habits questionnaire-revised (EHQ-R) to Hungarian

The results of the CFA supported the five-factor theoretical model of the EHQ-R questionnaire and showed an overall acceptable fit ($\chi^2(395) = 856.2$; $p < 0.001$, CFI = 0.914; TLI = 0.906; RMSEA = 0.082 [CI 90: 0.074–0.089]). The values of the factor weights ranged from 0.61 to 0.90. The correlation coefficients between the factors ranged from 0.73 to 0.95. In terms of reliability, Cronbach's alpha indicators of internal reliability ranged from 0.75 to 0.87, supporting the internal consistency of the subscales. To test the conceptual validity, I used the Orto-11-Hu questionnaire. This correlation analysis showed that all subscales of the EHQ-R showed a significant, strong relationship with the ORTO-11-Hu questionnaire as expected ($r / \rho = | 0.63-0.68 |$).

4.3.2. Relationship between gender, age and orthorexia nervosa

Regarding gender differences, only the EHQ-R Rigidity subscale showed a trend-level significant difference for women ($r=0.136$; $p = 0.073$). The direction of the correlation was the same between age and orthorexic tendencies: there was a significant negative relationship between age and the Negative Emotionality ($r = -0.18$; $p = 0.017$) and the Time Impairment subscale ($r = -0.21$; $p = 0.005$) of the EHQ-R questionnaire. For all other subscales of the EHQ-R (Rigidity, Violation of dietary rules, Body Image), no significant correlation with age was found.

4.3.3. Relationship between self-esteem, orthorexia nervosa, and satisfaction

Table 1 presents the results, which shows us how ON and its five dimensions depend on self-esteem, and also to what extent is this relationship influenced by contentedness (see schematic illustration for these mediation analyses on *Figure 4*). It can be seen that self-esteem has a negative relationship with all subscales, so the more orthorexic the individual is, the less self-esteem they have. This negative relationship was shown to be significantly mediated by contentedness, in the case of all dimensions, with the exception of the Rigidity subscale. So, if someone shows orthorexic eating behavior due to low self-esteem (which manifests itself in the remaining four subscales: anxiety about healthy appearance, anxiety about violating dietary rules, negative emotionality or time impairment), it is more likely that it is because they are not satisfied with their lives, not contented with what they have and depend on the opinions of others.

Output	Predictor	Path	R2	F	β	se	t	p	LLCI	ULCI
Contentedness EHQ-R	Self-esteem	β_a	0.1844	39.1156	0.4294	0.0687	6.2542	<0.0001	0.2939	0.5649
	Self-esteem	β_c	0.0939	17.9292	-0.3064	0.0724	-4.2343	<0.0001	-0.4493	-0.1636
	Self-esteem	$\beta_{c'}$	0.1654	17.0399	-0.1793	0.0771	-2.3248	0.0213	-0.3316	-0.0271
	Contentedness	β_b	0.1654	17.0399	-0.2960	0.0771	-3.8377	0.0002	-0.4483	-0.1438
Rigidity	Self-esteem	β_{ab}	-	-	-0.1271	0.0495	-	-	-0.2349	-0.0416
	Self-esteem	β_c	0.0405	7.3086	-0.2013	0.0745	-2.7034	0.0075	-0.3483	-0.0543
	Self-esteem	$\beta_{c'}$	0.0594	5.4329	-0.1360	0.0819	-1.6607	0.0986	-0.2976	-0.0256
	Contentedness	β_b	0.0594	5.4329	-0.1522	0.0819	-1.8584	0.0648	-0.3138	-0.0095
Violation of dietary rules	Self-esteem	β_{ab}	-	-	-0.0653	0.0448	-	-	-0.1623	-0.0117
	Self-esteem	β_c	0.0834	15.7461	-0.2888	0.0728	-3.9681	<0.0001	-0.4325	-0.1452
	Self-esteem	$\beta_{c'}$	0.1562	15.9212	-0.1605	-0.0776	-2.0701	0.0399	-0.3136	-0.0075
	Contentedness	β_b	0.1562	15.9212	-0.2987	-0.0776	-3.8519	0.0002	-0.4518	-0.1457
Negative emotionality	Self-esteem	β_{ab}	-	-	-0.1283	0.0474	-	-	-0.2304	-0.0454
	Self-esteem	β_c	0.1501	30.5559	-0.3874	0.0701	-5.5277	<0.0001	-0.5258	-0.2491
	Self-esteem	$\beta_{c'}$	0.2131	23.2864	-0.2681	0.0749	-3.5799	0.0004	-0.4160	-0.1203
	Contentedness	β_b	0.2131	23.2864	-0.2779	0.0749	-3.7098	0.0003	-0.4257	-0.1300
Healthy body appearance	Self-esteem	β_{ab}	-	-	-0.1193	0.0481	-	-	-0.2252	-0.0370
	Self-esteem	β_c	0.0530	9.6788	-0.2302	0.0740	-3.1111	0.0022	-0.3762	-0.0841
	Self-esteem	$\beta_{c'}$	0.1086	10.4827	-0.1180	0.0797	-1.4802	0.1406	-0.2753	0.0393
	Contentedness	β_b	0.1086	10.4827	-0.2613	0.0797	-3.2774	0.0013	-0.4186	-0.1039
Time Impairment	Self-esteem	β_{ab}	-	-	-0.1122	0.0446	-	-	-0.2016	-0.0369
	Self-esteem	β_c	0.0456	8.2617	-0.2135	0.0743	-2.8743	0.0046	-0.3601	-0.0669
	Self-esteem	$\beta_{c'}$	0.1405	14.0547	-0.0670	0.0783	-0.8561	0.9391	-0.2215	-0.0875
	Contentedness	β_b	0.1405	14.0547	-0.3411	0.0783	-4.3576	<0.0001	-0.4956	-0.1866
	Self-esteem	β_{ab}	-	-	-0.1465	0.0454	-	-	-0.2433	-0.0667

β_c : total effect, $\beta_{c'}$: direct effect, β_{ab} : indirect effect

Table 1: Results of mediation analyses - the effects of self-esteem on ON mediated by contentedness

5. Discussion and conclusions

The present study is the first to assess ON's correlates in the Hungarian adult population with increased risk in a fitness environment. The results and the related conclusions can be summarized in the following points.

1. The two research projects included in this dissertation show that *women suffer from a higher rate of ON than men*, despite the fact that several studies have not found such difference (8, 10) and that the fitness industry affects both genders.
2. Secondly, *younger age was also a significant correlate of ON*: the younger the participants, the more orthorexic they are. This result appeared in previous research findings as well (27–29).

3. The third hypothesis was also accepted, which assumed *a positive correlation between ON tendencies and training frequency*. There is indeed a link, however, multivariate linear regression analysis has shown that this is influenced by the simultaneous presence of OC traits.
4. In the fourth hypothesis, I stated that *there is a relationship between ON and the years spent with training*: the more years they have been exercising, the less orthorexic the participants are, but this significance has become lost in the regression model, due to age collinearity.
5. Next, the *EDI's three dimensions* were analyzed. *Interpersonal distrust* was also a significant correlate. This may be related to dietary fears and misinformation identified in ON and alternative food networks (30, 31) such as fitness dieters. Distrust evolves due to the “harmful substances” that can enter the body (32), accumulate and cause disease, but a connection between fearful attachment style has also been shown earlier (6). As for *perfectionist traits*, they are strongly presented through the *drive for thinness*, and this is more common in women (in my sample, they scored higher on the perfectionism subscale than men). The robust presence of drive for thinness suggests that similarly to anorexia nervosa, ON individuals are overwhelmed by weight gain-related anxiety. They are motivated by achieving a perfect body shape - and not so much by a healthy diet as they communicate to the outside world. It can be seen that OC traits also take away some of perfectionism's effects. Indeed, in some cases, striving for perfection may involve OC behaviors, but this compulsion might be a general impulse to, for example, keep the house clean or avoiding an accident etc. This broad sense of perfectionist compulsiveness is not specifically food-driven unless the compulsion is to restore a diet-related event that has already happened (for example, over-exercising after eating sweets) or avoiding a feared incident (for example, taking preliminary actions against weight gain or against eating unhealthy). This relationship would be proven by an external variable measuring personality type, so we can only guess that perhaps a conscientious or neurotic personality is in the background. This demonstrates that the use of personality tests in future research may be useful.
6. Thus, the sixth hypothesis, claiming that *compulsive traits correlate with ON* was also accepted, and in addition to presence of the relationship, compulsiveness is also a significant mediating factor in the relationship between perfectionism and ON.

7. The *theoretical factor structure of the five subscale EHQ-R presented in the 2019 study was supported; its internal and temporal reliability and conceptual validity were also acceptable and showed good results.*
8. It was verified that *low self-esteem and high ON tendencies are related.* Results on the Rosenberg self-esteem scale were negatively correlated with all EHQ-R subscales.
9. The relationship in point 8. is mediated by *contentedness: that dissatisfaction with life may be associated with orthorexia.* This mediating role was seen on *all subscales of EHQ-R, with the exception of Rigidity.* Although low self-esteem and rigid dietary regulation are linked, satisfaction is not affected, and this might be because a strictness of the diet is solely due to medical protocol. Thus, contentedness as a construct that also covers mental awareness, might not be related to items that are aiming these strict eating styles (e.g., “I follow a healthy diet rigidly ” or “I must thoroughly check the contents of food”).

Limitations of the study include the use of Ortho-11-Hu, as the quality of this tool is no longer adequate according to scientific consensus, so the 2017 study results should be interpreted with this knowledge. A further limitation of the study is that we do not currently know the cutpoint score of EHQ-R, so we were not able to determine the incidence of ON in the 2019 study. Additionally, the generalizability of the present findings needs to be taken into consideration: these were not general population samples, and due to the lack of a suitable control group (Hungarian adults not training), this study is only descriptive. Finally, in the forthcoming research on orthorexia nervosa, personality dimensions should be taken into account, which may provide further explanations for the psychological relationships of ON.

Publications used in doctoral thesis:

Bóna E., Erdész A., Túry F. (2021) Low self-esteem predicts orthorexia nervosa, mediated by spiritual attitudes among frequent exercisers. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity* doi:10.1007/s40519-020-01095 IF: 3.634

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