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# ANALYZING THE CORRELATES OF ORTHOREXIA NERVOSA AMONG HUNGARIAN GYM ATTENDEES

**PhD thesis**

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# List of abbreviations

AN = Anorexia nervosa
ARFID = Avoidant/restrictive food intake disorder
BED = Binge eating disorder
BMI = Body mass index
BN = Bulimia nervosa
BOT = Bratman Orthorexia Test
CFA = Confirmatory factor analysis
CFI = Comparative Fit Index
CI 90 or 95 = 90 or 95 % Confidence Interval
DOS = Düsseldorfer Orthorexie Skala
DSM = Diagnostic and Statistical Manual of Mental Disorders
EAT = Eating Attitudes Test
ED = Eating disorders
EDI = Eating Disorder Inventory
EHQ = Eating Habits Questionnaire
EHQ-R = Eating Habits Questionnaire-Revised
FEDNEC = Feeding and eating disorders not elsewhere classified
LLCI = Lower level confidence interval
M = Mean
MOCI = Maudsley Obsessive Compulsive Inventory
n = Sample size
OCD= Obsessive compulsive disorder
OC=Obsessive compulsive
ON = Orthorexia nervosa
RD = Registered dietitian
RMSEA = Root mean square error approximation
RSES = Rosenberg Self-esteem Scale
SD = Standard deviation
ULCI= Upper level confidence interval
TLI = Tucker-Lewis fit index
TOS = Teruel Orthorexia Scale
WLSMV = Weighted least squares with means and variances adjusted

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# 1. Introduction

The three main eating disorders (ED) mentioned in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) are anorexia nervosa (AN), bulimia nervosa (BN) and binge eating disorder (BED) (1). Besides AN, BN and BED, the DSM-5 contains three more specified eating disorders: pica is described as consuming indigestible items, moreover, rumination involves bringing up and re-chewing partially digested food that has already been swallowed, and finally, avoidant/restrictive food intake disorder (ARFID) occurs when the patient eliminates certain food types, causing malnutrition. In addition, Feeding and Eating Disorders Not Elsewhere Classified (FEDNEC) is also mentioned. Descriptions for various forms of FEDNEC keep appearing, for example, the night eating (2) or purging disorder (when purging behaviors are present but there are no binge eating episodes like in the case of BN) (3). A phenomenon that shows qualities similar to obsessive-compulsive disorder (OCD) called orthorexia nervosa (ON) has also appeared among these observations, depicting an ED that involves overly healthy eating habits.

In the introduction of this thesis, the theory of healthy eating becoming a disordered behavior will be summarized. By looking at different diagnostic criteria proposals, assessment questionnaires and ideas that attempt to underpin ON's sociocultural background, my aim is to give a brief overview of the description of this phenomenon at its current state in the beginning of the 2020s.

### 1.1. The two decades of orthorexia nervosa – a historical overview

The term "orthorexia nervosa" was first mentioned in an essay published in a periodical called the Yoga Journal (4). The article was written by physician Steven Bratman in 1997, defining ON as an *"extreme, obsessive, psychologically limiting and sometimes physically dangerous disorder, related to but quite distinct from anorexia."* "Ortho", in its meaning as straight, correct, and true, indicates that other foods outside the putative perfect diet are improper. Observations show that the obsessive and ritualized pattern of eating can be immobilizing, creating concern about accuracy (5, 6), leaving the person in mistrust, preoccupation and in the escalating restrictions of foods. This may lead to hazardous dietary decisions, despite the primary, positive aim to maintain health, avoid medication and correct minor health conditions through diet alone. Before writing his first essay, Bratman started seeing this behavior in alternative treatment communities of which he was also a member as a general practitioner. Twenty years later, he revealed that his intention was not to use this new term as a diagnosis, but over time, it was found to be a good description of a new form of disordered eating (7).

However, the theory saying that ON might be a health risk was often unclear and misunderstood: he writes that some viewed the mere enthusiasm for dieting as "prima facie evidence of disordered eating" (7). This viewpoint also appears in a 2017 qualitative study, where participants were asked about their attitudes towards fictional people described on vignettes, who were following strict diets: they evaluated ON with the same level of stigma as AN, by assuming negative traits to those who follow this "clean" eating regime (8). As a result, negative beliefs around healthy eating as a problem can assign an incorrect label ("orthorexic") to those who may just simply are careful about their food choices. Also, at the same time, it creates a defense from the opposite end: alternative medicine communities deconstructed "orthorexia" as a term encouraged by a food industry-driven agenda promoting unhealthy food (7), implying a controversy of medicalization, i.e., pathologizing healthy eating as being part of a "Big Pharma" conspiracy (9).

This tension makes it necessary to clarify the boundaries of this phenomenon. The number of scholarly articles about ON has grown in the past several years, however, the research is based on descriptive data and case reports, frequently with inconsistent results.

This section lists further subchapters that touch upon the definitions that prominent researchers and clinicians proposed since 1997.

### *1.1.1. Bratman's 6-item checklist (4)*

On www.orthorexia.com, this 6-item yes/no test covers the symptoms of the phenomenon according to Steven Bratman:

1. Spending so much thinking about, choosing and preparing healthy food that **it interferes with other dimensions of the person's life**, such as love, creativity, family, friendship, work and school.
2. When eating any food regarded to be unhealthy, the person feels **anxious, guilty, impure, unclean and/or defiled;** even to be near such foods disturbs them, and they **feel judgmental** of others who eat such foods.
3. Personal **sense of peace, happiness, joy, safety and self-esteem** is excessively **dependent on** the purity and rightness of **what the person eats**.
4. Sometimes **they would like to relax** their self-imposed "good food" rules for a special occasion, such as a wedding or a meal with family or friends, **but they cannot**. (Note: If the person has a medical condition in which it is unsafe to make ANY exception to the diet, then this item does not apply.)
5. Over time, the person has steadily **eliminated more foods and expanded the list** of food rules in an attempt to maintain or enhance health benefits; sometimes, they may **take an existing food theory and add to it with beliefs** of their own.
6. Following a theory of healthy eating causing to lose more weight than most people would say is good, or has caused other signs of **malnutrition such as hair loss, loss of menstruation or skin problems.**

This list has been also referred to as an assessment tool, the so-called Bratman Orthorexia Test (BOT), however the BOT's origins are unspecified and the author himself claims that it is not a real questionnaire (for more details, see *Tools for measuring ON* chapter, 1.2.1.).

### *1.1.2. Setnick's criteria (10)*

In 2013, registered dietitian (RD) Setnick elaborated on the definition by issuing a criterion list in an ED handbook for clinicians. Her addition was that the choices of eating habits are **not a result of lacking available food, or culturally/religiously sanctioned**

**practices.** The same eating behaviors might carry different meanings across cultures. This point reverberates that AN was called the disease of upper and middle class white women in the western countries, hence, it is a culture-bound syndrome.

#### *1.1.3. Moroze's criteria (5)*

Moroze and colleagues published a case study in 2015, in which a 188 cm tall patient weighing 45 kg at the date of the hospitalization received an informal ON diagnosis. He was aware that he focused overly on the "micronutrient" content of his diet and demonstrated disorganized thoughts. In this same article, the authors listed a new set of criteria for ON. Compared to the earlier ON definitions, they added that **excessive money and time spent on healthy foods** is an important symptom. They also mentioned that someone with ON **should not have a pre-existing psychotic disorder or obsessive-compulsive disorder (OCD), as those could originate ON-like compulsive symptoms.**

#### *1.1.4. Barthels' criteria (11)*

In her list, Barthels mentions the **importance of insight into the illness – or the lack of it.** Admitting versus denying the illness is a crucial trait of EDs and thus, could be present in ON as well.

#### *1.1.5. Dunn & Bratman's criteria (12)*

In 2016, Dunn and Bratman conducted a literature review and proposed a set of criteria because they found it necessary to bring in **the progressive development of its habits, the escalating nature of ON**. According to their additions, dietary eliminations are more and more strict and their habits progressively worsen. So far, none of the criteria has brought this up as an issue, even though it is important to distinguish that being a proponent of healthy eating is by no means pathological, only if it escalates over time.

#### *1.1.6. Commonalities and differences in the criteria systems*

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 control over one's life. However, there are a few aspects that are not consensual on all four lists but do seem crucial respectively. For example, mentioning malnutrition and severe weight loss is present in three of them (it is not mentioned on Setnick's list); impaired social functioning

and the lack of weight and shape are also a concern in almost all lists, yet do not show up in Moroze's article, but he does bring up spending excessive amounts of time and money as a criterion. Both Setnick and Moroze added 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 as calling orthorexic food avoidance "self-imposed" and "subjective". There is one idea raised by Dunn & Bratman that is critical and not mentioned elsewhere: becoming a "health-junkie" is only pathological if further progression takes place over time. Food-related obsessive thinking, compulsive behavior, self-punishment and the restrictions need to escalate in order to call the syndrome pathological. To summarize, there is no consensual definition. This is in connection with the fact that there are also varying measuring tools created and used for detecting ON's prevalence. These tests and questionnaires are introduced briefly in the next section.

## 1.2. Tools for measuring orthorexia nervosa

### *1.2.1. Bratman Orthorexia Test and ORTO-15*

The BOT was allegedly introduced in the book called Health Food Junkies issued in 2000 (13) – or at least, it is being said to be present in this book (14). Bratman refers to the BOT as "informal" and "non-existent" (7). Indeed, this questionnaire had remained without a reliability and validity test ever since, even though it was marked as the questionnaire used in multiple studies published in leading medical journals (15–17). Nevertheless, on his official website, Bratman claims the six-item test is the only one that he authorized and approved; in this dissertation, it is listed in the previous section (see subchapter 1.1.1.).

Five years after Health Food Junkies was published, Donini and colleagues constructed the "ORTO-15" test, based on the list of symptoms appearing in BOT, investigating the obsessive attitude of the subjects in choosing, buying, preparing and consuming food. The creators of the original test calculated the test's predicative value to distinguish "orthorexic" and "healthy" subjects. This diagnostic threshold value of below 40 points has a specificity of 73.6%, sensitivity of 100%, positive predicative value of 17.6%, and a negative predicative value of 100% (18). The majority of the published articles ever since, were based on models that have been using ORTO-15 and it became the most

known tool to measure orthorexic tendencies, hence the adaptations to other languages (Turkish, Portuguese, Hungarian (19), German and Spanish) (14). This tendency has been criticized over the years due to the questionnaire's lack of validity and reliability (20) and internal consistency (21).

### *1.2.2. Eating Habits Questionnaire*

In 2013, Gleaves and colleagues developed the Eating Habits Questionnaire (EHQ), which covers three aspects of ON (22). This 21-item tool includes three subscales. The first subscale includes eight items on healthy eating behaviors (e.g., "I prepare food in the most healthful way"), the second includes nine items on problems associated with healthy eating (e.g., "My healthy eating is a significant source of stress in my relationships"), and the third includes four items on feeling positively about healthy eating (e.g., "I feel in control when I eat healthy"). The authors demonstrated the validity of the EHQ, finding its scores positively correlating with higher levels of both disordered eating behaviors and OC tendencies. EHQ is a widely used questionnaire with good psychometric indicators however it is criticized in one study due to its lack of criterion-validity (14).

### *1.2.3. Düsseldorfer Orthorexie Skala*

In 2015, the Düsseldorfer Orthorexie Skala (DOS) was created by Barthels, Meyer, and Pietrowsky in Germany, consisting of ten questions. A four-point Likert scale is applied, ranging from "This applies to me" (four points) to "This does not apply to me" (one point). Scores ranging between 25 and 29 indicate risk for ON, and the threshold value is considered at 30 (23).

### *1.2.4. Teruel Orthorexia Scale*

As mentioned earlier, drawing a line between healthy and unhealthy ways of following a strict diet is important when setting up clearer definitions for ON. A diet based on healthy foods is obviously not a medical issue. However, unclear definitions might lead to this misunderstanding, as those who might have followed strict diets for medical reasons, or tried out non-standard dietary ideas can be labeled orthorexic (7). In 2019, Barrada and Roncero responded to this dilemma by showing the bidimensional characteristic of ON (24). In addition to the pathological dimension, there is also a non-pathological interest in healthy eating, which they called "healthy orthorexia". The results of Barthels and colleagues also show that these factors are conceptually distinguishable, supporting the

assumption that ON is pathological, whereas “healthy orthorexia” is a protective behavior against emotional distress (25).

#### *1.2.5. Eating Habits Questionnaire–Revised*

In 2018, the creator of EHQ developed a modified measurement tool called the Eating Habits Questionnaire-Revised (EHQ-R). Gleaves and colleagues created this 30-item version re-using subscales from the previous version. These questions focus more on pathological patterns of behavior (26). This thesis will introduce the Hungarian adaptation and validation in detail.

#### *1.2.6. Orthorexia Nervosa Inventory*

The Orthorexia Nervosa Inventory was developed in 2020 and has 24 statements using a 4-point Likert scale to indicate how true the statement is based on current eating habits. There are three different subscales: Behaviors (e.g., “I strictly avoid all foods I feel are unhealthy), Impairments (e.g., “My healthy eating is a significant source of stress in my relationships” or “The stricter I become with my diet, the more I seem to experience one of more physical symptoms such as fatigue, faintness, heart racing, nausea, diarrhea, pain etc.”) and Emotions (e.g., “I feel much guilt or self-loathing when I stray from my diet”).

### 1.3. Comorbid conditions

As it does not have its own category in the nosological systems, ON can also be viewed as a unique condition or a subtype of an ED that is already present in the DSM-5 (mostly AN, but ARFID may also be applicable). Also, OCD is often talked about as a comorbid disorder. The pathological obsession with healthy and pure food and the rigid avoidance of anything that is outside their allegedly perfect diet, while showing exemplary self-control could indeed be a characteristic of all three conditions (ON, AN and OCD). A Venn diagram introduced by Koven & Abry shows the possibly occurring overlaps on *Figure 1* (27).

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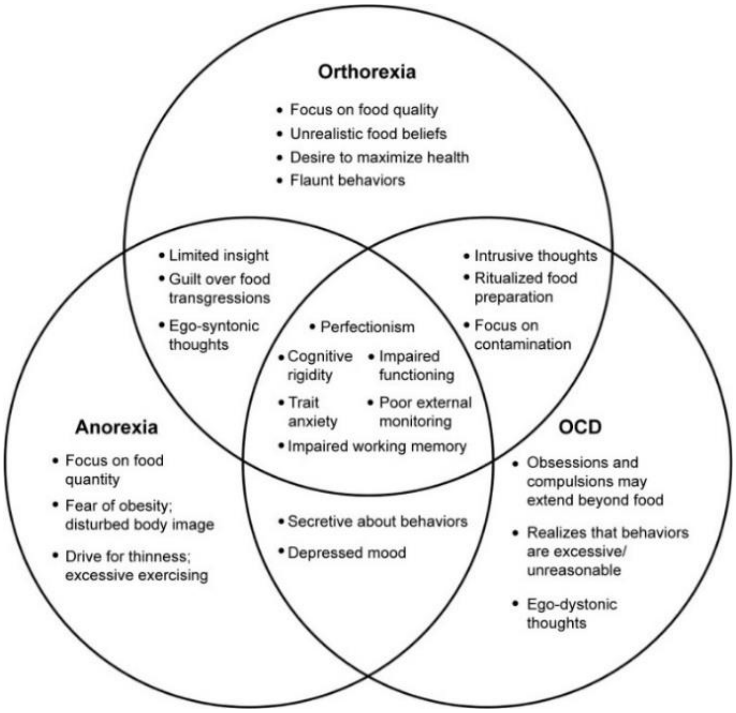


*Figure 1.* Overlapping characteristics in ON, OCD and AN

The existing evidence showing the presence of these conditions in relation to ON is described in the upcoming sections.

### 1.3.1. The comorbidity of orthorexia nervosa and DSM-5 eating disorders

Although ON has numerous distinctive qualities from the disorders appearing in the DSM-5, they may overlap in many aspects.

When comparing AN and ON, there are many similarities, e.g., both conditions start out by aspiring for an innocent goal. For AN patients, their rationale is to avoid obesity, and for ON individuals, they use self-help practices to overcome chronic illness, or to achieve an optimal diet for overall health improvement or so-called “biohacking” (28). However, over time, individuals turn to pathological dieting that may affect their mental health or cause clinical impairment. Also, food restriction related to strict self-discipline was an overlapping behavior between both AN and ON, along with food avoidance and a detailed preoccupation with food. Furthermore, it was observed that ego-centric behavior, traits of perfectionism, inflexibility, and extremism are present in both (29). The most notable similarity was a strong need for structure and control over their environment. There are some who propose that ON is a recovery phase from AN (30) or that ON is a coping strategy in patients with AN: they try to cure undereating with “healthy eating” (31). On

the other hand, a 2019 study interpreted ON's and AN's relationship the other way around: ON could be a risk factor for a future ED development: it has been measured that individuals (both from clinical and non-clinical settings) who self-identify as having ON had a mean score on the Eating Attitudes Test (EAT) that is in a range that urges them to seek ED advise from a professional. The EAT is sensitive to different EDs and is among the most widely used screening instruments. As the authors suggest, if it is true that ON is not so different from AN, just simply a variant of a known eating disorder, this would certainly explain why those in their ON group scored in the manner as they did on the EAT (32).

Not only AN, but the diagnosis of ARFID and the proposed diagnostic criteria of ON also have common elements, with special regards to selective eating and consequently, nutritional deficiency (33). Although patients with ARFID become malnourished or underweight because of their food intake, the majority of these patients restrict their intake because of an aversive experience that they have had with food, or neophobic selective eating. Aversion and neophobia as orthorexic strategies are particularly present regarding foods that are believed to be improper by being "impure" (34).

In their paper based on case studies, Zamora and Bonaechea (35) make a recommendation on performing differential diagnostics. It is important to discover the beliefs behind selective eating, also to separate ON from psychotic state, paranoid schizophrenia and other delusional disorders. Knowing the motivations for healthy eating behaviors can help in making a clearer separation and finding the right therapy.

### 1.3.2. The comorbidity of orthorexia nervosa and obsessive-compulsive disorder

The argument against the idea that orthorexic traits are special manifestations of AN is that ON is not a weight loss or health strategy (36). This rationale supports more the theory that claims picking certain foods can become an obsession that overshadows almost every other aspect of life. Due to its wide social acceptance, health foods happen to be the object of obsession, but it could be almost anything else (e.g., cleaning or organizing). This idea led to theories suspecting OCD to be the main driver for food-related preoccupation, orderliness, food rituals, or using healthy habits as a tool for expressing the need for perfectionism and self-discipline. In several studies, obsessing

over food intake was the most significant correlating behavior: compulsively adhering to purity in dieting (27). Another study reveals (37) that time-consuming activity of obeying food rules might lead to impaired set-shifting skills. The self-centered focus would cause difficulty in processing external cues, and repetitive health-related thoughts weaken the working memory.

Hypochondriasis and OCD also have a common cognitive background. This similarity contains threatening thoughts and health anxiety that are based on unfounded fear, either of an illness or of becoming overweight (38). In EDs, intrusive thoughts may take over (39), being based on false beliefs, and the distress evolving around these intrusions can only be resolved by obeying the imperatives about their health. This would result in orthorexic behaviors.

## 1.4. Orthorexia nervosa among athletes and fitness participants

The previous chapter characterized ON's psychiatric qualities. Besides the clinical setting, discussions about orthorexic behaviors are also present in everyday life: ON has been apostrophized as a "lifestyle syndrome" (40). Food choice has been a cultural expression for thousands of years, and this is not different today: eating habits can vary in different communities by expressing values and priorities through food. Results have demonstrated that sport, exercise and fitness participants can be predisposed to eating-related psychopathologies. This chapter will review the studies that have so far examined this relationship.

### 1.4.1. Eating disorders and sports

ED and sports have been linked to each other in the field of sport science, psychology and medical literature. As early as in 1993, a study examining 522 elite female athletes and 448 non-athlete controls revealed that 18% of athletes were diagnosed with an eating disorder compared to 5% of the controls. The participants completed the Eating Disorder Inventory (EDI) and overwent a clinical examination and an interview (88). Another study included 1620 athletes and 1696 controls and found that 20% of female athletes met criteria for an eating disorder, compared to 9% of female controls. 26 years later, a 2019 study showed that this tendency has escalated: in a sample of female physique athletes competing in the divisions of bikini, fitness, figure and bodybuilding, 46.6% were

at risk of disordered eating behaviors, from which 27.3% were exhibiting clinical and 19.3% subclinical disordered eating. The tendency towards these eating patterns was measured using the Drive for Thinness, Body Dissatisfaction, and Bulimia subscales of the EDI, Pathogenic Weight Control Measures, and the Cognitive Dietary Restraint subscale of the Three-Factor Eating Questionnaire (41).

Disordered eating is not uncommon amongst male athletes either. It was shown that male disordered eater athletes mostly compete in aesthetic sports, long distance running, wrestling in low weight groups or horseback riding (42). The Eating Attitudes Test-26 (EAT-26) and the Survey of Eating Disorders Among Cyclists were completed by male cyclists (n=61) and noncyclists (n=63). This study revealed that male cyclists scored significantly higher on the EAT-26 compared to the male control group ($p < 0.001$). Of the 12 cyclists who showed the greatest tendency towards disordered eating (EAT-26 >20), only five self-reported having an eating disorder (43). These results are in line with suggestion that the gender distribution of eating disorders will even out in this century (44).

Not only the common EDs, but the occurrence of ON was also among competitive athletes measured using the ORTO-15 scale (45). The results indicated that one-third of the condition was present among athletes compared to non-athlete controls. Shape preoccupation appeared more frequently among the control group, but weight preoccupation and obsessively rigid dietary rituals were more present in the case of athletes.

Therefore, competitive sports are shown to be at risk, but since athletic activities are now widely available for the amateur public, ON can extend to those who only practice sports as hobbies. The following subchapter discusses this scenario, which is also a topic in this thesis.

### 1.4.2. Fitness sports – a risk environment for eating disorders and orthorexic tendencies?

Recreational sports (from now on, also referred to as fitness sports) have gained a lot of interest in the past decades. The fitness industry has become a powerful part of the economy: gyms, sport supplement companies and sportswear brands offer opportunities

for leisure and physical activity. The aim of starting to engage in fitness sports is different from those who play as athletes: moving is for entertainment, achieving bodyweight goals, or preventing diseases (mostly obesity) without taking performance enhancement to a competitive or professional level. Many have benefited from starting to train regularly, by buying membership to a recreation center and working with a personal trainer. Diet plans are essential in this lifestyle and can be highly effective in achieving whatever weight goal is set. However, as seen in the reviewed literature, healthy eating and training behaviors may progress to an extreme level and, consequently, can become unhealthy by escalating to eating disorders. Mental health disturbances are manifesting not only among competing athletes, but also in a much milder area of sports that is, paradoxically, determined to help people maintain their health.

The number of studies conducted to measure the connection between fitness practice and orthorexic behaviors is growing. Eriksson and colleagues (15) measured its prevalence among active fitness center clients. Women's high scores can be explained by the results they has shown on exercise frequency, anxiety levels and internalization of awareness of sociocultural appearance. A Swedish study concluded that business and exercise science students have differences in orthorexic tendencies (46), showing that exercise students demonstrate more symptoms. Higher ON traits were measured in a yoga-practitioner sample among vegetarians whose particular care for their diet might push their attention to potentially orthorexic limits (47). Two studies revealed that perfection-related over-exercising and ON tendencies also might go hand in hand. Significant relationship was detected between ON symptomatology and addictive exercise habits among German fitness participants (48) and another study among university students linked ON to exercise addiction characterized by compulsive traits (49). These results match with previously observed tendencies: a handbook about the relationship of eating disorders and sports treats perfectionism as a general trait among athletes that can also lead to a higher risk of developing disordered symptoms (50). According to a 2017 focus group study performed with personal trainers from the fitness industry, this extreme self-control and dietary ascetism becomes a new form of suffering, and since "everybody does it", these unhealthy behaviors become normalized and socially accepted (51).

The chosen population of the two studies introduced in this dissertation is the Hungarian community of fitness participants. The relationship between disordered eating behaviors and fitness sports is relevant, because these groups that are centered around healthy lifestyle and deserve special attention while learning about ON. Despite exercising and eating well are both valuable and essential components of maintaining health, trends of the fitness and wellness industries may be potentially harmful practices which can turn into desired and encouraged behaviors.

## 1.5. Sociocultural aspect of orthorexia nervosa

Sociocultural factors strongly interplay with the biological and psychological aspects of ON. This chapter will focus on studies that examined social and cultural phenomena in relation to ON, and will also discuss theories that may serve as an explanation of this tendency.

### 1.5.1. Disordered eating and fitness lifestyle portrayed online and in social media

A research based in the Fiji Islands studied the change in the frequency of eating disorders among adolescent girls (52). They examined disordered eating habits one month and then three years after the introduction of television broadcasting (which happened in 1995). In the study population, the number of people using abnormal weight control methods increased dramatically over three years. This study supports the theories about the significant role of media in eating and body image disorders.

After the spreading of television, mass communication via internet forums has shown similar characteristics, in terms of forming the body image of their readers. The speed of communication, however, and the lack of physical barriers assist in forwarding their messages to the recipients. After 2010, this speed has accelerated especially due to smartphones and newer trends in social media communication each year.

In this day and age, plenty of online communities are designed to help those who want to lose even more weight. As the subtypes of disordered eating varies, so do the forms and contents of these websites, however the aim is common: to motivate in pursuing weight loss goals in or eating perfectly pure and healthy. The ones that are designed to provide information for those suffering in AN are called “pro-ana” sites, for bulimics “pro-mia”.

Here, members can give tips and tricks on how to look even thinner by restricting, purging, explicitly and admittedly showing their devotion to the illness. On these forums, members glorify extreme thinness and present symptoms of a mental illness as a virtue (53). Since their first appearance, several attempts have been made to ban these sites, but most can still be found online, publicly. Regardless whether they get removed or not, the philosophy of skinniness as perfection would still continue under various hashtags on social media (for example: #thinspiration, #thinspo, #bonespiration, #ana), uncontrollably. Not only "pro-ana/pro-mia", but "fitness lifestyle" is also highly represented on various online platforms, encouraging their members to participate in lifestyle changes. It is important to stress that weight loss channels on YouTube or #thinspiration images on Instagram are not problematic on their own, because encouraging people to lose weight, exercise and eat healthy could be considered a useful behavior. However, two studies looked for connections between using social media and developing orthorexic symptoms (54, 55). This implies that for certain individuals, health promoting narratives can escalate to eating disorders.

Taking place on Instagram, one experimental study focused on #Fitspiration and health food images. "Fitspiration" is a response to the trend of "thinspiration" by signifying the difference, as the reign of the popular slim figure has been taken over by the athletic body shape (54). "Fitspiring" messages rather prefer a muscular body image which involves eating more calories. The person on the image is not at all skeletal, implying that sufficient calories are consumed, yet still in a well-engineered, controlled manner. #Fitspiration aims to motivate the viewer of the image to exercise and pursue a healthier lifestyle. However, after being exposed to the images, the participants took surveys to measure mood and body dissatisfaction, inspiration levels, and social comparison. Findings show that when motivated by an appearance-based reason, adopting disordered eating habits is more likely (56). The general effects of social media affect psychological wellbeing, as the healthy eating community on Instagram has a higher chance to develop ON symptoms than the general population (55).

These results show that this might solve the problem of the particular thin ideal pushing people to diet, but it also creates a new discussion about new issues. The following section will touch on the ideology of healthism that could lie behind these problems.

### 1.5.2. The ideology of healthism

The notion of healthism was labeled to describe individual responsibility for achieving and maintaining health in 1980 by Crawford. He describes healthism as a statement of an identity, as health is a "super value" and a "distinct set of behaviors, attitudes, and emotions" (57). Besides the obvious advantages of healthy eating habits, the additional normative obligations of reaching an attractive fit body has been prioritized. Dieting can be a perfect tool for reaching this goal: instead of food being "just food", it has become a quest and destination (58). Nicolosi points out that food is a cultural object that can channel important symbolic meanings. Artificial foods versus natural foods is a symbolic opposition of bad or good, urban or rural, corrupt or uncontaminated (59). Whether certain foods are unhealthy or healthy is a similar opposition: this is symbolically charged binary pair, carrying more meaning than just being good for optimal health.

The link between healthist statements and ON has been acknowledged. In a 2020 article written about the current state of healthist narratives, the author claims: "*Whether accompanied by obsessive exercising or not, restrictive dietary rules in the name of health are more acceptable than if made in the name of thinness*" (60). Three studies have connected the normalization and disordered eating habits by examining the phenomena of alternative food network members and those who engage in special diets voluntarily (and not for medical reasons) (6, 21, 61). It can seem that dietary plans, detoxification practices, diets and fasting are marketed for achieving health, but it is rather about spreading often pseudo-scientific and dogmatic beliefs about food. For those who are susceptible, these can become dangerous tools to drive them into disordered eating behaviors.

## 1.6. Orthorexia nervosa and self-esteem

It has been shown that low self-esteem is one of the most prominent risk factors for developing DSM-5 eating disorders (62). A healthy level of self-esteem is an extremely important part of mental health. To function in everyday life, one needs to trust and value themselves. ED can be discovered among those who lack this ability. No matter what they own, or how well they perform in many areas of life, they still feel useless when someone

they know tries to explain to them that this is not the case, they usually do not believe it (63).

Bratman theorized that an orthorexic person's self-esteem is often tied to their adherence to the diet, furthermore, they would feel a sense of superiority over others based on their eating practices which is the primary focus of their lives. He writes in his original essay: *"Most must resort to an iron self-discipline bolstered by a sense of superiority over those who eat junk food"* (4). In an "orthorexic society", certain lifestyle choices have added an extra meaning to the dietary choices: food has moral significance, a prestige that is associated with differentiating "them" versus "others" not practicing these rituals, that are disguised as self-care methods (59).

However, social comparison theory, which involves people coming to know themselves by evaluating their own abilities and traits in competition with others, suggests that this is a false version self-esteem (64). Images from the media distort the perceptions of reality: the more we encounter their messages, the more we assume that the images are meant to be mimicked and easily attained. Specific vulnerability traits, like self-objectivization can vary the effects of internalizing these messages, i.e., their impact is largely dependent on the receiver's characteristics (65).

A recent meta-analysis concluded that self-esteem difficulties are highly relevant in the treatment of AN and that transdiagnostic approaches regarding other conditions (such as ON) can be recommended (66). Despite its relevance in disordered eating and other destructive health behaviors (67), self-esteem was generally found to be unrelated to ON (29, 68–70). These findings are aimed to be challenged in this present thesis. I presume that having a low self-esteem in ON is very plausible, because perfect control and complete achievement of health is impossible, and not being able to get out of this cycle would lead to low self-efficacy, and therefore to low self-esteem.

### 1.7. Why this topic?

I have a particular interest in "fad" diets and as a dedicated future RD, I observe them with a critical lens. Some special diets promoted on the internet have no scientific evidence for any helpful effect, but many online figures provide diet advice without proper knowledge. Based on my personal observations, the population who visits gyms

and follows fitness advice can be especially vulnerable to misleading health information. In many cases, diet plans and products are advertised by images showing professional athletes who have a lifestyle that is not at all attainable or reasonable for an average person.

I believe that attentive and conscious eating, regular exercise and maintaining normal Body Mass Index (BMI) is extremely important. In some cases, these may involve strict exercise regime and accurate monitoring food intake for weight loss, which is reasonable when controlled by professional help and expert guidance. However, in certain cases, restrictive diet advice may lead to radically restrictive, purging eating behaviors. This may be present not only in the fitness industry but also in the case of medical help: if a registered dietitian is not fully aware about the patomechanism of an eating disorder, they might put their client to danger with diet therapies.

My motivation to research orthorexia was to stress that assessment of orthorexic tendencies is important. Health professionals and fitness staff should be aware that assessment tests exist, and apply them when necessary while helping patients and clients.

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# 2. Objectives

Even though there is a rising interest for orthorexic tendencies among clinicians and in mass media, currently, Hungarian research on ON is scarce. The general objective of this study is the examination of ON symptomatology and its correlates in a high-risk population in Hungary, which is adult fitness participants.

Two cross-sectional studies were carried out for this dissertatio. After publishing the results of the first study, I recognized the importance to conduct a second, on a sample with the same characteristics. The two samples are similar also in terms of size, and both studies investigated sociodemographics, anthropometrics and training habits of the participants. There were two main reasons that had led to the decision to organize another analysis.

The first was the need for a methodological development. ORTO-15 (and its adaptations to other languages, like Orto-11-Hu also) became less and less valued in the academic community. Missbach and colleagues (20) strongly criticized ORTO-15 and also Brytek-Matera's narrative review challenges the foundations of the questionnaire. The inaccurate cut point, low reliability, a lack of clear articulation of the development of construct validity suggests that its usage should be rethought or replaced (71). Consequently, it became necessary to create a valid tool in Hungarian that measures orthorexic eating behaviors more comprehensively. For the second study, I sought out to find and translate a new questionnaire and validate it in Hungarian, so that researchers will be able to use in the future.

Another reason for a second study was the intention to investigate new constructs that may relate to ON. In order to think outside the variables that point to psychiatric clinical diagnoses used in the first study (from now on also referred to as the "2017 study"), instead, I measured traits that are more connected to the participant's personality or their outlook of life. Hence, the second study's scope (from now on also referred to as the "2019 study") was to explore further psychological traits through variables such as self-esteem and contentedness.

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## 2.1. Aims and hypotheses both for the 2017 study and the 2019 study

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

As for the hypotheses, they are the same in both surveys regarding sociodemographics and training habits. 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 gender and ON.**

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.

## 2.2. Aims and hypotheses for the 2017 study only

In the first study, two possible comorbid psychiatric illnesses were in focus: eating disorders and OC traits. It is hypothesized that other DSM-registered eating disorders and OC traits 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 more orthorexic they are.

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

### 2.3. Aims 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, construct, and discriminant 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.**

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# 3. Methods

## 3.1. Sample and study design

### 3.1.1. The 2017 study

The study examining the relationship between eating disorders, OC traits and orthorexic tendencies was conducted between March and October, 2017. I distributed an online survey using the Google Forms application, which took about 15 minutes to complete. The chosen population was the group of fitness enthusiast adults. The participants were recruited online: the questionnaire was posted through various online sources such as social media groups, public posts by fitness center and gym owners, and the online mailing list of a fitness trainer certifying school in Hungary. Eligibility criteria were speaking Hungarian, being aged 18 or above, and attending a fitness center at least three times a week. Modern fitness centers were aimed because these have members that are potentially influenced by the milieu of the fitness industry. It is possible, that those who practice sports that are outside the realm of gym communities (e.g., endurance sports, tennis, martial arts) also might develop orthorexic tendencies. However, the reason behind choosing gym members is that the specific scope of this thesis is to examine the eating habits of those who use the services of the health and wellness industry.

Altogether 217 answers were recorded; after removing duplicates (n=5) and underage participants (n=5), the final sample was 207 subjects (67 males and 140 females).

### 3.1.2. The 2019 study

The study examining the relationship between self-esteem, contentedness and orthorexic tendencies, including the validation of the EHQ-R, was conducted between April and June, 2019. The characteristics of the sample was similar to the one that was used in 2017: I collected data from Hungarian adults who perform recreational exercise regularly (at least three times per week) for the same reasons. This questionnaire was distributed mostly online, via social media posts, both in open and closed groups, and also offline among communities evolving around certain gyms.

Altogether 181 responses were collected from which I removed one invalid response and underage participants (n= 2) and those who were over 60 years old (n=2). A 42-year-old

woman was also excluded who, according to her self-reported weight, was just 28 kg, leaving a final sample of 175 subjects (50 males and 125 females).

## 3.2. Ethical approval

Ethical approval for the studies was obtained from the Hungarian Medical Research Council (Ethics approval number: TUKEB 3563-1). All participants were informed of their anonymity and provided informed consent. They were not rewarded for participation and taking part in the study was voluntary. All procedures performed in this study were in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans.

## 3.3. Measuring instruments

### 3.3.1. Measuring instruments used in the 2017 study

#### *3.3.1.1. Sociodemographic, anthropometric and training-related data*

In the first section, participants were asked about their gender, age, education, and place of residence, data on self-reported body weight (kg) and height (cm) were also collected. I targeted to measure training habits with the following questions:

- The frequency of exercising 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 (it was mentioned in the survey's introduction), thus, there was no option for less frequency 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.
- The form of training the participants have been practicing. Optional answers: body building, functional training, yoga, cardio exercise, group classes.

#### *3.3.1.2. Orto-11-Hu*

The Orto-11-Hu is the Hungarian translation of ORTO-15 created by Varga and collegues in 2014 (19) 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 inner reliability in this study had a Cronbach alpha of 0.72.

#### *3.3.1.3. Eating Disorders Inventory*

The EDI questionnaire was developed in 1983 by Garner and collegues (72). In this study, the Hungarian adaptation created by Túry and collegues (73) was used, incorporating three subscales: Drive for Thinness, Perfectionism and Interpersonal Distrust. “Drive for thinness” consists of statements regarding preoccupation with dieting, worrying about bodyweight, thriving for fat loss, thinness, and intensive fear of weight gain. “Perfectionism” subscale covers the expectations of perfect performance, as one of the identifiers of anorexic patients is to have these high expectations from their parents’ side, the ethic of discipline, austerity, and hard work. Items on the “Interpersonal distrust” subscale refer to alienation, reluctance to form close relationships and suspicion. The subscales in EDI contain both positive- and reverse-worded items. Items were rated on a 6-point Likert-type scale (1 = never, 6 = always). In this study, the Cronbach alphas were good: for Drive for thinness it was 0.869, for Perfectionism it was 0.820 and for Interpersonal distrust it was 0.759. When all three subscales are added up, the alpha is 0.838. There might be doubt whether the separate subscales are useable with such high overall Cronbach alpha, but other studies and clinical practice (72, 74, 75) have demonstrated that these subscales are valid and reliable on their own and useful for measuring separate constructs.

#### *3.3.1.4. Maudsley Obsessional-Compulsive Inventory*

Finally, the 30 item Maudsley Obsessional-Compulsive Inventory (MOCI) was used, which measures OCD by identifying self-reported obsessionality and compulsivity. It was developed in 1977 by Hodgson and Rachman (76); the Hungarian version was created in 2007 (77). The questionnaire measures thirty “true” or “false” statements regarding “checking” (symptoms associated with monitoring routines), “cleaning” (the intensity of cleansing efforts), “slowness” (showing actions of compulsion, repetition, slowness) and “doubting” (the tendency to worry and ruminate). This study does not use any of these subscales, instead, applies the total score that is referred to as “OC traits” or “obsessionality” throughout the dissertation. The summarized scores have shown good inner reliability with a Cronbach alpha of 0.81.

### 3.3.2. Measuring instruments used in the 2019 study

#### *3.3.2.1. Sociodemographic, anthropometric, and training-related data*

In the first section, respondents answered the same questions as the 2017 study had about their sociodemographic and anthropometric features; as well as their exercise habits.

#### *3.3.2.2. Eating Habits Questionnaire–Revised*

In the second section, participants were asked to fill out the Hungarian version of the EHQ-R (26). The questionnaire was adapted after acquiring the written permission and assistance of the creator. During the construction of the Hungarian version of the EHQ-R, the forward-backward-forward translation technique was applied. I first translated the questionnaire from English to Hungarian, and then a colleague translated it back into English. This was sent back to the creator of the questionnaire, and he reviewed and compared the backward translation with his own, original version and made linguistic-semantic suggestions to have the most accurate and similar content as possible. Taking these into account, the final forward translation of the questionnaire became finalized with help of a third, independent person. The details of the adaptation process of this questionnaire are discussed in the 3.4.2.1. subchapter.

The instrument has five subscales. The seven-item "Rigidity" subscale assesses the rigor of compliance level to self-prescribed dietary rules. The six-item "Body image" 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 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). The Cronbach alphas ranged from 0.75 to 0.87, confirming the internal consistency of the subscales. The Cronbach alpha of the total scale, ignoring the subscales is 0.946.

#### *3.3.2.3. Rosenberg self-esteem scale*

The third part of the survey presented the Rosenberg self-esteem scale (RSES) which is a one-dimensional, 10-item self-report instrument without any reverse items (67). RSES assesses the construct of global self-esteem understood as a person's overall evaluation of their worthiness as a human being. Participants responded using a Likert scale ranging from 1 ("strongly disagree") to 4 ("strongly agree"). For the present study, the RSES's internal reliability was good (Cronbach alpha: 0.89).

#### *3.3.2.4. Contentedness*

Finally, the fourth section listed six questions that aim to measure whether the participant has a healthy relationship with oneself and their surroundings. Higher scores mean that the individual is not reactive or oversensitive in interpersonal relationships, does not rely on external sources of validation and is not troubled by desires, being conscious behind their thoughts and emotions. Instead, they are characterized by being calm and not feeling burdened with their daily activities. The items were rated on a six-point Likert scale: Never or almost never (6), Rarely (5), Sometimes (4), On most days (3), Every day (2), Many times a day (1). The higher the scores, the more satisfied the person is.

The questions that are used are part of a questionnaire with the name "Spiritual Awareness Scale". I chose to take these questions for this section of the survey because I found them accurately describing good mental health and existential well-being. This tool has three subscales and one that this study uses is titled "Ego diastole" subscale, as according to the creator of the scale, this rewarding experience is attributed to the "decreased functioning of the Ego" (78). This present dissertation calls this subscale "Contentedness" because this name implies the characteristics of the questions. In the present study, their internal reliability was good (Cronbach alpha: 0.85).

### 3.4. Data analyses

Both studies are descriptive, cross-sectional, and their primary aim is to explore correlates and possible predictors of ON in the fitness industry. All hypothesis tests were performed with SPSS 21.0 statistical software package. *Model 4 and Model 6* of the macro called PROCESS (v3.4) were used for mediation-based path analyses, which can be inserted into SPSS (79). PROCESS uses a bias-corrected bootstrap confidence interval approach when providing estimates of indirect effects. This bootstrapping method is a robust

regression, showing what the lower and upper limits of the estimated CI are and based on these values: lower level confidence interval (LLCI) and upper level confidence interval (ULCI). There is no significance value, because the decision is based on the CI, whether it can be generalized to the population or not.

For the CFA in the 2019 Study, MPLUS software was used.

### 3.4.1. 2017 Study

#### *3.4.1.1. Testing the hypotheses 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*.

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 model was carried out, this time a mediated one, in order to analyze the paths between these variables, using *Model 6* of PROCESS.

### 3.4.2. 2019 Study

#### *3.4.2.1. Adaptation of Eating Habits Questionnaire-Revised in Hungary*

Before testing for hypotheses, a CFA was performed to test the theoretical factor structure of the five subscales. Due to its significant deviation from the normal distribution, the items were treated as ordinal variables and the robust weighted least squares estimation method was used (80, 81). The goodness of fit of the model was examined using the following indicators: $\chi$2-test, RMSEA, CFI and TLI. The RMSEA value that is below 0.05 indicates an excellent fit, medium fit is around 0.08, and poor fit is the value above 0.10. CFI and TLI values of $\geq$0.90 are acceptable and $\geq$0.95 indicate a good fit (80). To estimate the internal reliability of the scales, a Cronbach's alpha-index was calculated, together with their 95% confidence interval.

Test-retest reliability was checked 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 see the conceptual validity (construct validity) of the scales, I also calculated a correlation coefficient with the Orto-11-Hu questionnaire.

*3.4.2.2. Testing the hypotheses in the 2019 study*

I performed correlation analysis to assess the predictor role of age on ON and to test for gender differences.

The 2019 study used mediation analyses, too: PROCESS (v3.4) macro's *Model 4* was applied to determine the effect of contentedness on the relationship between self-esteem and orthorexic tendencies. First, the summarized scores of EHQ-R were used as a dependent variable, then I checked the relationships with each dimension of ON (by testing with each EHQ-R subscale).

### 3.4.3. Difference between the aims of applying mediation analyses in 2017 and in 2019

Questions may arise about the reasoning behind applying mediation in both analyses. Although it is the same methodology, there are still different motives and applied models regarding my examinations.

In 2017, I applied mediation models because it was an explorative, more data-driven analysis: it was a step-by-step structured exploration in order to check for indirect effects between the key variables.

Whereas in 2019, I used the mediation method to test the hypothesis claiming that the lack of self-esteem among ON individuals is influenced by spiritual contentedness, because the idea is that self-esteem is dependent on being satisfied with life circumstances and acceptance of one's own well-being without longing for more. This is assumed to be true in the presence of orthorexic tendencies because of the self-help nature of dieting is highly visible, as discussed in the Introduction (see chapter 1.6).

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# 4. Results

## 4.1. The 2017 study

### 4.1.1. Sample description and presence of ON

Out of 207 subjects 67 were males and 140 were females. The description of the sample can be seen in *Table 1*, which lists the age, BMI of the participants, and also their results scored on the screening instruments used in this survey: Orto-11-Hu, EDI and MOCI.

*Table 1*. Sample description of the 2017 study

| | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|
| Age | 18 | 59 | 31.86 | 8.719 |
| BMI | 17.19 | 37.65 | 23.4427 | 3.65975 |
| Orto-11-Hu | 13.00 | 44.00 | 27.2609 | 5.12557 |
| EDI- Drive for thinness | 0.00 | 21.00 | 6.7729 | 5.96443 |
| EDI- Perfectionism | 0.00 | 18.00 | 7.2850 | 4.79997 |
| EDI- Interpersonal distrust | 0.00 | 18.00 | 5.1304 | 3.25865 |
| MOCI | 1.00 | 25.00 | 8.5797 | 4.91996 |

Regarding their training habits, the highest proportion of participants reported practicing functional training (41%), followed by body building (36.2%), aerobic (16%), and yoga (6.8%). Most of them (76.8%) reported exercising 3–6 times per week, 19.3% reported going to the gym daily, while 3.8% more than once per day. Most of the participants (57.4%) have been exercising regularly for five or fewer years, the rest had started earlier (5-10 years ago, or more than 10 years).

### 4.1.2. Hypothesis testing of the psychological correlates: linear regression and mediation analysis

The first regression model measured how Drive for thinness, Perfectionism and MOCI results predict ON. *Table 2* shows that a significant correlation was calculated for every relationship.

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*Table 2.* Correlations between orthorexic tendencies, age, gender, training habits and psychological correlates (drive for thinness, perfectionism, interpersonal distrust and obsessive-compulsive traits) n= 207.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| (1) Orto-11-Hu | 1.000 | | | | | | | | |
| (2) Age | -0.201* | 1.000 | | | | | | | |
| (3) Gender | 0.233*** | 0.040 | 1.000 | | | | | | |
| (4) When did you start attending the gym? | -0.076 | 0.333*** | -0.083 | 1.000 | | | | | |
| (5) How often do you go to the gym? | 0.313*** | -0.138* | 0.022 | 0.110 | 1.000 | | | | |
| (6) EDI - Drive for thinness | 0.636*** | -0.073 | 0.291*** | -0.011 | 0.264*** | 1.000 | | | |
| (7) EDI - Perfectionism | 0.287*** | -0.159* | 0.145* | -0.059 | 0.329*** | 0.402*** | 1.000 | | |
| (8) EDI - Interpersonal distrust | 0.302*** | -0.096 | 0.094 | -0.001 | 0.280*** | 0.184** | 0.298*** | 1.000 | |
| (9) MOCI results | 0.425*** | -0.265*** | 0.090 | -0.081 | 0.232*** | 0.432*** | 0.372*** | 0.310*** | 1.000 |

* p<0.05, ** p<0.01, ***p<0.0001

The first regression model proved to be significant and showed that the predictors accounted for 45.6% of the variance in the Orto-11-Hu score. However, when comparing the effects of the predictors, it is visible that Perfectionism is no longer significant and fails to be a predictive component in this model, as seen in *Table 3.*

*Table 3.* Coefficient table of the linear regression measuring psychological correlates as predictors

| | | Unstandardized coefficients | | Standardized coefficients | | | Collinearity statistics |
|---|---|---|---|---|---|---|---|
| Model | | B | Std. Error | Beta | t | Sig. | Tolerance |
| 1 | (Constant) | 21.678 | 0.639 | | 33.920 | 0.000 | |
| | MOCI results | 0.154 | 0.063 | 0.148 | 2.442 | 0.015 | 0.731 |
| | EDI – Drive for thinness | 0.480 | 0.052 | 0.558 | 9.285 | 0.000 | 0.745 |
| | *EDI - Perfectionism* | *0.044* | *0.064* | *0.042* | *0.697* | *0.487* | *0.759* |
| | EDI – Interpersonal distrust | 0.260 | 0.088 | 0.165 | 2.960 | 0.003 | 0.865 |

a. Dependent Variable: Orto-11-Hu

$R^2$ = .456; Adjusted $R^2$ = .445; F(4, 202) = 42.317

These results prompted for further investigation around perfectionism's effect, as it might be possible that there are direct and indirect paths between perfectionism and ON. For

example, drive for thinness or obsessionality can be mediator variables, and based on the correlation analysis (as seen in *Table 2)*, this might be possible as they have the strongest relationship with orthorexic tendencies.

#### *4.2.2.1. Examining possible mediating effects between perfectionism and orthorexic tendencies*

To test for the indirect and direct effects that Perfectionism has on ON, a mediation analysis was performed using Drive for thinness and MOCI results as potential mediators. The paths are visualized on a schematic figure (on *Figure 2*), and the calculated ß-values and their significance is reported in the text, afterwards.

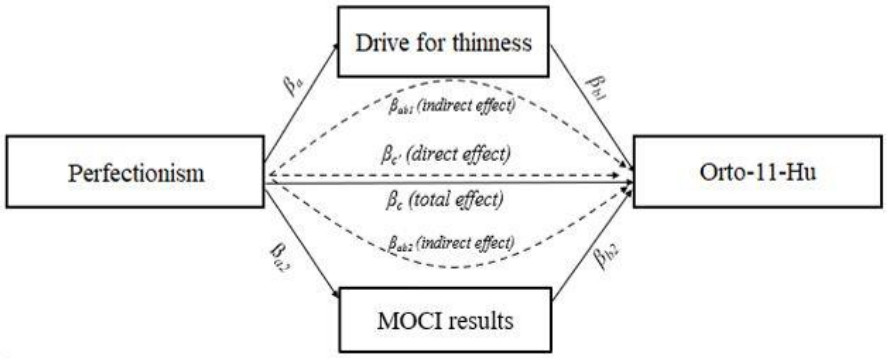


*Figure 2:* Mediation paths between perfectionism and orthorexic tendencies

The following results were calculated:

- The effect of the path going from Perfectionism to Drive for thinness is significant ($ß_{a1}$=0.4023, p<0.0001): perfectionist traits may lead to an increased intention to lose weight.
- The effect of path $a_2$ going from Perfectionism to MOCI results is also significant ($ß_{a2}$=0.3720, p<0.0001). This means that the more perfectionist someone is, the more likely it is to develop OC traits.
- The path called $b_1$, leading to ON from Drive for thinness is also significant ($ß_{b1}$=0.5579, p<0.0001), showing that aiming for a thin body is a predictor for ON.
- The path $b_2$ going from MOCI results to ON is significant ($ß_{b2}$=0.1865, p=0.0023), meaning that OC traits can lead to ON.

- **The total effect** called path c calculates how ON can be affected by Perfectionism. This **resulted in a significant** value ($ß_c$=0.2874, p<0.0001).
- The **direct effect calculation, path c'** (which calculates how ON can be predicted by Perfectionism, in the context of the two mediators: Drive for thinness and MOCI) **brought the effect of this relationship to a lower and nonsignificant value**. In other words: the total effect ($ß_c$=0.2874, p<0.0001) became reduced once the mediation was performed, bringing it to $ß_{c'}$=0.0064 (direct effect). This lowering is due to the indirect effects of the mediators.
- The **indirect effects** show which mediator variable is responsible for lowering the direct effect. **ON can be influenced both via MOCI results** (effect: $ß_{ab2}$= 0.0694, LLCI: 0.0245, ULCI: 0.1214) **but stronger through Drive for thinness** ($ß_{ab1}$= 0.2244, LLCI: 0.1485, ULCI: 0.3053). According to Cumming and Finch (82), the difference between the effect of the two mediators is significant due to the lack of overlap between the confidence intervals: perfectionism, in this sense is more likely to be a desire to lose more weight. This suggests, given two individuals with the same drive for thinness scores, perfectionism alone does not significantly increase the expected ON score.

### 4.1.3. Controlling for age, gender and training habits

The regression and mediation examining the psychological correlates were followed by a second regression. While the first was looking at the psychological factors on their own, this next model controlled for other variables as well: age, gender, training frequency and training experience were entered.

The detailed results of the regression are displayed in *Table 4*. Gender, age, training experience and training frequency explain **17.9%** of the orthorexic tendencies that fitness participants show. Both age and sex are significant predictors of ON: the younger the participants, the more orthorexic they are, furthermore, female fitness participants tend to be more orthorexic. The question "How long have you been training" had no significant effect, but the frequency of going to the gym ("How often do you go to the gym?") predicts orthorexic tendencies significantly.

However, in the third regression model, Gender has lost its significance compared to its effect in the first or second model. It can also be seen that not only Gender, but MOCI

results have lost their significance as well. These are indicated with bolded values in the table.

*Table 4:* Coefficient table of the linear regression controlling for age, gender, training habits and measuring psychological correlates as predictors

Coefficients[a]

| Model | | Unstandardized coefficients | | Standardized coefficients | | | Collinearity statistics |
|---|---|---|---|---|---|---|---|
| | | B | Std. error | Beta | t | Sig. | Tolerance |
| 1 | (Constant) | 26.779 | 1.741 | | 15.377 | 0.000 | |
| | Age | -0.124 | 0.039 | -0.211 | -3.165 | 0.002 | 0.998 |
| | Gender | 2.639 | 0.727 | 0.242 | 3.630 | 0.000 | 0.998 |
| 2 | (Constant) | 22.788 | 1.928 | | 11.821 | 0.000 | |
| | Age | -0.093 | 0.041 | -0.158 | -2.293 | 0.023 | 0.853 |
| | Gender | 2.514 | 0.702 | 0.230 | 3.582 | 0.000 | 0.986 |
| | When did you start attending the gym? | -0.223 | 0.430 | -0.036 | -0.520 | 0.604 | 0.854 |
| | How often do you go to the gym? | 2.826 | 0.638 | 0.290 | 4.432 | 0.000 | 0.952 |
| 3 | (Constant) | 22.276 | 1.661 | | 13.408 | 0.000 | |
| | Age | -0.061 | 0.033 | -0.104 | -1.824 | 0.070 | 0.806 |
| | **Gender** | **0.697** | **0.590** | **0.064** | **1.182** | **0.239** | **0.893** |
| | When did you start attending the gym? | -0.239 | 0.345 | -0.038 | -0.694 | 0.489 | 0.852 |
| | How often do you go to the gym? | 1.169 | 0.555 | 0.120 | 2.106 | 0.036 | 0.805 |
| | EDI - Drive for thinness | 0.459 | 0.053 | 0.534 | 8.619 | 0.000 | 0.679 |
| | EDI – Perfectionism | -0.086 | 0.064 | -0.080 | -1.337 | 0.183 | 0.723 |
| | EDI - Interpersonal distrust | 0.223 | 0.088 | 0.142 | 2.533 | 0.012 | 0.833 |
| | **MOCI results** | **0.121** | **0.064** | **0.116** | **1.897** | **0.059** | **0.691** |

a. Dependent Variable: Orto-11-Hu

Model 1: $R^2$ = .099; Adjusted $R^2$ = .090; F(2, 204) = 11.161
Model 2: $R^2$ = .179; Adjusted $R^2$ = .162; F(2, 202) = 9.849
Model 3: $R^2$ = .485; Adjusted $R^2$ = .464; F(4, 198) = 29.375

The correlation table (see *Table 2*) shows that Gender correlates significantly with both Drive for thinness and Perfectionism. Subsequently, a mediation analysis was

implemented using the following variables: Gender as the predictor, ON as the output and Perfectionism, along with Drive for thinness as possible mediators. Assuming that there might be an indirect effect working between ON and these variables.

### 4.1.4. Mediated mediation between gender, psychological correlates and ON

To test for the detailed relationships between Gender, Perfectionism, Drive for thinness and ON, a mediated mediation was performed. Gender has become lost in the third regression model (see *Table 4*). After using it as a predictor in a new mediation model, it shed light on the variable that is responsible for this loss. The paths that were examined are visualized on the schematic figure (*Figure 3*):

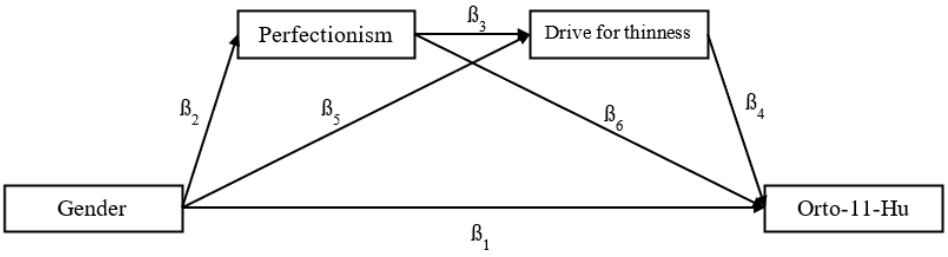


*Figure 3:* Mediated mediation between gender and orthorexic tendencies

The results of the mediated mediation were the following:

- The path leading to ON from Gender: this effect is not significant ($ß_1$=0.1095, p=0.3640), meaning that in the context of these two other variables, women are no more likely to become orthorexic than men.
- The path leading towards Perfectionism from Gender is significant ($ß_2$=0.3085, p=0.0375).
- The path to Drive for thinness from Perfectionism: this effect is significant ($ß_3$=0.3678, p<0.0001).
- The path leading to ON from Drive for thinness: this effect is significant ($ß_4$=0.6388, p<0.0001).
- The path to Drive for thinness from Gender: this effect is also significant ($ß_5$=0.5073, p=0.0002).
- The path leading to ON from perfectionism: this effect is not significant ($ß_6$=0.0360, p=0.5428).

**When viewing the total effect, the effect of Gender is significant (ß=0.4972, p=0.0007).** This means that without taking the mediator variables into account, the effect of Gender on ON is significant, **however, as seen, when mediated, it is no longer significant (ß$_1$=0.1095, p=0.3640).** This means that women's ON tendencies can be explained through Perfectionism and/or Drive for thinness.

- **Indirect effect 1, which would show how Gender influences ON through Perfectionism is not significant** (ß=0.0111, LLCI: -0.0284, ULCI: 0.0588). This path is visualized with the dotted line on the schematic figure (*Figure 4*). The meaning behind this is that women are not orthorexic solely because they have perfectionist traits; instead, there has to be another variable that took away this effect.

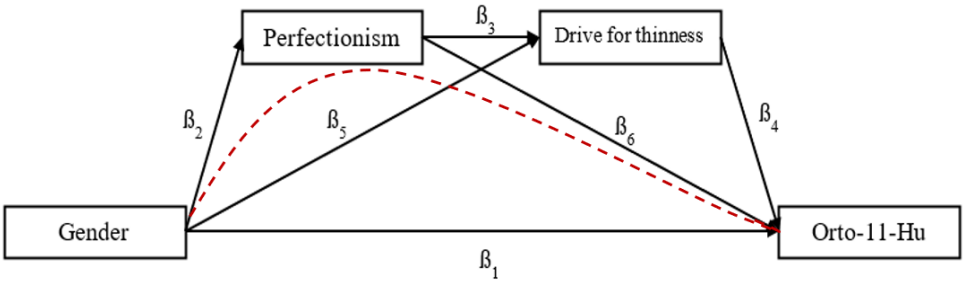


*Figure 4:* Mediated mediation between gender and orthorexic tendencies: indirect effect of perfectionism

- **Indirect effect 2, which would show how Gender influences ON through Drive for thinness is significant** (ß=0.3077, LLCI: 0.1610, ULCI: 0.4560). This path is visualized with the dotted line on the schematic figure (*Figure 5*), answering the question whether it is rather women who want to be thinner and therefore develop ON. The results show that this is likely to be true.

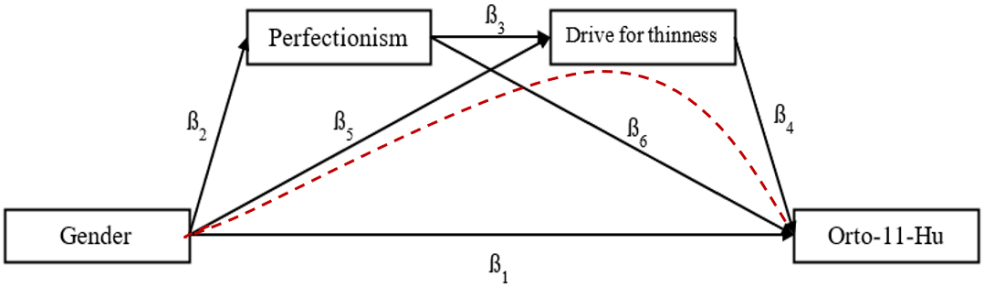


*Figure 5:* Mediated mediation between gender and orthorexic tendencies: indirect effect of drive for thinness

- **Indirect effect 3, which would show how Gender influences ON through Perfectionism and Drive for thinness is also significant** (ß=0.0688, LLCI: 0.0072, ULCI: 0.1396). This path is visualized with the dotted line on the schematic figure (*Figure 6*). The results show that despite its significance, the effect is much weaker.

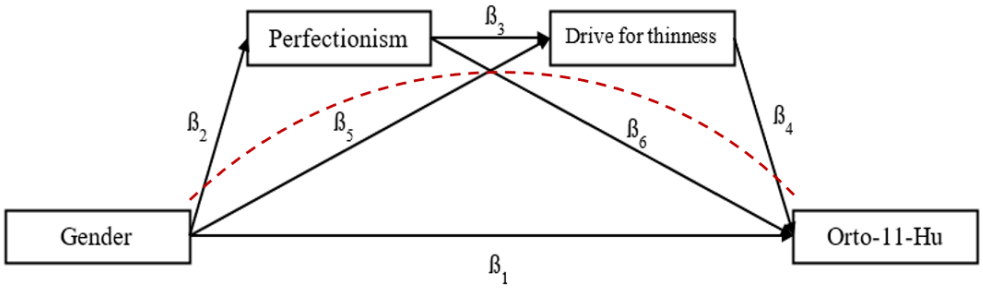


*Figure 6:* Mediated mediation between gender and orthorexic tendencies: indirect effect of perfectionism and drive for thinness

To sum up, this mediated mediation shows that women are more orthorexic than men because they are more perfectionistic AND more driven for thinness, and even the perfectionism mostly matters because it leads to a drive for thinness in itself.

## 4.2. The 2019 Study

### 4.2.1. Sample description and presence of ON in the 2019 study

The sample consisted of 175 individuals from which 50 were males and 125 females. The description of the sample can be seen in *Table 5*, which lists the age of the participants,

and also their results scored on the screening instruments used in this survey: EHQ-R, RSES and the Spiritual Awareness Questionnaire's Contentedness subscale.

*Table 5:* Description of the 2019 sample: age and scores on EHQ-R, RSES and Contentedness

**Descriptive Statistics**

| | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|
| Age | 18 | 57 | 35.41 | 7.594 |
| BMI | 17.4 | 47.8 | 24.7 | 4.94 |
| EHQ-R | 34.00 | 118.00 | 59.3943 | 16.57616 |
| Rosenberg SES | 11.00 | 40.00 | 26.9600 | 5.78182 |
| Contentedness | 13.00 | 47.00 | 33.2629 | 7.80948 |

44.6% of the study participants trained for more than 5 years, 26.3% for 5-10 years and 29.1% have been training regularly for at least 11 years. Their training habits were the following: 89.7% of respondents exercised several times a day, 7.4% every day and 2.9% multiple times a day. In terms of the exercise form, functional training was the most frequent (36.0%), aerobic activity was performed by 28% of the participants, followed by bodybuilding (14.3%), group classes (11.4%) and yoga (10.3%).

### 4.2.2. Psychometric analysis of the Eating Habits Questionnaire-Revised

In order to utilize EHQ-R for all the analyses planned for this study, it was first necessary to carry out the psychometric analysis. The following assessments were performed: verifying the original theoretical factor structure (in addition to the CFA, I tested for an alternative, single factor solution as well), testing for scale reliability and construct validity.

#### *4.2.2.1.Factor structure*

Results of the CFA supported the five-factor theoretical model of the EHQ-R questionnaire and showed an 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]). Factor weights ranged from 0.61 to 0.90 (*Table 6)*. The correlation coefficients between the factors ranged from 0.73 to 0.95 (*Table 7*).

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*Table 6:* Standardized factor weights from confirmatory factor analysis of the EHQ-R questionnaire

| **Factor** | **Item** | **Weight** |
|---|---|---|
| Rigidity | 1. I must follow a strict method of food preparation. | 0.61 |
| | 6. I follow my dietary rules to avoid feeling stressed about consuming unhealthy foods. | 0.83 |
| | 7. I follow a health-food diet rigidly. | 0.74 |
| | 16. I must thoroughly check the contents of food. | 0.68 |
| | 18. I feel safer when I prepare my own meals rather than eating out at a restaurant. | 0.52 |
| | 20. I follow a diet with many rules. | 0.75 |
| | 24. I have spent more time than anyone else researching healthy foods. | 0.84 |
| Healthy body appearance | 3. I feel like I must make my body look healthier. | 0.69 |
| | 13. I am concerned about how healthy my body looks. | 0.82 |
| | 14. I believe following my dietary rules will make my body look healthy. | 0.70 |
| | 19. It is important to me that my body looks healthy. | 0.57 |
| | 25. When I follow my dietary rules, I feel good about my body looking healthy. | 0.74 |
| | 27. I only eat what my diet allows. | 0.58 |
| Violation of dietary rules | 12. I removed entire food groups from my diet because I needed to eat healthier. | 0.54 |
| | 15. Fasting after violating my dietary rules makes me feel healthier. | 0.66 |
| | 17. If I violate my dietary rules, I must exercise to feel healthy. | 0.71 |
| | 22. If I violate my dietary rules, I worry that I won't look healthy. | 0.88 |
| | 23. If I violate my dietary rules, I must increase the number of rules I have. | 0.88 |
| | 28. I am scared that violating my dietary rules will make my body look unhealthy. | 0.85 |
| | 29. If I violate my dietary rules, I must commence a cleanse to remain healthy. | 0.78 |
| Negative emiotionality | 2. I feel anxious if I eat impure foods. | 0.85 |
| | 4. My healthy eating is a significant source of stress in my relationships. | 0.75 |
| | 5. I would feel guilty if I consumed unhealthy foods. | 0.82 |
| | 8. I punish myself if I don't follow my health-food diet. | 0.84 |

| | | |
|---|---|---|
| Time impairment | 9. I feel ashamed of myself if I consume unhealthy foods. | 0.75 |
| | 11. I loathe myself if I eat unhealthy foods that are not in my diet. | 0.90 |
| | 10. I spend more than three hours a day thinking about healthy food. | 0.84 |
| | 21. I spend over two hours a day checking my body for a healthful appearance. | 0.85 |
| | 26. I feel in control of my health when I follow my dietary rules. | 0.66 |
| | 30. I constantly think about eating healthily. | 0.85 |

n=175. All items' weight had a significance of $p<0.001$.

*4.2.2.2.Reliability check*

To test the reliability of the EHQ-R questionnaire, first, the Cronbach alpha index was calculated to estimate the internal reliability of the scales. The values ranged from 0.75 to 0.87, verifying the internal consistency of the questionnaire subscales.

To estimate time consistency, a correlation coefficient was calculated between the scale scores from the data measured over the five-week time interval. The results show that for four out of the five subscales, the value of the test-retest correlation coefficient exceeds 0.70, while for the one exception, the "Healthy body appearance" subscale it approaches it ($r = 0.67$; $p < 0.001$). Consequently, overall, the temporal reliability of the EHQ-R subscales is adequate. The descriptive and reliability data and correlation coefficients of the subscales of the questionnaire are summarized in *Table 7*.

*4.2.2.3. Checking the validity of the construct*

To the best of our knowledge, there is only one measuring tool currently available in Hungarian, the Orto-11-Hu questionnaire [19], with which I chose to test the construct validity for the EHQ-R. According to the results of the correlation analysis, all subscales of the modified version of the EHQ-R showed a significant, anticipated, strong relationship with the Orto-11-Hu questionnaire ($r / \rho = | 0.63–0.68 |$). The results are detailed in *Table 7*.

*Table 7:* Descriptive data, correlation coefficients, reliability and validity indicators of the EHQ-R questionnaire

| **Subscale (number of items)** | **M (SD)** | **2.** | **3.** | **4.** | **5.** | **Reliability Cronbach-alpha [CI 95] (*n*=175)** | **Test-retest reliability (*n*=48)** | **Validity (Orto-11-Hu)** |
|---|---|---|---|---|---|---|---|---|
| 1. Rigidity (7) | 14.5 (4.61) | 0.73 | 0.80 | 0.83 | 0.85 | 0.82 [0.78–0.86] | *r*=0.78 | *r*=–0.68 |
| 2. Healthy body appearance (6) | 15.2 (3.74) | - | 0.95 | 0.83 | 0.91 | 0.78 [0.73–0.83] | *r*=0.67 | *r*=–0.67 |
| 3.Violation of dietary rules (7) | 12.4 (4.35) | | - | 0.88 | 0.91 | 0.84 [0.79–0.87] | *ρ*=0.76 | *ρ*=–0.63 |
| 4. Negative emotionality (6) | 10.3 (3.87) | | | - | 0.82 | 0.87 [0.84–0.90] | *ρ*=0.86 | *ρ*=–0.68 |
| 5. Time impairment (4) | 7.0 (2.50) | | | | - | 0.75 [0.68–0.80] | *ρ*=0.72 | *ρ*=–0.64 |

r = Pearson correlation coefficient *ρ* = Spearman correlation coefficient. Both cases $p < 0.001$.

#### *4.2.2.4. Testing for an alternative factor structures*

In the CFA introduced in subchapter *4.2.2.1*, correlation coefficients between the factors ranged from 0.73 to 0.95, which are high correlations (as *Table 7* demonstrates). Therefore, two other tests were carried out to see whether they bring us results that confirm a structure that works in either a one-factor structure model, or in a hierarchical model.

In case of the one-factor model, the following results were calculated: $\chi2\ (405) = 965.33$, the RMSEA was 0.089 and the CFI and TLI do not reach the 0.9 value which would be required (CFI = 0.896 TLI = 0.888), thus, ignoring the subscales and using EHQ-R in a one-dimensional manner would have been inaccurate.

Also, I tested a model with a hierarchical approach. The fit of the model containing the second order factor did not prove to be better than that containing the five first order factors: $\chi2\ (400) = 871.457$, $p < 0.001$; CFI = 0.912, TLI = 0.905. As introduced in subchapter 4.2.2.1, the fit indices of the original five-factor model were as follows: $\chi2\ (395) = 856.246$, $p < 0.001$; CFI = 0.914, TLI = 0.906. Thus, the goodness of fit is similar in these two approaches.

All in all, after considering the CFA and two alternative solutions to use EHQ-R, the tested CFA is the best solution due to the five subscales that intend to measure different aspects of problematic eating behavior, but the EHQ-R is also a good tool to use while adding its summed scores.

### 4.2.3. Hypothesis testing: gender differences and age in ON characteristics

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), there was no significant correlation found with age. All correlation coefficients are shown in *Table 8.*

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*Table 8.* Correlations between age, gender, orthorexic tendencies (EHQ-R summed score and subscales), training habits and psychological correlates (self-esteem and contentedness) n= 175.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Age | 1.000 | | | | | | | | | | | |
| (2) Gender | 0.111 | 1.000 | | | | | | | | | | |
| (3) When did you start attending the gym? | 0.113 | -0.041 | 1.000 | | | | | | | | | |
| (4) How often do you go to the gym? | -0.014 | -0.044 | 0.025 | 1.000 | | | | | | | | |
| (5) EHQ-R summed | -0.150* | 0.104 | -0.050 | 0.223** | 1.000 | | | | | | | |
| (6) Rigidity | -0.115 | 0.136 | -0.064 | 0.260*** | 0.851*** | 1.000 | | | | | | |
| (7) Healthy body appearance | -0.079 | 0.059 | -0.039 | 0.067 | 0.839*** | 0.582*** | 1.000 | | | | | |
| (8) Violation of dietary rules | -0.100 | 0.085 | 0.010 | 0.210** | 0.913*** | 0.676*** | 0.737*** | 1.000 | | | | |
| (9) Negative emotionality | -0.181* | 0.096 | -0.048 | 0.214** | 0.880*** | 0.690*** | 0.666*** | 0.771*** | 1.000 | | | |
| (10) Time impairment | -0.210** | 0.053 | -0.099 | 0.201** | 0.855*** | 0.682*** | 0.679*** | 0.769*** | 0.680*** | 1.000 | | |
| (11) Self-esteem | 0.239** | -0.099 | 0.150* | -0.010 | -0.306*** | -0.201** | -0.230** | -0.289*** | -0.387*** | -0.213** | 1.000 | |
| (12) Contentedness | 0.205** | -0.118 | 0.034 | -0.170* | -0.337*** | -0.211** | -0.312*** | -0.368*** | -0.393*** | -0.370*** | 0.429*** | 1.000 |

* p<0.05,
** p<0.01,
***p<0.0001

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#### 4.2.4. Hypothesis testing: mediation analyses between self-esteem, contentedness and orthorexic tendencies

The paths between self-esteem and orthorexic tendencies are visualized on a schematic way on *Figure 7.* 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. All the path coefficients are reported in *Table 9.*

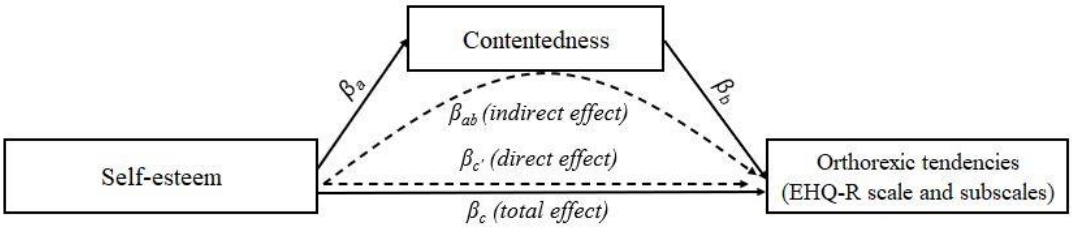


*Figure 7*: Mediation paths between self-esteem and orthorexic tendencies

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*Table 9*: Results of mediation analyses - the effects of self-esteem on ON mediated by contentedness

| Output | Predictor | Path | $R^2$ | F | β | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|---|---|---|---|
| Contentedness | Self-esteem | $\beta_a$ | 0.1844 | 39.1156 | 0.4294 | 0.0687 | 6.2542 | <0.0001 | 0.2939 | 0.5649 |
| EHQ-R sum | Self-esteem | $\beta_c$ | 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 | $\beta_b$ | 0.1654 | 17.0399 | -0.2960 | 0.0771 | -3.8377 | 0.0002 | -0.4483 | -0.1438 |
| | Self-esteem | $\beta_{ab}$ | - | - | -0.1271 | 0.0495 | - | - | -0.2349 | -0.0416 |
| Rigidity | Self-esteem | $\beta_c$ | 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 | $\beta_b$ | 0.0594 | 5.4329 | -0.1522 | 0.0819 | -1.8584 | 0.0648 | -0.3138 | -0.0095 |
| | Self-esteem | $\beta_{ab}$ | - | - | -0.0653 | 0.0448 | - | - | -0.1623 | -0.0117 |
| Violation of dietary rules | Self-esteem | $\beta_c$ | 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 | $\beta_b$ | 0.1562 | 15.9212 | -0.2987 | -0.0776 | -3.8519 | 0.0002 | -0.4518 | -0.1457 |
| | Self-esteem | $\beta_{ab}$ | - | - | -0.1283 | 0.0474 | - | - | -0.2304 | -0.0454 |
| Negative emotionality | Self-esteem | $\beta_c$ | 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 | $\beta_b$ | 0.2131 | 23.2864 | -0.2779 | 0.0749 | -3.7098 | 0.0003 | -0.4257 | -0.1300 |
| | Self-esteem | $\beta_{ab}$ | - | - | -0.1193 | 0.0481 | - | - | -0.2252 | -0.0370 |
| Healthy body appearance | Self-esteem | $\beta_c$ | 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 | $\beta_b$ | 0.1086 | 10.4827 | -0.2613 | 0.0797 | -3.2774 | 0.0013 | -0.4186 | -0.1039 |
| | Self-esteem | $\beta_{ab}$ | - | - | -0.1122 | 0.0446 | - | - | -0.2016 | -0.0369 |
| Time Impairment | Self-esteem | $\beta_c$ | 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 | $\beta_b$ | 0.1405 | 14.0547 | -0.3411 | 0.0783 | -43576 | <0.0001 | -0.4956 | -0.1866 |
| | Self-esteem | $\beta_{ab}$ | - | - | -0.1465 | 0.0454 | - | - | -0.2433 | -0.0667 |

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

In the following subchapters, the detailed results (effect and significance) of all six models are reported. *Table 9* includes the same numbers, along with the $R^2$, F, standard error and t-values.

#### *4.2.4.1. EHQ-R summed score*

In the model where the output variable was EHQ-R summed score, the results were the following:

- The total effect ($ß_c$=-0.3064, p<0.0001) was significant, so self-esteem influences orthorexic tendencies, in a way that lower self-esteem predicts ON.
- The direct effect ($ß_{c'}$=-0.1793, p=0.0213) was significant, which means that the relationship between low self-esteem and ON is partly an immediate effect.

- However, it is also shown that this relationship is revealed through contentedness, which is shown by the significant indirect effect ($ß_{ab}$=-0.1271, LLCI: -0.2380, ULCI: -0.44).
- Moreover, besides its mediator role, it can be seen that ON depends on contentedness as well ($ß_b$=-0.2960, p=0.0002).

*4.2.4.2. Rigidity subscale*

- The total effect ($ß_c$=-0.2013, p=0.0075) was significant: low self-esteem also leads to rigid eating patterns.
- This relationship is not a direct effect, as this path was not significant ($ß_{c'}$=-0.1360, p=0.0986).
- The indirect effect was also non-significant ($ß_{ab}$=-0.0653, LLCI: -0.1540, ULCI: 0.0114).
- Moreover, the effect of Contentedness on Rigidity was also non-significant ($ß_b$=-0.1522, p=0.0648).

*4.2.4.3. Healthy body appearance subscale*

- The total effect ($ß_c$=-0.2302, p=0.0022) was significant: lower self-esteem predicts a wish for healthy appearance.
- The direct effect was not significant ($ß_{c'}$=-0.1180, p=0.1406).
- The indirect effect was however, significant ($ß_{ab}$=-0.1122, LLCI: -0.2092, ULCI: -0.0364).
- Furthermore, the effect of Contentedness on the wish for having a healthy-looking body was significant ($ß_b$=-0.2613, p=0.0013).

*4.2.4.4. Violation of dietary rules subscale*

- The total effect was significant ($ß_c$=-0.2888, p<0.0001): the lower the self-esteem is, the more guilty the participants are about breaking dietary rules.
- The direct effect between these two variables were also significant ($ß_{c'}$=-0.1605, p=0.0399), which means that low self-esteem and worrying about rulebreaking can be directly linked.
- The indirect effect is also significant ($ß_{ab}$=-0.128, LLCI: -0.2276, ULCI: -0.0428), meaning that the total effect is partly influenced by the role of contentedness.

- In addition, the effect of Contentedness on the outcome variable is also significant ($ß_b$=-0.2987, p=0.0002)

*4.2.4.5. Negative emotionality subscale*

- The total effect was significant ($ß_c$=-0.3874, p<0.0001), which indicates a negative correlation between negative emotions regarding dieting and self-esteem.
- The direct effect was significant ($ß_{c'}$=-0.2681, p=0.0004), showing that the predictor role of self-esteem is partly due to its immediate effect on negative emotions.
- The indirect effect is also significant ($ß_{ab}$=-0.1193, LLCI: -0.2158, ULCI: -0.0391), so this predictor role also comes from the mediator role of Contentedness.
- Moreover, the effect of Contentedness on negative emotions was also significant ($ß_b$=-0.2779, p=0.0003).

*4.2.4.6. Time impairment subscale*

- The total effect was significant ($ß_c$=-0.2135. p=0.0046), meaning that those who waste too much time thinking about healthy foods due to ON, are doing so because they have low self-esteem.
- The direct effect was not significant ($ß_{c'}$=-0.0670, p=0.3931), which means that this relationship is not valid, because this effect is immediate.
- The indirect effect was significant ($ß_{ab}$=-0.1465, LLCI: -0.2618, ULCI: -0.0620), so the relationship between the predictor and the outcome is due to the mediating effect of Contentedness.
- Also, the effect of being contented on time consuming activities was significant ($ß_b$=-0.3411, p<0.0001).

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# 5. Discussion

In the two studies which are introduced in this dissertation, I investigated the relationship between orthorexic tendencies and psychiatric/psychological variables, along with demographics and training habits. The aim was to explore these traits and their connection to ON on the population of Hungarian fitness participants. Besides finding out more about this community in terms of their pathological eating habits, I also intended to improve the methodological quality of measuring ON in the Hungarian population by implementing a new questionnaire, as there was only one available tool in our language.

## 5.1. ON's occurrence in fitness communities

The intention was to explore how widespread ON is in communities where participants face non-evidence-based fad diet advice daily, in a climate that judges based on one's appearance. The 2019 study showed that intermediate EHQ-R scores were obtained by participants (see Descriptive Statistics in *Table 5*). In 2017, 13% of the survey participants fall below the 23 cut-off point (see *Table 1*). This 13% in a fitness-oriented population could possibly mean that they are a compromised group, although this statement can only be confirmed using a fitted control group, which is worth considering in future research. According to previously published results, there are certain members of this community that are visibly careful about their diet in a manner that could be harmful (15, 46–49, 51). Perhaps the obsessive pursuit of "clean" foods, perfect macro- and micronutrient intake is a great focus among fitness participants, just like the pursuit of a thin and fit body. One solution could be the emergence of countermovements that prefer a relaxed way of eating and training. This will be discussed more in detail in the following section.

### 5.1.1. A countermovement against healthism

The current beauty ideal is ever-changing. Around 2010, the "thinness becomes beauty" slogan was no longer justifiable, instead, an athletic body meets the cultural expectations of this past decade (44). This type of body communicates health and is in line with the norms of healthism: if one is taking care of their own body then they can become a public display of healthy lifestyle habits. Nevertheless, this trend might come to an end soon as well: one sign is the rejection that is taking place in social media against the perfectionist fitness beauty standards.

Based on content analysis, “fitspiring” messages may also promote thinness and disordered eating (54, 56, 83). As a result, to respond to endless dieting and striving to achieve the slim female ideal, a movement called “body positivity” is more and more widespread in the social media. As defined by Sastre in 2014: *“Body positivity aims to challenge dominant appearance ideals; foster acceptance and respect for all bodies regardless of shape, size and features; and focus on appreciating the functionality and health of the body rather than solely focus on its appearance”* (84). In the Introduction, I reviewed the harmful effects that social media can cause. However in 2018, there were 9 665 082 body positivity related posts on Instagram (85) and this number has grown to approximately 25 million posts are present on Instagram under the tags #bodypositivity, #bopo or #bodypositive (86). Research has shown that young women experienced greater acceptance of their own bodies following exposure to pictures of women who do not conform the thin ideal (87). As both samples in 2017 as well as in 2019, have shown orthorexic tendencies for a number of fitness participants, a positive, compassionate message coming from social media needs to be interpreted to the public discussions as well. This way, the affected participants would realize that chasing health and fitness goals is not always about being healthy – it is rather marketing products. Moreover, it is important to realize that striving for a thin body is a falsely perceived as a virtue that covers up a deeper issue of perfectionism. Revealing this interconnection in individual cases could be a helpful item to integrate into eating disorder therapies in the future.

### 5.1.2. Drawbacks of self-reporting: underreporting eating disorder symptoms

It needs to be noted that patients tend to underreport disordered eating symptoms on questionnaires. In a 1993 study using the EDI and interviewing methods, 522 female athletes and 448 non-athlete controls were assessed. It became visible that unlike the control group, the participating athletes had the tendency to have contradictory results coming from their interviews, clinical evaluations and their EDI score (88). This evidence echoes what Vandereycken has written about in his narrative review study on denial of AN, as early as in 1983. In this study reviewing the level of AN, their results tell that the disordered eating habits are underreported on occasion. In one reviewed study, 13 out of 40 AN inpatients scored below the cutoff score of 30 on the EAT (89).

Underreporting problematic eating habits in the questionnaire rather implies that the concept of “distortion” is probably more appropriate than “denial”, as the latter implies the rejection of reality (89). This was observed among one obese sample as well – they reported consuming less calories than what they had really eaten (90). Nonetheless, the supposition that participants of this study had reported false behaviors is not valid until it is verified, for example by using other methods (such as interviews) or other screening instruments. Conducting retrospective studies could also show evidence where the participants would assess their past judgements on their conditions. Nevertheless, knowing this characteristic of EDs and obesity, the question merits further investigation in the case of ON.

### 5.2. Drive for thinness and obsessionality as mediators between perfectionism and orthorexia nervosa

In the 2017 study, there was a significant correlation observed between all the following: Drive for thinness, Perfectionism, MOCI results measuring OC traits and ON tendencies. However, the regression analysis where ON was the outcome variable has shown that Perfectionism loses its effect (see chapter 4.1.2). Thus, a mediation analysis was conducted to see why this might be. The mediator variables were Drive for thinness and the MOCI scores, due to their high correlations with ON.

The results of this analysis have shown that perfectionist attitudes can cause orthorexic tendencies because OC traits are cooccurring, but the mediator role of OC traits is less important than the mediator role of Drive for thinness. 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. (91). This broad sense of perfectionist compulsiveness is not specifically food-driven unless the compulsion aims to restore a diet-related event that has already happened (for example, over-exercising after eating snacks) or avoiding a feared incident (for example, taking preliminary actions against weight gain or against eating unhealthily).

On the other hand, the fact that Drive for thinness proved to be a stronger mediator than OC traits could mean that perfection in orthorexic dieting is much more viable through a strong desire to lose weight. The desire to be thinner, or the willingness to compensate for the caloric intake can be similar to wanting to achieve a perfectly-shaped body through

orthorexic dieting habits. Drive for thinness is probably where the participants would manifest their perfectionist standards. Even though the body ideal is a changing construct over time (see subchapters 1.5.1. and 5.1.1.), it can be concluded that those who place great importance on their body shape are at risk of ON in the fitness communities.

### 5.2.1. A possible way for placing orthorexia nervosa into the diagnostic criteria systems

If underpinned by similar results, these conclusions could serve as valuable information when considering the categorization of ON in the upcoming psychiatric diagnostic systems. One possible approach could be to make the description of AN more comprehensive, also encompassing ON symptoms. Similarly to AN, food is restricted, but due to a perception of food quality. Based on the findings of my thesis, this may only be an excuse on the surface; the underlying psychological factors such as perfectionism, obsessionality and wishing for a thinner body could be the real reasons, which overlap with AN. Thus, the AN definition with additional suggestions could be the following (emphasis added in italics for suggested new text): "Intense fear of gaining weight or becoming fat *or of eating unhealthy foods*, even though underweight *and/or malnourished*" and "Disturbance in the way in which one's body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current low body weight *and/or malnourishment*" (1).

In case this connection is also confirmed by future research, this could be a valuable addition to the ethical dilemma as well: does "overly healthy eating" really deserve its own place in the DSM, as a separate psychiatric disorder category? Including the most serious orthorexic cases (by drawing a line at malnourishment and distress about weight gain) on a spectrum of AN might lessen the stigma of becoming "orthorexic" for those who struggle with some health food preoccupation. ON has been stigmatized by assuming negative traits, and it is not even a separate diagnostic category (8). Such an updated diagnostic classification system could avoid the medicalization of healthy eating in itself, and could simply expand the definition of AN, due to the similarity of AN's pathogenesis with ON.

Another approach of including ON into psychiatric taxonomies would be considering patterns of generic correlations and overlaps between the known genetic markers of

different diseases. The overlap of psychiatric disorders is displayed well in these systems. AN tends to cluster with OCD (92, 93). As for ON, we would only know whether it belongs to this spectrum if we had such data.

### 5.3. Exercise dependency: is the frequency of training related to obsessive-compulsive disorder?

In the second regression of the 2017 study, I controlled for several other variables besides the EDI subscales and MOCI. When putting these factors into the model, it became visible that training frequency is closely correlated with OC traits, so OC traits' effect on ON tendencies has lost its significance (see *Table 4* in chapter 4.1.3.). This is not surprising after seeing that MOCI and training frequency (possible answers: few times per week; daily; multiple times per day) were significantly correlated ($r=0.232$, $p<0.0001$) according to *Table 2.*

Among fitness communities, earlier studies measured that people with diagnosed eating disorders often depend on physical exercise and sport. In 1976, Glasser called excessive exercise a positive addiction because it is a health-promoting habit (94). As exercise is a healthy activity, in contrast to other addictions (for example, drinking and gambling), it is communally viewed as being beneficial (95). But in some cases, athletes will keep training despite getting injured or have weak performance (96). Obligatory exercise is not "positive", because it is compulsive and causes suffering when the activity is not performed, not to mention the impairment of all other aspects of life (50). Regarding its connection with eating disorders, one study showed that those triathletes who score high on the eating disorder questionnaire would develop a secondary exercise dependence (97). The results of my study showed that going to the gym often (more than once per day) can also explain and predict ON, which are in line with one German study as well (48). A Hungarian study conducted on a similar population echoed this relationship as well by stressing out the role of guilt over skipping training in explaining ON behaviors (98).

A possible explanation for the predicting role of excessive exercise lies in the fitness industry's health food marketing strategies. Those who spend a lot of time in the gym environment, often meet the messages that diet is the tool of achieving the "dream body".

Also, after hearing that as a rule of thumb, weight loss is generally “80 percent diet and 20 percent exercise” (99), it is understandable that gym goers would pay extra attention to micromanaging their food.

Currently, there is little evidence to support specific treatment plans or interventions for ON, but turning the attention away from bodyweight control could be a favorable direction. More research is needed to reveal the effect of different prevention tactics to eliminate ON and over-exercising among recreational athletes.

### 5.4. Relationship between gender and orthorexia nervosa

In the 2017 study, there was a significant correlation between female gender and ON, therefore, the hypothesis was not verified that claimed there would be no gender difference in orthorexic tendencies.

In the second regression model for the 2017 study (subchapter 4.1.3., *Table 4.*) after seeing that gender has lost its significance in the third regression model, a mediated mediation analysis was conducted. This has shown that women are more prone to have orthorexic tendencies because of two reasons: they are significantly more perfectionist than men (according to the correlation table, p=0.019, r=0.145) and this leads them to stricter eating behaviors, but what is more obvious is that their drive for thinness is what mediates this relationship.

In the 2019 study, there were no significant results showing this difference, however, EHQ-R’s Rigidity subscale has shown a tendency towards women. Thus, the same directionality was shown in this study and sample as well (see chapter 4.2.3.).

The initial motivation to assume an equal outcome for females and males was based on several studies – these had not found this difference (28, 29, 32). I also took into consideration the prediction that this tendency would even out in the 21$^{st}$ century, especially because the fitness industry equally aims men and women with messages. Yet, results show that ON, similarly to AN, is still an issue that affects more women than men in both of my studies. This result brings us back to the statement that ON among fitness participants is rather a culture-bound syndrome: the social expectations for maintaining a fit and slim body and taking care of their health are high for women (100), affecting their self-criticism and self-confidence levels, which can be in connection with unreasonable

food choices. Rangel and collegues conclude that Western societies might influence women's dietary behaviors. Their female study participants placed an emphasis on individual responsibility, decision making, and expressed an anxiety regarding dietary health decisions (101). In order to take off this burden, it would be necessary to address the importance of expert advice and therapists specifically curing body image issues and anxiety around food choice, specifically discussing topics on the ideas of femininity, self-confidence and self-esteem.

### 5.5. Relationship between age and orthorexia nervosa

Results pointed out that the younger the fitness participants are, the more likely it is that they have ON traits. Both the 2017 and 2019 studies have shown the similar direction.

A 2012 epidemiological study found that while the incidence rate remained stable over the past decades, there has been an increase of developing an ED in the high risk-group of 15–19 year old girls (102). It is unclear whether this reflects earlier detection of AN cases or an earlier age at onset. For all EDs, the age at onset has classically been described in adolescence. As for ON, there have been mixed findings regarding age as a risk factor (29). These results are in line with studies that measured ON in a student population: Croatian adolescents (103), Turkish medical students (104) and Italian university students of mixed majors (105). Other studies, however, show no association between age and ON (106) while again, others found an association between older age and a tendency to ON (18). Among fitness communities, there was one study that reported the same relationship in a research conducted in Portugal (107).

The study results of this dissertation suggests that in this sample, younger people are more interested in fashion diets, but later, over the years, they might have reached a health-conscious, yet balanced state. One explanation could be that younger people are simply more interested in looking good, so they invest more time and energy to follow diet-advice and as a result, they are more impacted by misinformation. Another reason for this relationship could be that this younger age group has more time to create and explore their own habits through online research and belonging to groups and communities that are preoccupied with diet – more than those who already have a family or are at a different stage of their lives. As currently middle-aged adults, probably this age group has not

encountered ON and health industry's messages, because these simply did not yet exist when they were at this exploratory stage of their lives.

According to our best knowledge, ON research has so far focused on people from age groups closer to the generation of university students (29). Both the 2017 and 2019 studies can be considered rare with the average ages of 31.9 and 35.4. More studies are necessary to explore whether this directionality is also present among middle-aged and older adults.

### 5.6. Interpersonal distrust and orthorexia nervosa

In the 2017 study, the relationship between EDI subscale titled Interpersonal distrust and ON was significant and strong, with an effect that was not influenced by other variables such as perfectionism, drive for thinness or obsessionality. Distrust became a strong correlate for ON, independently. The items in this questionnaire include items like "I trust others", "I need to keep people at a certain distance", or "I have trouble expressing my emotions to others". The reason for this might be that whenever a person starts dieting, there is a central, narrowed attention on food. Thus, there will also be a narrowed perspective and interest developed regarding the surrounding environment and as a result, social and personal relationships may worsen (108). Prior research has also shown that fearful and avoidant attachment styles were common among ON individuals (68).

This lack of trust in the industrial food preparation system is often present in ON. Nicolosi's (59) theory suggests that neophobic food anxiety about "bad" food is oftentimes based on the fear of the "artificial", expressing hostility towards biotechnologies, as opposed to the "natural". Scoring high on EDI's Interpersonal distrust subscale can possibly mean that those who have orthorexic tendencies, do not trust the food engineering procedures and biotechnologies, which is a common misconception among the members of alternative food networks (21, 59). A possible coping mechanism to this fear can be eliminating certain foods from the diet, being picky with finding "safe" places to eat, or disagreeing with friends and family members on the rightful way of eating. Also, according to Zörgő, another important attractor could be "naturalness" in the form of consuming organic, non-GMO food not associated with mass production. This affection towards the "natural" is based on the "appeal to nature fallacy" (109): what is perceived as "natural" is also "healthy". Distrust comes due to the "harmful substances" from the world can enter the body, accumulate and cause disease. On the other hand, the

concept and practice of “detoxification”, in which an individual experiences cleansing from chemicals, toxins, waste products are considered as trustworthy (110) .

This connection has not been verified so far; more research about trust and belief systems may be able to shed light upon this relationship. Also, the data is insufficient to decide the directionality (if a person was first fearful about food and then became orthorexic, or their orthorexic habits had led to become extra watchful about the cleanliness of the food procedure). However, investigating personality traits could answer where this relationship derives from. It is also a possibility that fearing food (among other orthorexic tendencies) are consequences of an underlying biological trait and do not cause each other. Thus, trait-based explanations can be a possible new way of investigating ON, as they provide richer data even in a cross-sectional study design.

### 5.7. Seeking self-esteem and contentedness through dieting

According to the data collected in the 2019 study, low self-esteem is a predictor for ON, in a way that higher EHQ-R scores associated negatively with RSES results (see subchapter 4.2.4.). This significant relationship can be seen in the case of the summed EHQ-R results and also four out of five of its subscales. As mentioned in the introduction, there was no published research to base the hypothesis upon, but certain theories drawn from both academic and non-academic scientific literature were sufficient to work with, which my study results did end up supporting.

When making a connection between self-esteem and ON, the handbook “Orthorexia: When Healthy Eating Goes Bad” written by Renee McGregor, RD, must be acknowledged. The author describes behavioral patterns she has observed as a practitioner on her clientele, explaining orthorexic tendencies originating from people pushing their potentials to their limits in order to gain self-esteem (111). However, she stresses that what has started as self-care, often turns into self-harm. Chasing self-esteem by following a perfectly planned diet is not possible, as it is a flawed approach to find inner peace.

Eating is an important symbol and a cultural signifier. As seen, dietary asceticism and a sense of superiority over those who eat “artificial, toxic, junk” (60) point to the fact that this cult of diet and exercise are the closest thing our secular society offers in terms of

philosophy of the self. Healthism, which comes in the form of dietary and lifestyle choices, can be an important building block for self-esteem. Participants in a qualitative study on social media blog posts also admitted having a sense of superiority and applying downward comparisons, identifying themselves as better and healthier than others (112). Perhaps this is due to the absence of the traditional, religion-based way: modern people adopt belief and behaviors to feel morally superior. Thus, healthism is a tool that is now used for positioning oneself within the world, and if there is too much meaning attached to the diet, it can lead to social comparison and remaining uncontented. This is the possible mechanism of ON becoming negatively correlated with self-esteem: as it is an endless cycle, not leading to a satisfactory state. Therefore, because of this assumption, the variable of "Contentedness" was tested as a mediator.

### 5.7.1. Analyzing the mediation models

Lower self-esteem was a predictor for ON tendencies, and in some cases, it was significantly mediated by the level of contentedness. In other words, those who have a lower self-worth, might be more likely to strive for a perfect diet and practice self-care using healthy food, and this relationship, in some cases is due to the lack of contentedness with their life.

The six different mediation analyses (one representing the summed EHQ-R scale and then the five subscales) helped the understanding what the relationship between low self-esteem and ON show, by involving contentedness as a hypothetical variable. The effect of self-esteem and the mediator role of contentedness affecting ON is visualized in *Table 10*. The six lines summarize the three possibilities: if self-esteem affects ON tendencies (total effect) and this could happen with and without contentedness (direct effect) or only through contentedness (Indirect effect). For the exact effect sizes of these paths, see *Table 9.*

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*Table 10:* Presence of mediations in the six models of the 2019 study. Dependent variable: orthorexic tendencies, the predictor variable is self-esteem and the mediator is contentedness.

| **Dependent variable** | **Is there a *total effect* present?** | **Is there a *direct effect* present?** | **Is there *an indirect effect* present?** |
|---|---|---|---|
| EHQ-R summed scores | Yes | Yes | Yes |
| Rigidity | Yes | No | No |
| Healthy Body appearance | Yes | No | Yes |
| Violation of dietary rules | Yes | Yes | Yes |
| Negative emotionality | Yes | Yes | Yes |
| Time impairment | Yes | No | Yes |

The analysis examining the paths between *Self-esteem, Contentedness, and Rigidity* showed only one significant effect among the possible paths: the total effect, meaning that the predictor role of low self-esteem on rigid diet rules is not influenced by the lack of contentedness. In other words, higher self-esteem and a life without rigid food rules are linked, but not impacted by the levels of satisfaction or the number of complaints in one's life. The reason for this could be that the items in Rigidity could also suggest that the diet is strict because of a health protocol. Thus, contentedness as a construct that also covers mental awareness, might not be related to items that are aiming these strict eating styles (for example, "I follow a health-food diet rigidly" or "I must thoroughly check the contents of food").

The next analysis that examined the question whether *lower self-esteem could predict a wish for a healthy appearance,* has shown a significant effect between these two variables, but this total effect was due to the mediator variable only. In other words, the wish to have a healthy-looking appearance is therefore heavily dependent on being unsatisfied. This subscale of the EHQ-R contains questions such as: "It is important to me that my body looks healthy" or "I am concerned about how healthy my body looks". The lack of contentedness with life's "little things" could trigger these statements, as these signify a person who is motivated by external factors, as one of the subscale's item mentions: "In conversations, I mention things that I possess in order to look more valuable in the eyes of others." This could be explained by trying to gain temporary self-esteem by wanting to appear better for the outside world, craving positive external feedback. The study examining sociocultural attitudes towards appearance (SATA) and ON's relationship found that both sexes who scored high on the SATA questionnaire's

Internalization subscale also scored high on the BOT. Internalization indicates that women have accepted the western imperative of leanness, and men identify masculinity with muscularity (15).

In the model where the output variable was *Violation of dietary rules*, both direct effect and mediation are present. This shows that if the fitness participant shows excessive guilt about breaking the rules, it may be a consequence of low self-esteem, but this effect is significantly influenced by being contented with one's life events. Based on the knowledge we have acquired so far, perfectionist personality traits could cause ON tendencies (because of a desire for a thin body shape). This manifests in the exaggerated self-criticism when violating self-imposed dietary rules [4, 15], leading to restrictions that only escalate over time. Keeping the rules rigorously can often be a cure to a disease that can be treated by dietary therapies, however, in this case, it may just become a form of internal conflict. Due to their resemblance to OC-related problems, cognitive therapy could be a possible tool to prevent these behaviors from devolving into pathology.

The next analysis presents *Negative emotionality* as an outcome variable. There was a direct effect between low self-esteem and negative emotions, but also the mediator role of contentedness was verified. This means that these emotions such as self-criticism, fear of disease, sense of personal impurity accompanied by shame can derive from either having low self-esteem or having low self-esteem because of lacking contentedness.

Finally, the model that examines *Time impairment* as an output, shows that there is no immediate significant relationship between low self-esteem and prolonged preoccupations, but the mediation analysis indicates that the lack of contentedness plays an important role in losing a lot of time while planning the perfect diet. Rites, rituals, cognitive rumination around food draw attention to the role of lack of security and might show a connection with OC traits. Thus, directly this might not be related to low self-esteem, but the lack life satisfaction could become an important link to the time-consuming, burdening habits. Another possible explanation to this mediating effect is that this calmness and contentedness can lead to increased acceptance and less need for rigid discipline and planning.

To conclude, the results of these mediations show us that in most cases, the lack of life satisfaction is what could cause self-esteem issues, which in the end, cause orthorexic tendencies. This is true especially in the case of wishing for a healthy appearance and time impairment, as they were lacking an immediate relationship with ON and only had a connection through the lack of contentedness. Future research should investigate the relationship between what these subscales represent and OC personality traits.

## 5.8. Limitations

There are several limitations to this work. First of all, the quality of Orto-11-Hu is no longer adequate according to scientific consensus, so the 2017 study results should be interpreted with this knowledge. Second, generalizability of the present findings needs to be taken into consideration: this sample is not a general population sample, and the lack of a fitted control group (non-exercisers) makes this study a solely descriptive one inside this homogenous group. Third, the direction of causality remained uncertain during the analyses. The main purpose was to test the connections between the results of two types of ON-questionnaires and other variables; I did not distinguish the antecedents and consequences. This would be useful to explore because currently, there is little evidence to support specific treatments or interventions for ON. Future research should include more prospective study designs that could clarify the direction and timeliness of these associations.

The lack of measuring more psychometric scales is also weakness in this study. While the EDI test measures distinct specific qualities like “drive for thinness” or “perfectionism”, and MOCI measures “obsessiveness”, they might reflect larger personality traits (for example, neuroticism or conscientiousness). In this study, there were no measures of personality performed, which should be controlled for in future research.

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# 6. Conclusion

The turning up of damaging fad diets can be an underestimated medical problem. Malnutrition and cognitive deterioration are two possible somatic consequences of trying to adhere to rigid diet plans, but if it brings the person to AN, or starts other behavioral addictions, it might be just as harmful. Regarding the trigger factors of ON, it does not matter whether starting such diets emerge from a societal pressure generated by the fitness industry, the intention to "self-heal" or any other underlying neuropsychologically-originated problems. Either case, the consequence can be a condition that deserves special attention.

Adhering to strict dieting emerges as a virtue in Western culture, such are the characteristics that the variables used in these studies stand for. Self-discipline in order to exercise more, become thinner and the associated perfectionism are idealized traits, so there is less attention and focus on the potential health and psychological risks. More studies are needed in the future on health deterioration and the clinical implications of ON. Clear boundaries need to be drawn between a healthy diet for the prevention of obesity recommended for all and diets that are detrimental to health and build on belief systems and unprofessionalism. The help of a specialist (e.g., a dietitian or internal medicine specialist) is recommended for the correction of malnutrition and for proper health education. Last but not least, the support of a psychotherapist is also necessary: all EDs require long-term therapy, otherwise they would escalate to chronic, in some cases life-threatening illnesses, which can be avoided when they are discovered on time.

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# 7. Summary

*The first aim* of this thesis was to explore whether ON is highly present among fitness participants in Hungary. 13% of the participants scored over the cutpoint of ORTO-15 scale, additionally, scoring average on EHQ-R. *The first hypothesis* claiming that there would be no difference between gender and ON is rejected, as both the 2017 and 2019 study has shown a direction towards women being more orthorexic than men. In the 2017 study, this connection became shadowed by the strong *correlation between gender and drive for thinness*, as striving for a thin body –which is much stronger among females– is a strong predictor for ON. In the 2019 study, there was a trend-level significance in the same direction towards women. *Secondly,* regarding age, both studies showed the directionality of younger fitness participants having orthorexic eating behaviors. *Thirdly,* the link between ON and the frequency of exercise is also confirmed: there is a link indeed, however, the multivariate linear regression analysis showed the influence of OC traits being simultaneously present. *Fourth,* the longer the participants had trained, the less orthorexic the are, but this significant relationship got lost in the regression model because of the collinearity with age. *Fifth,* the study showed that regarding EDI subscales, drive for thinness is the main predictor for ON, while perfectionism loses its effect as it is shadowed by compulsiveness and drive for thinness. Interpersonal distrust also predicts ON. The *sixth hypothesis* is also accepted: obsessive-compulsive traits are indeed correlated with ON, and are important mediators when it comes to the explanation how perfectionism influences ON. Supporting the *seventh hypothesis,* the 2019 study has shown between lower self-esteem and each EHQ-R subscale. The last, *eighth hypothesis* assumed that this connection is mediated by contentedness in a way that dissatisfaction with one's life predicts ON. This mediation was shown in the case of all subscales of the EHQ-R except for Rigidity. These sub-dimensions are Healthy body appearance, Violation of dietary rules, Negative emotionality and Time impairment.

Results of the psychometric analysis supported the theoretical factor structure and the internal and temporal reliability as well as the conceptual validity of the EHQ-R. Based on the calculations, the introduction of EHQ-R as a measuring tool can be recommended.

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# 9. Bibliography of the candidate's publications

**Publications related to the dissertation:**

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# APPENDIX

**The questionnaires used in the questionnaires:**

**Orto-11-Hu**

Kérjük, válaszoljon a következő állításokra aszerint, hogy mennyire jellemző Önre! Nincsenek jó vagy rossz válaszok. Kérjük, minden kérdésre őszintén válaszoljon! Jelölje x-szel a megfelelő választ!

| | **mindig** | **gyakran** | **ritkán** | **soha** |
|---|---|---|---|---|
| 1. Ha eszik, figyel az étel kalóriatartalmára? | | | | |
| 2. Ha bemegy egy élelmiszerboltba, zavartnak érzik magát? | | | | |
| 3. Az utóbbi három hónapban az étel gondolata aggasztotta Önt? | | | | |
| 4. Ételválasztásának feltételévé vált-e az egészségi állapota miatti aggódás? | | | | |
| 5. Az étel íze fontosabb, mint a minősége, amikor az ételt értékeli? | | | | |
| 6. Hajlandó több pénzt költeni egészségesebb ételekre? | | | | |
| 7. Az ételekről szóló gondolatok naponta több mint három órán át aggasztják? | | | | |
| 8. Megengedi magának az étkezési szabályok áthágását? | | | | |
| 9. Gondolja, hogy hangulata befolyásolja étkezését? | | | | |
| 10. Gondolja, hogy az a meggyőződés, hogy csak egészséges ételt egyen, növeli az önbecsülést? | | | | |
| 11. Gondolja, hogy az egészséges étel evése megváltoztatja az életstílusát (az otthonon kívül evés gyakorisága, barátok...)? | | | | |
| 12. Gondolja, hogy egészséges ételek fogyasztása javíthatja a megjelenését? | | | | |
| 13. Bűnösnek érzi magát, ha kihágást követ el? | | | | |
| 14. Gondolja, hogy a piacon vannak egészségtelen ételek is? | | | | |
| 15. Általában egyedül van, amikor eszik? | | | | |

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**2. Evészavar Kérdőív (Eating Disorder Inventory, EDI)**

Ez a kérdőív különböző véleményeket, érzéseket és viselkedéseket mér. A tételek némelyike ételekkel és evéssel kapcsolatos. Más tételek az Ön saját magával kapcsolatos érzéseire vonatkoznak. Nincs jó vagy rossz válasz, próbáljon meg tehát őszintén válaszolni.
1 = mindig
2 = rendszerint
3 = gyakran
4 = néha
5 = ritkán
6 = soha

1. Édességeket és szénhidráttartalmú ételeket anélkül eszem, hogy idegességet éreznék.
2. Diétázásra gondolok.
3. Rendkívül bűnösnek érzem magma túlevés után.
4. Csak a kiemelkedő teljesítmény elég jó, megfelelő a családomban.
5. Ki tudom fejezni érzelmeimet.
6. Szorongok a hízástól.
7. Megbízom másokban.
8. Könnyen kapcsolatba tudok kerülni másokkal.
9. Eltúlzom vagy felnagyítom a testsúly fontosságát.
10. Gyermekként nagyon erősen próbáltam elkerülni, hogy a nagyszüleim vagy a tanáraim csalódjanak bennem.
11. Közeli barátaim vannak.
12. Nagyon foglalkoztat a vágy, hogy soványabb legyek.
13. Nehezemre esik, hogy másoknak kimutassam érzelmeimet.
14. Gyűlölöm, ha nem a legjobbat teljesítem.
15. Szüleim kiemelkedőt vártak tőlem.
16. Ha hízom 1 kg-t, félek, hogy elhízom.
17. Úgy érzem, hogy vagy tökéletesen kell csinálnom a dolgokat, vagy sehogy.
18. Az embereket bizonyos távolságra kell tartanom (kényelmetlen számomra, ha valaki túl közel próbál kerülni hozzám).
19. Tudok személyes gondolatokról, érzésekről beszélni.
20. Igen magas céljaim vannak.

**Maudsley Obsessive Compulsive Inventory**

Jelölje be az IGAZ vagy HAMIS választ minden állításnál aszerint, hogy azt **önmagára vonatkoztatva igaznak vagy hamisnak érzi-e**. Nincsenek jó vagy rossz

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válaszok vagy tréfás kérdések. Válaszait gyorsan adja meg, s ne sokat gondolkozzon a kérdések pontos jelentésén! Jelölje x-szel a megfelelő választ!

I - H

1. Kerülöm a nyilvános telefon használatát, hogy kivédjem a lehetséges fertőzést.
2. Gyakran jutnak eszembe ocsmány dolgok, s nehezen tudok szabadulni tőlük.
3. Többet törődöm a tisztességgel, mint a legtöbben.
4. Gyakran elkésem, mert képtelen vagyok mindennel időre elkészülni.
5. Nem aggódom különösebben a fertőzés miatt, ha megsimogatok egy állatot.
6. Gyakran többször is ellenőriznem kell különböző dolgokat, mint pl. gáz- és vízcsapok, ajtók stb.
7. Nagyon lelkiismeretes vagyok.
8. Azt tapasztalom, hogy majd' mindennap felidegesítem magam olyasmitől, ami önkéntelenül, akaratom ellenére jut eszembe.
9. Nem idegesítem fel magam különösebben, ha véletlenül beleütközöm valakibe.
10. Minduntalan súlyos aggályaim vannak hétköznapi tennivalóim végzése során.
11. Egyik szülőm sem volt különösebben szigorú velem gyermekkoromben.
12. Gyakran elkések a munkámmal, mert folytonosan újraellenőrzöm a dolgokat.
13. Csak átlagos mennyiségű szappant használok.
14. Bizonyos számok nagyon szerencsétlenek.
15. Nem szokásom a leveleket feladás előtt újra meg újra ellenőrizni.
16. Nem szoktam reggelente hosszasan öltözködni.
17. Nem vagyok a normális mértéket meghaladóan tisztaságigényes.
18. Egyik fő problémám, hogy túl sok figyelmet szentelek a részleteknek.
19. Egy tisztán tartott WC-t minden további nélkül használok.
20. Fő problémám a dolgok újra és újra való ellenőrzése.
21. Nem foglalkoztatnak különösebben a baktériumok és a betegségek.
22. Nem szokásom egynél többször ellenőrizni a dolgokat.
23. Nem szoktam szigorú szabályokhoz kötni magam, mindennapi dolgok végzése során.
24. Nem érzem piszkosnak a kezem, ha megfogom a pénzt.
25. Nem szoktam magamban számolni rutinfeladatok végzése során.
26. Hosszabb időt szoktam tölteni reggel a mosakodással.
27. Nem szoktam nagy mennyiségű fertőtlenítőszert használni.
28. Rengeteg időm elmegy nap nap után a dolgok újra meg újra történő ellenőrzésével.
29. Nem megy el sok idő a ruháim esténkénti összehajtogatásával.
30. Még ha valamit nagyon gondosan végzek is el, gyakran úgy érzem, nem jártam el helyesen.

**Evési Szokások Kérdőív – módosított változat (EHQ-R)**

Kérem, karikázza be azt a választ, amely a leginkább érvényes jelenlegi evési szokásaira!

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| | Egyáltalán nem igaz | Kissé igaz | Nagyrészt igaz | Teljesen igaz |
|---|---|---|---|---|
| 1. Szigorú előkészületekkel kell felépítenem az étrendemet. | 1 | 2 | 3 | 4 |
| 2. Szorongok, ha nem tisztán étkezem. | 1 | 2 | 3 | 4 |
| 3. Úgy érzem, meg kell dolgozzak azért, hogy a testem egészségesebbnek tűnjön. | 1 | 2 | 3 | 4 |
| 4. Az egészséges étkezés jelentős stressz forrása a kapcsolataimban. | 1 | 2 | 3 | 4 |
| 5. Bűntudatom lenne, ha egészségtelen ételt fogyasztanék. | 1 | 2 | 3 | 4 |
| 6. Azért követem az étrendbeli szabályokat, hogy elkerüljem a stresszt, ami az egészségtelen ételek fogyasztásából adódna. | 1 | 2 | 3 | 4 |
| 7. Mereven követem az egészséges étrend szabályait. | 1 | 2 | 3 | 4 |
| 8. Megbüntetem magam, ha megszegem az egészséges étrend szabályait. | 1 | 2 | 3 | 4 |
| 9. Szégyellem magam, ha egészségtelen ételt eszek. | 1 | 2 | 3 | 4 |
| 10. Több, mint napi három órát töltök azzal, hogy az egészséges ételekre gondolok. | 1 | 2 | 3 | 4 |
| 11. Gyűlölöm magam, ha olyan egészségtelen ételeket eszek, melyek nincsenek az étrendemben. | 1 | 2 | 3 | 4 |
| 12. Kiiktattam bizonyos ételcsoportokat azért, hogy egészségesebben étkezzek. | 1 | 2 | 3 | 4 |
| 13. Aggódom azon, hogy a testem mennyire tűnik egészségesnek. | 1 | 2 | 3 | 4 |
| 14. Úgy hiszem, hogy ha követem az étrendem, akkor egészségesnek fog tűnni a testem. | 1 | 2 | 3 | 4 |
| 15. Ha böjtölök, miután megszegtem az étrendem szabályait, akkor egészségesebbnek érzem magam. | 1 | 2 | 3 | 4 |
| 16. Alaposan ellenőriznem kell az ételek tápanyagtartalmát. | 1 | 2 | 3 | 4 |
| 17. Ha megszegem az étrendem szabályait, le kell mozognom, hogy egészségesebbnek érezzem magam. | 1 | 2 | 3 | 4 |
| 18. Úgy érzem, otthon elkészíteni az ételt biztonságosabb, mint étteremben enni. | 1 | 2 | 3 | 4 |

| | | | | |
|---|---|---|---|---|
| 19. Fontos számomra, hogy testem egészségesnek tűnjön. | 1 | 2 | 3 | 4 |
| 20. Olyan étrendet követek, melynek sok szabálya van. | 1 | 2 | 3 | 4 |
| 21. Több, mint napi két órát foglalkozom annak ellenőrzésével, hogy a testem egészségesnek tűnik-e. | 1 | 2 | 3 | 4 |
| 22. Ha megszegem az étrendem szabályait, aggódom, hogy nem tűnök egészségesnek. | 1 | 2 | 3 | 4 |
| 23. Ha megszegem az étrendem szabályait, akkor több szabályra van szükségem. | 1 | 2 | 3 | 4 |
| 24. Többet foglalkozom az egézséges ételek kutatásával, mint bárki más, akit ismerek. | 1 | 2 | 3 | 4 |
| 25. Amikor követem az étrendem szabályait, úgy érzem, a testem egészségesnek tűnik. | 1 | 2 | 3 | 4 |
| 26. Úgy érzem, én irányítom az egészségem, amikor az étrendem szabályait követem. | 1 | 2 | 3 | 4 |
| 27. Kizárólag azt eszem, amit az étrendem megenged. | 1 | 2 | 3 | 4 |
| 28. Aggódom attól, hogy az étrendem megszegése ahhoz vezetne, hogy testem egészségtelennek tűnik. | 1 | 2 | 3 | 4 |
| 29. Ha megszegem az étrendem szabályait, meg kell tisztulnom ahhoz, hogy egészséges maradjak. | 1 | 2 | 3 | 4 |
| 30. Folyamatosan azon gondolkodom, hogy miként tudok egészségesen enni. | 1 | 2 | 3 | 4 |

**Rosenberg Önértékelés Skála (Rosenberg Self-Esteem Scale)**

Az alábbiakban néhány állítást sorolunk fel azzal kapcsolatban, amit általában Önmagával kapcsolatban érezhet. Soronként egy választ jelöljön meg attól függően, hogy mennyire ért egyet az adott állítással.

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1 = egyáltalán nem értek egyet
2 = nem értek egyet
3 = egyetértek
4 = teljesen egyetértek
1. Úgy érzem, értékes ember vagyok, legalábbis másokhoz képest.
2. Úgy érzem, sok jó tulajdonságom van.
3. Mindent egybevetve, hajlamos vagyok arra, hogy egy csődtömegnek tartsam magam.
4. Képes vagyok olyan jól csinálni a dolgokat, mint mások.
5. Úgy érzem, nem sok mindenre lehetek büszke.
6. Jó véleménnyel vagyok magamról.
7. Összességében elégedett vagyok magammal.
8. Bárcsak jobban tudnám magam tisztelni.
9. Időnként értéktelennek érzem magam.
10. Néha azt gondolom, hogy semmiben sem vagyok jó.

**Elégedettség méréséhez: Spirituális tudatosság – Ego dyastole alskála**

Az alábbiakban különböző emberi magatartásra, viselkedésre, beállítottságra utaló megállapításokat találsz. Kérjük karikázd be a kérdések után lévő számokat, hogy mennyire értesz egyet az egyes állításokkal, a következő skálának megfelelően:

1=soha vagy majdnem soha, 2= ritkán, 3=néhanapján, 4= a napok többségében, 5= minden nap, 6= sokszor egy nap

| | | | | | | |
|---|---|---|---|---|---|---|
| 8. Úgy érzem, hogy sok dologban igazam van, de ezt mások nem ismerik el. | 1 | 2 | 3 | 4 | 5 | 6 |
| 9. Könnyen megsértődöm. | 1 | 2 | 3 | 4 | 5 | 6 |
| 10. Beszélgetés során meg szoktam említeni olyan dolgokat, amelyeket birtokolok, hogy ezáltal értékesebbnek tűnjek mások szemében. | 1 | 2 | 3 | 4 | 5 | 6 |
| 11. Úgy érzem, hogy nekem semmi nem elég, mindig valami többre, másra vágyom. | 1 | 2 | 3 | 4 | 5 | 6 |
| 12. Tehernek érzem, hogy azt kell tennem, amit éppen csinálok. | 1 | 2 | 3 | 4 | 5 | 6 |
| 13. Sérelmeimet tovább táplálom magamban. | 1 | 2 | 3 | 4 | 5 | 6 |
| 14. Úgy érzem, hogy nyughatatlan és elégedetlen vagyok. | 1 | 2 | 3 | 4 | 5 | 6 |
| 15. Panaszkodom másokra. | 1 | 2 | 3 | 4 | 5 | 6 |