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**ORTHOREXIA NERVOSA AND RISK FACTORS
IN YOGA PRACTITIONERS**



UNIVERSIDADE DO ALGARVE

Faculdade de Ciências Humanas e Sociais

2019

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IN YOGA PRACTITIONERS**

Mestrado em Psicologia Clínica e da Saúde

Trabalho efetuado sob a orientação da Prof. Doutora Cláudia Carmo



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Declaro ser a autora deste trabalho, que é original e inédito. Autores e trabalhos consultados estão devidamente citados no texto e constam da listagem de referências incluída.

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AGRADECIMENTOS

Esta dissertação é o culminar de 5 anos de estudos de Psicologia. Muitas vezes me perguntam o que é que vou fazer com o curso de Psicologia, tendo eu uma carreira na área da Biologia Marinha... Na verdade, esta formação deu-me muitas ferramentas que uso diariamente na minha vida pessoal e profissional, e não trocaria estes 5 anos de trabalho, de suor, de fins-de-semana “perdidos”, e até de algumas lágrimas, por nada!

Costuma agradecer-se em primeiro lugar aos orientadores do trabalho, mas o meu primeiro agradecimento tem que ir para o meu colega e amigo Márcio Santos. Conhecemo-nos no segundo dia de aulas do 1º ano da licenciatura e formámos uma parceria imbatível (!!) que nos permitiu ter sucesso e superar as dificuldades que fomos encontrando pelo caminho. Sem o Márcio, estes anos não teriam tido metade da piada!

Agora sim, a minha orientadora, a Prof. Doutora Cláudia Carmo, que sem hesitação aceitou ajudar-me nesta minha obsessão pelos praticantes de yoga, e esteve presente em todos os momentos.

Outros docentes de Psicologia foram importantes ao longo deste caminho, mas tenho que referir o Prof. Doutor Luís Faísca, que arranja sempre um bocadinho de tempo para mim e é sempre capaz de esclarecer aquelas dúvidas de estatística que às vezes tanto me apoquentam!...

Tive colegas de curso fantásticas, com quem ri muito, e a quem desejo imenso sucesso profissional.

Também é devido um agradecimento aos meus colegas e alunos do CIMA e da FCT, por compreenderem as minhas ausências...

Por fim, é da praxe agradecer à família, e é de facto merecido, pois a família - marido, filhos e pais, está sempre lá para me apoiar nestas loucuras de fazer uma segunda licenciatura e um segundo mestrado (e até um segundo doutoramento!), com todo o tempo roubado que isso implica...

ABSTRACT

Yoga has been increasingly used as a complementary practice for disordered eating. However, it is not clear whether yoga is effective in the prevention and treatment of eating disorders, as some studies show elevated levels of disordered eating behaviours, particularly orthorexia nervosa (ON), in yoga practitioners. Therefore, it is urgent to understand potential long-term effects of the practice, in order to guide yoga interventions and treatment recommendations. The main goal of this work was, thus, to analyse the occurrence of disordered eating, specifically ON, in seasoned yoga practitioners, and its relationship with potential risk factors (body and appearance-related variables, personality traits, yoga engagement).

To accomplish this goal, we conducted two studies. The first was a systematic review that identified 12 cross-sectional studies on disordered eating behaviours and correlates in yoga practitioners. The second was a cross-sectional study; we developed an online questionnaire that was responded by 469 yoga practitioners.

Results across studies identified in the review were inconsistent. Some studies suggested that yoga practice is associated with healthier eating behaviours, but others found a high prevalence of disordered eating and ON in yoga practitioners. Our cross-sectional study indicated a high prevalence of ON, predicted by a high drive for thinness and a healthy interest in diet. This suggests that, like in anorexia and bulimia, orthorexic individuals are also concerned about food quantity and physical appearance, rather than just food quality. Practitioners of Ashtanga Vinyasa showed slightly higher tendencies for ON and drive for thinness than practitioners of other yoga styles.

Future work should focus on disordered eating symptomatology across yoga dosages and yoga styles, on the potential role of body, appearance and weight-related variables as mediators/moderators of ON, and the effect of the peer-pressure to eat clean on the development of orthorexic thinking in yoga practitioners.

Keywords: eating disorders; orthorexia nervosa; body; risk factors; yoga; complementary therapies.

RESUMO

Os comportamentos alimentares disfuncionais e as perturbações da alimentação e da ingestão (PAI) são sérios problemas de saúde pública devido à sua elevada prevalência e consequências físicas, sociais e psicológicas potencialmente nefastas. Os comportamentos alimentares disfuncionais podem ser subtis e aparentemente inócuos no início do seu aparecimento, mas ao longo do tempo podem evoluir e conduzir ao desenvolvimento de perturbações alimentares clinicamente relevantes. Apesar da diversidade de comportamentos alimentares disfuncionais, são três as perturbações da alimentação e da ingestão mais relevantes: anorexia nervosa, bulimia nervosa e a ingestão alimentar compulsiva. Observa-se também uma grande variedade de comportamentos alimentares disfuncionais que não são necessariamente clinicamente severos, mas podem afetar o bem-estar físico e psicológico do indivíduo, e acabar por evoluir para uma PAI clinicamente relevante.

Neste contexto, várias perturbações alimentares “novas” têm sido descritas, mas a falta de dados tem impedido a sua inclusão nos manuais de classificação diagnóstica; destas novas perturbações, a ortorexia nervosa é o exemplo mais pertinente. A ortorexia nervosa caracteriza-se como uma obsessão patológica por alimentos considerados biologicamente puros, o que pode conduzir a limitações nutricionais, a pensamentos obsessivos acerca da comida, problemas emocionais e isolamento social. Vários fatores de risco têm sido associados à ortorexia nervosa, nomeadamente fatores relacionados com a dieta (vegetarianismo, veganismo), com o corpo, a aparência física e o peso (imagem corporal, tendência para a magreza, idealização do ideal magro, insatisfação corporal), com o estilo de vida (exposição às redes sociais, dependência do exercício físico, ocupações relacionadas com a saúde), com a personalidade (perfeccionismo, autoestima, narcisismo, tendências obsessivo-

compulsivas), entre outros. A prevalência de ortorexia nervosa é consistentemente elevada em indivíduos com profissões ou ocupações relacionadas com a saúde, como nutricionistas, atletas, frequentadores de ginásio, bailarinos e também praticantes de yoga. Apesar do grande interesse que a ortorexia nervosa tem suscitado na comunidade académica e médica, a sua etiologia, sintomatologia, características diagnósticas, epidemiologia, tratamento e prognóstico ainda não estão bem estabelecidos.

Uma das terapias complementares que tem sido mais usada no tratamento e prevenção das perturbações alimentares é o yoga, devido à sua capacidade de aumentar a conexão com o corpo e, conseqüentemente, a sua aceitação. O yoga é percebido tanto por pacientes como por clínicos como uma intervenção potencialmente positiva, mas a investigação acerca dos efeitos do yoga nas perturbações alimentares está ainda no seu início. Existem poucos ensaios clínicos randomizados controlados, a maioria dos estudos são transversais e as amostras estudadas são pequenas. Os resultados dos estudos são inconsistentes; no geral, os praticantes de yoga parecem ter um menor risco de desenvolver PAI, e a sintomatologia associada às PAI diminui ou não se altera após intervenções com yoga. Apesar do crescente interesse no yoga como terapia para as PAI, muita investigação é ainda necessária para estabelecer o yoga como uma prática eficaz e efetiva na prevenção e tratamento destas psicopatologias, incluindo revisões sistemáticas e meta-análises para sistematizar o estado do conhecimento e propor novos caminhos de investigação, estudos transversais e longitudinais com praticantes de yoga para avaliar a prevalência de PAI e a relação com potenciais fatores de risco, e ensaios clínicos randomizados controlados para testar os efeitos das intervenções com yoga na sintomatologia associada às PAI.

Este trabalho foca-se na ortorexia nervosa em praticantes de yoga, uma vez que: estudos recentes sugerem que a prevalência de ON neste grupo é elevada; a maioria dos estudos aborda indivíduos com pouca ou nenhuma experiência de yoga;

sendo o yoga cada vez mais usado como terapia para as PAI, é essencial compreender o efeito de uma prática de yoga continuada nos comportamentos e atitudes alimentares dos praticantes.

Assim, este trabalho tem como objetivos: a) rever de forma sistemática a ocorrência de comportamentos alimentares disfuncionais, incluindo ortorexia nervosa, em praticantes de yoga; b) analisar as relações entre a ortorexia nervosa e potenciais fatores de risco, nomeadamente variáveis relacionadas com o corpo e a aparência (tendência para a magreza, crenças acerca da aparência), traços de personalidade (perfeccionismo, autodisciplina), e compromisso com a prática (paixão, imersão), em praticantes experientes de yoga.

Para tal, foram realizados dois estudos. O primeiro foi uma revisão sistemática da literatura usando as diretrizes do PRISMA. Foram identificados 12 artigos, todos transversais, e os resultados entre estudos foram inconsistentes. A prática de yoga está, de modo geral, associada a comportamentos alimentares mais saudáveis, a uma imagem corporal positiva e maior satisfação com o corpo, estando os praticantes em menor risco de desenvolver PAI. Porém, outros estudos indicam que uma maior dosagem de yoga está associada a uma maior prevalência de comportamentos alimentares disfuncionais, incluindo ortorexia nervosa.

O segundo estudo baseou-se num questionário *online* que foi respondido por 469 praticantes experientes de yoga de várias nacionalidades. Os resultados indicam que os valores de ortorexia nervosa na amostra são elevados, e os principais preditores desta perturbação é a tendência para a magreza e a ortorexia saudável, ou seja, um interesse não disfuncional pela dieta. Estes resultados sugerem que, tal como na anorexia e na bulimia, os indivíduos com tendências ortoréxicas também estão preocupados com a aparência física e a quantidade da comida, e não apenas com a qualidade dos alimentos. Os praticantes de Ashtanga Vinyasa yoga pontuaram ligeiramente mais alto na ortorexia nervosa e tendência para a magreza que praticantes de outros estilos de yoga.

Trabalhos futuros deverão focar-se nos comportamentos alimentares disfuncionais em praticantes com diferentes dosagens e estilos de yoga, no potencial papel das variáveis relacionadas com o corpo, a aparência e o peso como mediadoras/moderadoras da ortorexia nervosa, e nos efeitos da pressão dos pares na adoção de hábitos alimentares mais restritivos e no desenvolvimento do pensamento ortoréxico em praticantes de yoga.

Palavras-chave: perturbações alimentares; ortorexia nervosa; corpo; fatores de risco; yoga; terapias complementares.

TABLE OF CONTENTS

| | |
|--|-----------|
| Agradecimientos | Iii |
| Abstract | Iv |
| Resumo | V |
| 1. General introduction | 1 |
| 1.1 Eating disorders | 2 |
| 1.2 Orthorexia nervosa | 3 |
| 1.3 Correlates of eating disorders | 5 |
| 1.4 Yoga | 6 |
| 1.5 Yoga for eating disorders | 7 |
| 1.6 Rationale and objectives | 9 |
| 1.7 Thesis outline | 10 |
| 2. Disordered eating behaviours and correlates in yoga practitioners: a systematic review | 11 |
| Abstract | 12 |
| 2.1 Introduction | 13 |
| 2.2 Methods | 16 |
| 2.2.1 Inclusion criteria | 16 |
| 2.2.2 Literature search | 16 |
| 2.3 Results | 17 |
| 2.3.1 Study selection | 17 |
| 2.3.2 Study characteristics | 18 |
| 2.3.3 Eating behaviours in yoga practitioners | 21 |
| 2.4 Discussion | 23 |
| 2.4.1 Eating behaviours and correlates in yoga practitioners | 23 |
| 2.4.2 Methodological limitations | 27 |
| 2.5 Conclusions | 28 |
| 3. Orthorexia nervosa in yoga practitioners: relationship with personality, attitudes about appearance, and yoga engagement | 29 |
| Abstract | 30 |
| 3.1 Introduction | 31 |
| 3.2 Methods | 33 |
| 3.2.1 Study design | 33 |
| 3.2.2 Participants | 33 |
| 3.2.3 Characteristics of yoga practice and yoga engagement | 33 |
| 3.2.4 Body and appearance-related variables | 34 |
| 3.2.5 Personality traits | 34 |
| 3.2.6 Orthorexia nervosa and healthy orthorexia | 35 |
| 3.2.7 Data analysis | 36 |

| | |
|--|-----------|
| 3.3 Results | 36 |
| 3.3.1 Characteristics of yoga practice and yoga engagement | 36 |
| 3.3.2 Body and appearance-related variables | 38 |
| 3.3.3 Personality traits | 38 |
| 3.3.4 Orthorexia nervosa and healthy orthorexia | 38 |
| 3.3.5 Associations between variables | 39 |
| 3.3.6 Predictors of orthorexia nervosa | 40 |
| 3.4 Discussion | 41 |
| 3.4.1 Methodological limitations | 44 |
| 4. Final remarks | 45 |
| 5. References | 48 |
| Appendix 1 | 59 |
| Appendix 2 | 60 |

Chapter 1

General introduction

1.1 Eating disorders

Disordered eating and eating disorders are major public health concerns due to their high prevalence and potentially serious physical, social and psychological consequences. Disordered eating behaviours can be subtle and apparently innocuous at the beginning, such as fasting, eating little food, using food substitutes, skipping meals, and may evolve to more extreme behaviours such as taking diet pills, inducing vomit, using laxatives and diuretics (Neumark-Sztainer, Eisenberg, Wall, & Loth, 2011). Over time, these behaviours may lead to the development of clinically relevant eating disorders. These include a variety of persistent disturbances of eating behaviour that results in the altered consumption or absorption of food, leading to a significantly impairing of physical health and psychological functioning (American Psychiatric Association, 2013).

Despite the diversity of disordered eating behaviours, only three eating disorders (ED) are usually considered: anorexia nervosa, bulimia nervosa and binge eating disorder. The prevalence of these clinically relevant eating disorders is low, but the occurrence of disordered eating behaviours and attitudes is, on the contrary, high. For instance, a prevalence of 3.7% of full-threshold eating disorders in adolescents was identified in the USA (Flament et al., 2015). In Portugal, a 3% prevalence for all eating disorders among young females was referred (Machado, Machado, Gonçalves, & Hoek, 2007), but other study conducted in a sample of female college students found high scores of body dissatisfaction and a significant fear of gaining weight in 31% of the respondents (Machado, Calaldo Otero, Gonçalves, Martins, & Lameiras Fernández, 2004). There is a wide range of disordered eating behaviours that do not fulfil all diagnosis criteria and may not be clinically severe, but may still affect individuals' physical and mental well-being, and may develop over time into full-blown eating disorders.

In this context, several “new” eating disorders have been described, but lack of data hinders their inclusion in diagnostic manuals. Orthorexia nervosa (ON), an unhealthy obsession with healthy eating, is the most remarkable example.

1.2 Orthorexia nervosa

The term “orthorexia” was first introduced in a 1997 article published in *Yoga Journal*, a mainstream American magazine focused on yoga and wellness, where the author, the physician Steve Bratman, describes how the most unbalanced people he has met were those devoted to healthy eating. This led Bratman (1997) to believe that many of them suffered from a new eating disorder, that he coined “orthorexia nervosa” – a fixation on eating proper food. The initial stage of choosing to eat a healthy diet is not pathological; orthorexia nervosa sets in only when there is an intensification of that pursuit into an unhealthy obsession, with obsessive thinking about food, compulsive behaviours, self-punishment and escalating dietary restriction (Bratman, 2017).

In the last decade, orthorexia nervosa (ON) has sparked interest among the scientific and medical community. Although research on orthorexia is scarce, controversy around it has flooded scientific articles and mainstream media. An evidence-based definition of orthorexia is still missing, as well as consensus on its diagnostic criteria, and even a fully validated psychometric instrument to assess the condition and distinguish it from other eating disorders. Despite being accepted as a distinct eating disorder by many researchers and medical practitioners, ON was not included in the DSM-5 due to a lack of robust empirical data to allow a proper diagnosis. ON even failed to be included in DSM-5 section “Conditions for further study”, defined as those for which the scientific evidence is not yet available to support widespread clinical use, but for which criteria are included to aid diagnostics

and stimulate further research (American Psychiatric Association, 2013). Actually, the debate on the nature of orthorexia, if it is an eating disorder, an anxiety disorder, a separate disorder, or if it can be considered a mental disorder at all, still continues (Varga, Dukay-Szabó, Túry, & Van Furth Eric, 2013).

Initially, Bratman simply defined orthorexia as an unhealthy obsession with healthy eating (Bratman, 1997). Since then, the definition has evolved, to allow proper differentiation from other eating disorders. Drawing on previous studies, Brytek-Matera (2012) described ON as an eating behaviour disorder characterized by a pathologic obsession for biologically pure foods, which can cause dietetic limitations and lead to obsessive thoughts about food, affective problems and social isolation.

ON presents many similarities in terms of behaviours and complications with anorexia nervosa and bulimia nervosa. One crucial difference is the motivation behind the behaviour; unlike anorexia and bulimia, weight and body image issues are not relevant in orthorexia (Barthels, Meyer, & Pietrowsky, 2015; Dunn & Bratman, 2016). However, orthorexia and anorexia present several common features, suggesting that ON may be a subset of AN; shared characteristics include perfectionist traits, cognitive rigidity, trait anxiety, impaired functioning, poor external monitoring, impaired working memory, limited insight, guilt over food transgressions and, unlike the ego-dystonic bulimia, both ON and AN are ego-syntonic (Koven & Wabry, 2015). Regarding risk factors for ON, some studies found associations between vegetarianism, veganism or frequent dieting behaviour and orthorexic behaviours (Barthels, Meyer, & Pietrowsky, 2018; Valera, Ruiz, Valdespino, & Visioli, 2014), but further research is still needed to fully understand the aetiology, symptoms and diagnostic characteristics, epidemiology, treatment, and prognosis of orthorexia nervosa.

1.3 Correlates of eating disorders

Body, appearance and weight-related variables are particularly relevant in the context of eating disorders, given their importance as antecedents/mediators of disordered eating behaviours and attitudes. Body dissatisfaction, a construct that reflects a person's overall dissatisfaction with body shape and weight, is considered the best predictor of eating disordered behaviour. Hence, body dissatisfaction is the main target of prevention programs, given that if body dissatisfaction can be prevented or reduced, the prevalence of disordered eating behaviours will decrease (Cook-Cottone & Phelps, 2003). Dysfunctional beliefs about bodily appearance (*i.e.*, body shape, weight, attractiveness, etc.) are also commonly associated with ED and may successfully predict ED symptomatology over time (Spangler & Stice, 2001).

Another body image-related risk factor for eating disorders is the internalization of the "thin ideal", or the belief that thinness is the standard female beauty (Craighead & Smith, 2010), leading to body dissatisfaction and subsequent disordered eating behaviours, as individuals, particularly women, seek to achieve an "ideal" physique that is often unattainable (Schaefer, Burke, & Thompson, 2019). This can be expressed as a drive for thinness that translates as an excessive concern with dieting, preoccupation with weight, and fear of gaining weight (Garner, Olmstead, & Polivy, 1983).

Self-objectification is another construct that has been related with disordered eating and other psychopathological problems, particularly in women. According to the Objectification Theory (Fredrickson & Roberts, 1997), in social environments where women are viewed as aesthetic objects to be evaluated by others, they tend to view themselves as objects of evaluation; over time, self-objectification may lead to negative psychological outcomes and may contribute to disordered eating attitudes and behaviours in girls and women (Daubenmier, 2005; Schaefer & Thompson, 2018).

Besides body-related correlates, exercise-related variables are also relevant in the context of ED. Exercise dependence or excessive exercise, *i.e.*, pathological behaviours and attitudes related to the practice of physical exercise, namely when moderate to vigorous physical activity becomes a compulsive, addictive, obligatory, or fanatic behaviour (Hausenblas & Downs, 2002), are commonly associated with disordered eating behaviours (Shroff et al., 2006).

Finally, certain personality traits such as self-esteem, narcissism, obsessive compulsive tendencies, and perfectionism, are putative risk factors for the development of ED symptomatology (McComb & Mills, 2019). Perfectionism in particular is a personality trait that can be positive and functional, without any clinical relevance, but when high standards are pursued despite significant adverse consequences, perfectionism then becomes dysfunctional and may lead to psychopathological states (Shafran, Cooper, & Fairburn, 2002). Perfectionism is considered a risk factor for eating disorders (Craighead & Smith, 2010; Polivy & Herman, 2002), particularly for the development of anorexia nervosa (Fairburn, Cooper, Doll, & Welch, 1999), and for the subsequent development of bulimia nervosa in individuals with binge eating disorder (Fairburn et al., 1998). Individuals with high ON tendencies also show significant perfectionist traits (McComb & Mills, 2019).

1.4 Yoga

Yoga is an ancient Indian spiritual practice originated in the Indian subcontinent more than 5000 years ago. Yoga is the science of the mind; rather than focusing on the outer world, yoga is concerned with the exploration of one's inner world with the goal of achieving *Samadhi*, a state of higher consciousness (Saraswati, 1976). Over the last 150 years, yoga has been transported into the western world and

has progressively become acculturated, emerging today as a transnational, predominantly Anglophone phenomenon (De Michelis, 2007; Singleton, 2010).

Despite being at its core a spiritual practice encompassing several elements, the yoga currently practiced in the West is mainly based on the practice of physical postures with varying amounts of breath control techniques and meditation (Domingues, 2018), which can be more accurately identified as modern postural yoga (De Michelis, 2005). A myriad of postural yoga styles can be found across yoga studios, gyms and other venues, but all styles fall in the category of Hatha yoga; the most popular forms of Hatha yoga include Ashtanga Vinyasa, Vinyasa Flow, Power, Iyengar, Integral, Bikram, among others.

1.5 Yoga for eating disorders

Recognizing the “universal appeal” of yoga and the fact that “yoga provides a holistic approach to health and well-being”, the United Nations proclaimed June 21st as the International Day of Yoga, with the goal of raising awareness worldwide of the benefits of practicing yoga (United Nations, n.d., 2015). These benefits have been increasingly studied by the scientific community, particularly due to the growing use of yoga in clinical contexts, urging the empirical validation of different yogic practices (De Michelis, 2007).

Yoga has been shown to have many physical and psychological benefits, not only in non-clinical populations, but also as a complementary therapy in the treatment of physical and mental ailments (Field, 2016; Khalsa, 2013). Correlational and experimental studies, including randomized controlled trials, have bloomed in the last 15-20 years, focused on the relationship between yoga practice and mental health (for reviews, see Büssing, Michalsen, Khalsa, Telles, & Sherman, 2012; Jeter, Slutsky, Singh, & Khalsa, 2015), particularly on negative mental health indicators and

psychopathology. Bibliometric analyses show that most yoga studies are focused on depression, stress, anxiety, pain management, and cancer conditions (Büssing et al., 2012; McCall, 2014). Recently, more attention has been given to the optimal functioning of individuals, with the emergence of positive psychology (Gable & Haidt, 2005). A growing body of research emphasizing positive mental health indicators has been accumulating (for reviews see Domingues, 2018; Hendriks, de Jong, & Cramer, 2017), demonstrating the potential of yoga practice as a tool for human improvement.

In the arena of eating disorders, yoga has been increasingly used as a complementary therapy, due to its potential ability to enhance the connection and, hence, the acceptance of one's body (Boudette, 2006; Douglass, 2009). Indeed, the individual's relationship with his or her body is a key aspect in disordered eating, and to prevent or recover from disordered eating, it is crucial that individuals learn to be in and with their bodies in a healthy manner (Cook-Cottone, 2015). Both clinicians and clients tend to view yoga as a potentially positive intervention (Douglass, 2009), and yoga is currently used as an adjunct component in many ED treatment programs (Neumark-Sztainer, 2014). However, research on the effects of yoga on eating disorders and disordered eating behaviours and attitudes is still in its infancy. A recent systematic review on the effects of yoga on ED referred that a major limitation is the absence of randomized controlled trials to test yoga interventions for the prevention and treatment of ED, as most studies are cross-sectional and use small samples that hamper statistical analysis (Klein & Cook-Cottone, 2013). Results are inconsistent; overall, yoga practitioners seem to be at lower risk for developing ED, and ED risk and symptoms decrease or do not change after yoga interventions (Klein & Cook-Cottone, 2013).

1.6 Rationale and objectives

Yoga research is a field undergoing substantial growth and interest, but the evidence for yoga effectiveness and efficacy in the prevention and treatment of eating disorders is still missing. Thus, more research is needed to address limitations and inconsistencies (Klein & Cook-Cottone, 2013). This include systematic reviews and meta-analysis to summarize our current knowledge and to propose avenues for future research, cross-sectional and longitudinal studies with yoga practitioners to evaluate the prevalence of ED and relationships with potential risk factors, and randomized controlled trials to test the effects of yoga interventions on ED symptomatology.

In this thesis, we will focus on orthorexia nervosa in seasoned yoga practitioners, given that:

- a) Orthorexia nervosa was first described in Yoga Journal, as yoga practitioners are typically concerned with “healthy eating” and are thus included in the group of individuals that Bratman (1997) considered “unbalanced”;
- b) Recent studies confirm that, indeed, the prevalence of orthorexia nervosa in yoga practitioners is high (Bóna, Szél, Kiss, & Gyarmathy, 2019; Valera et al., 2014);
- c) RCTs and pilot studies that evaluate the effects of short-term, well-defined yoga interventions on ED symptoms and correlates in yoga naïve individuals, *i.e.*, individuals that never practiced yoga or have only a minor yoga practice, populate the literature. In contrast, the body of research that deals with yoga-experienced individuals, *i.e.*, individuals that have a long-term, dedicated practice, is much more modest; in addition, these studies are all cross-sectional, correlational, and results across studies are inconsistent (Domingues & Carmo, 2019);

- d) Yoga is increasingly used as complementary practice for the prevention and treatment of ED, so it is crucial to understand how yoga practice can affect individuals on the medium/long-term.

Therefore, the main goals of this thesis are:

- a) To systematically review the occurrence of disordered eating behaviours, including orthorexia nervosa, in yoga practitioners;
- b) To analyse the relationships between orthorexia nervosa and potential risk factors for ON, namely body and appearance-related variables (drive for thinness and beliefs about appearance), personality traits (perfectionism and self-discipline), and yoga engagement (passion and immersion).

1.7 Thesis outline

A general introduction to eating disorders and yoga is presented in Chapter 1, followed by the rationale behind this study and its goals. Chapters 2 and 3 represent the main contribution of the thesis to the advancement of knowledge in the eating disorder/complementary practices realm. Chapter 2 is a systematic review on the occurrence of disordered eating in yoga practitioners, and Chapter 3 is a cross-sectional study that analyses the relationships between orthorexia nervosa and potential risk factors in seasoned yoga practitioners. Finally, general conclusions are presented in Chapter 4.

Chapter 2

Disordered eating behaviours and correlates in yoga practitioners: a systematic review

**Disordered eating behaviours and correlates in yoga practitioners:
a systematic review**

Rita B. Domingues, Cláudia Carmo

Eating and Weight Disorders (in press)

<https://dx.doi.org/10.1007/s40519-019-00692-x>

Abstract

Purpose Yoga has been increasingly used as a complementary therapy for eating disorders. However, it is still not clear whether yoga is effective in the prevention and treatment of eating disorders, as some studies suggest that yoga practitioners show elevated levels of disordered eating behaviours. The goal of this systematic review is, thus, to analyse the occurrence of disordered eating behaviours and correlates in yoga practitioners.

Method PRISMA guidelines for systematic reviews were used. Search was conducted in several databases and specific journals.

Results Twelve articles, all cross-sectional, were identified, following PRISMA guidelines. Results across studies were inconsistent. Yoga practice was usually associated with healthier eating behaviours, lower disordered eating symptoms, and higher positive body image and body satisfaction, suggesting that yoga practitioners may be at a lower risk of developing eating disorders. However, other studies suggested that a high dosage of yoga practice may be associated with a higher prevalence of disordered eating behaviours.

Conclusions As yoga is increasingly used as therapy for eating disorders, understanding the relationship between yoga dosage and disordered eating behaviours is critical to guide treatment recommendations and establish yoga as a valuable complementary therapy.

Keywords: eating disorders; yoga; therapy; risk factors; orthorexia.

2.1 Introduction

Yoga is an ancient Indian spiritual practice concerned with the exploration of one's inner world with the goal of achieving samadhi, a state of higher consciousness (Saraswati, 1976). Over the last 150 years, yoga has been transported into the western world and has progressively become acculturated, emerging today as a transnational, predominantly Anglophone phenomenon (De Michelis, 2007; Singleton, 2010). Despite being at its core a spiritual practice encompassing several elements, the yoga currently practiced in the West is mainly an asana-based practice (physical postures) with varying amounts of breath control techniques and meditation (Domingues, 2018), which can be more accurately identified as modern postural yoga (De Michelis, 2005). A myriad of modern postural yoga styles can be found across yoga studios, gyms and other venues; the most popular forms include ashtanga vinyasa¹, vinyasa flow, power, Iyengar, integral, Bikram, among others.

Yoga has been shown to have many physical and psychological benefits, not only in non-clinical populations, but also as a complementary therapy in the treatment of physical and mental disorders (Field, 2016; Khalsa, 2013). Correlational and experimental studies, including randomized controlled trials, have bloomed in the last 15-20 years, focusing on the relationship between yoga practice and mental health (for reviews see Büssing et al., 2012; Jeter et al., 2015), particularly on negative mental health indicators and psychopathology. Bibliometric analyses show that most yoga studies deal with depression, stress, anxiety, pain management and cancer conditions (Büssing et al., 2012; McCall, 2014). Recently, more attention has been given to the optimal functioning of individuals, with the emergence of positive psychology (Gable & Haidt, 2005). A growing body of research emphasizing positive mental health indicators has been accumulating (for reviews see Domingues, 2018;

¹ Hereafter, we refer to ashtanga vinyasa as ashtanga; not to be confused with Ashtanga Yoga or Raja Yoga, the path of eight limbs described by Patanjali.

2. Disordered eating behaviours and correlates in yoga practitioners: a systematic review

Hendriks et al., 2017), demonstrating the potential of yoga practice as a tool for human improvement.

In the area of eating disorders, yoga has been increasingly used as a complementary therapy, due to its potential ability to enhance the connection and, hence, the acceptance of one's body (Boudette, 2006; Douglass, 2009). Eating disorders and disordered eating behaviours are currently major public health concerns due to their high prevalence and potentially serious physical, social and psychological consequences. Disordered eating behaviours can be subtle and apparently innocuous at the beginning, such as fasting, eating little food, using food substitutes, skipping meals, and may evolve to more extreme behaviours such as taking diet pills, inducing vomit, using laxatives and diuretics (Neumark-Sztainer et al., 2011). Over time, these behaviours may lead to the development of clinically relevant eating disorders. These include a variety of persistent disturbances of eating behaviour that results in the altered consumption or absorption of food, leading to a significantly impairing of physical health and psychological functioning (American Psychiatric Association, 2013). Three main eating disorders (ED) are usually considered, namely anorexia nervosa, bulimia nervosa and binge eating disorder. In addition, there is a wide range of disordered eating behaviours that do not fulfil all diagnosis criteria and may not be clinically severe, but may still affect individuals' physical and mental well-being, and may develop over time into full-blown eating disorders. In this context, several "new" eating disorders have been described, of which the most remarkable example is orthorexia nervosa, an unhealthy obsession with healthy eating characterized by obsessive thinking about food, compulsive behaviours, self-punishment and escalating dietary restriction (Bratman, 2017).

The individual's relationship with his or her body is a key aspect in disordered eating, and to prevent or recover it is crucial that individuals learn to be in and with their bodies in a healthy manner (Cook-Cottone, 2015). Yoga may play a role in the prevention and treatment of ED due to its focus on the enhancement of the

2. Disordered eating behaviours and correlates in yoga practitioners: a systematic review

mind-body connection and body image (Cook-Cottone, Beck, & Kane, 2008), but research on the effects of yoga on ED symptoms and behaviours is still in its infancy. A major limitation is the absence of randomized controlled trials to test yoga interventions for the prevention and treatment of ED, as most studies are cross-sectional and use small samples that hamper statistical analysis (Klein & Cook-Cottone, 2013). In addition, there is little systematic information on the amount of yoga needed to create an effect, and current dosage recommendations are variable and lack empirical support (Cook-Cottone, 2013). Finally, yoga interventions use distinct styles of yoga that differ in the relative amounts of yoga components offered (*i.e.*, physical postures, breathing techniques, and meditation), yielding different outcomes to practitioners (*e.g.*, Cowen & Adams, 2005).

Although yoga research is a field undergoing substantial growth and interest, it is still not clear whether yoga practice is effective in the prevention and treatment of disordered eating. Yoga is usually regarded by clinicians and clients as a potentially positive intervention for ED (Douglass, 2009), but some studies indicate that yoga practitioners present higher levels of disordered eating behaviours (Bratland-Sanda, Nilsson, & Sundgot-Borgen, 2015; Valera et al., 2014). Therefore, it is relevant to address the occurrence of these dysfunctional behaviours in individuals that already have a consistent yoga practice; for this reason, we exclude from our analysis yoga interventions on patients with ED that do not have a previous yoga practice. Indeed, the dosage of yoga is a critical variable in evaluating the effects of yoga, as evidence suggests that the length of time someone practices yoga is associated with the benefits of the practice (Carbonneau, Vallerand, & Massicotte, 2010). In addition, the motivations for starting a yoga practice differ between seasoned yoga practitioners and participants in ED interventions; whereas the former group may adopt yoga due to its physical and spiritual aspects (Büssing et al., 2012), the latter participate due to a specific health condition. Understanding how a consistent yoga practice affects eating behaviours is thus critical to establish

2. Disordered eating behaviours and correlates in yoga practitioners: a systematic review

therapeutic dosages of yoga for ED patients and to guide treatment recommendations; we aim to contribute to this discussion by systematically reviewing the occurrence of disordered eating behaviours in experienced yoga practitioners.

2.2 Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines (Moher et al., 2009) were followed in this review.

2.2.1 Inclusion criteria

Types of studies. All studies that evaluated associations between yoga practice and disordered eating variables, published until October 2018, were considered. Studies that reported effects of yoga interventions in patients with eating disorders were excluded. Only studies in English were eligible. Books, book chapters, dissertations, conference abstracts, book reviews and editorials were excluded.

Types of participants. Studies with adult yoga practitioners, with or without disordered eating behaviours, were eligible.

Types of outcomes. Quantitative and qualitative studies that evaluated ED-related variables, such as ED symptomatology, body satisfaction, body image, self-objectification, etc., in yoga practitioners were eligible.

2.2.2 Literature search

Five electronic databases, Scopus, Web of Science, Pubmed, PsycINFO, and Psychology and Behavioral Sciences Collection (PBSC), were searched between 7th-

2. Disordered eating behaviours and correlates in yoga practitioners: a systematic review

11th October 2018. Search terms used were “yoga” AND “eating disorder” OR “disordered eating” OR “eating behaviour”. On Scopus, these terms were searched in the article title, abstract and keywords; on Web of Science the topic field was used. On PubMed, the same terms were searched on the title and abstract, and on PsycINFO and PBSC, the terms were searched on the abstract. We also searched specific international, peer-reviewed journals, namely: Eating Behaviors, Advances in Eating Disorders, Eating Disorders, International Journal of Eating Disorders, Eating and Weight Disorders, Journal of Eating Disorders, European Eating Disorders Review, Appetite, Body Image, International Journal of Yoga, and International Journal of Yoga Therapy. On the ED-related journals, the term “yoga” was searched in the abstract, title and keywords, whereas the term “eating” was searched on the yoga journals.

2.3 Results

2.3.1 Study selection

A total of 384 records were identified, 271 after the removal of duplicates. The title and abstract of the 271 records were screened for adequacy, and 246 were excluded; excluded studies included reports of yoga interventions for ED patients, and documents other than journal articles. Finally, 20 full-text articles were assessed for eligibility. Of these, 8 articles were excluded because they did not distinguish between yoga practitioners and other exercisers, or were yoga interventions with non-practitioners, or did not evaluate ED-related variables in yoga practitioners. Twelve studies were thus included in the review. Figure 2.1 presents the flowchart of the study selection process.

2.3.2 Study characteristics

The 12 studies identified were cross-sectional studies conducted with a) yoga practitioners only (5 studies), b) yoga practitioners and other exercisers (2 studies), and c) yoga practitioners and non-practitioners (5 studies) (Table 2.1). Most studies involved yoga practitioners in the USA; 3 studies were conducted in Australia, 1 in Spain and 1 in Norway. Most studies included evaluations of eating-related behaviours or disordered eating symptoms; other studies analysed ED-related variables such as body image, body satisfaction, self-objectification, exercise dependence, among others.

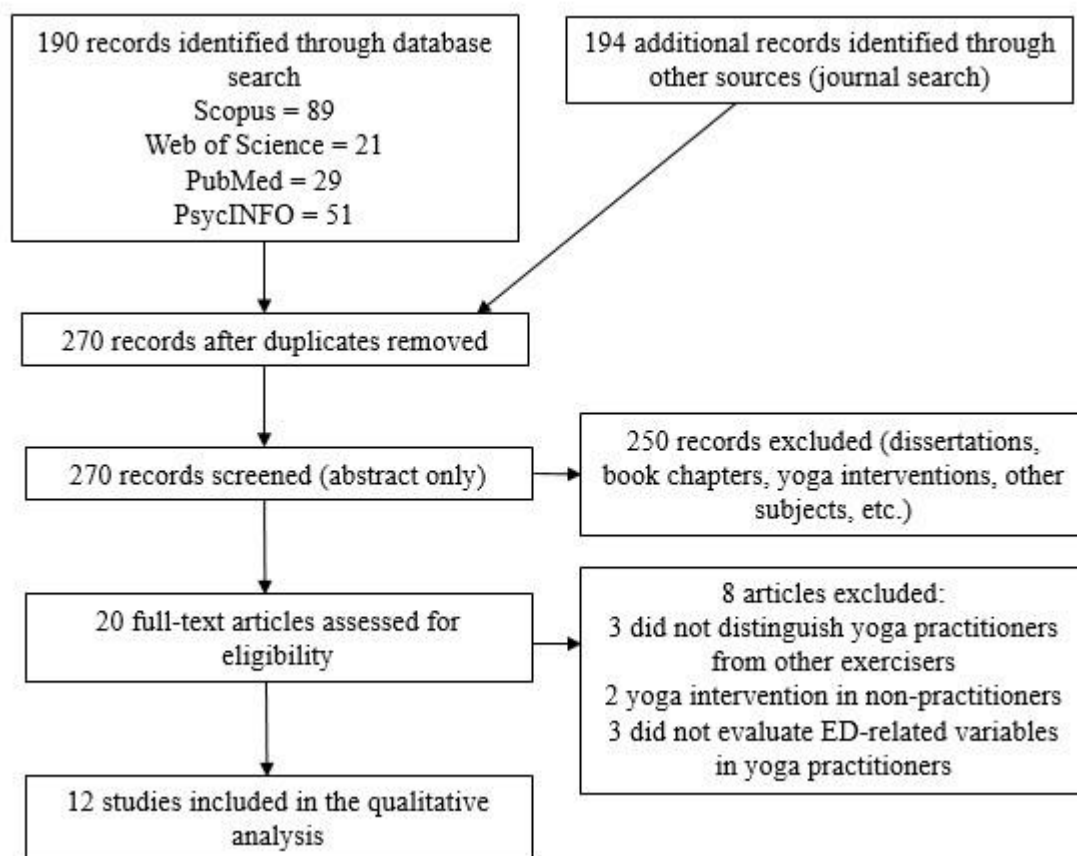


Figure 2.1 – Flowchart of the study selection process.

2. Disordered eating behaviours and correlates in yoga practitioners: a systematic review

Table 2.1 – Main characteristics of the studies included in the review.

| Study | Population | Characteristics | Outcome variables | Results |
|------------------------------|--|---|--|---|
| Daubenmier 2005 | Female yoga practitioners and non-practitioners (<i>n</i> = 139) | Three groups: yoga (Iyengar and ashtanga), aerobic, non-practitioners. Yoga practitioners practiced 4.96 ± 3.19 hours/week for average of 6 years | Self-objectification Body satisfaction Disordered eating symptomatology Body awareness Body responsiveness | Yoga practitioners had lower body mass index and self-objectification, and higher body awareness, body responsiveness and body satisfaction than aerobics and non-practitioners. Yoga practitioners had lower disordered eating symptomatology than aerobics practitioners, but no different than non-practitioners. |
| Prichard & Tiggeman 2008 | Female fitness class participants (<i>n</i> = 571) | Three groups: yoga, cardio, weights | Drive for thinness Body dissatisfaction Self-objectification Body esteem Reasons for exercise | Yoga practice is negatively correlated with self-objectification and appearance-related reasons for practice, and positively correlated with health/fitness reasons. No relationships between yoga practice and ED symptomatology. |
| Dittman & Freedman 2009 | Female yoga practitioners (<i>n</i> = 157) | Group 1 – psychospiritual reasons (<i>n</i> = 99); Group 2 – physical appearance reasons (<i>n</i> = 30) | Body satisfaction Body awareness Body responsiveness Spiritual readiness Intuitive eating | Body awareness positively correlated with body responsiveness, body satisfaction, intuitive eating and spiritual readiness. Body mass index inversely correlated with body responsiveness, intuitive eating and body satisfaction. Group comparisons: body satisfaction and spiritual readiness is higher in group 1 (psychospiritual reasons for practice). |
| Delaney & Anthis 2010 | Yoga practitioners (<i>n</i> = 92) | Different styles of yoga | Eating attitudes Body satisfaction Body objectification | Disordered eating attitudes are positively correlated with body dissatisfaction and body objectification. |
| Neumark-Sztainer et al. 2011 | Yoga and Pilates practitioners (<i>n</i> = 274), non-practitioners (<i>n</i> = 2013) | Practitioners reported average of 30 min or more practicing yoga or Pilates per week | Body satisfaction Disordered eating | Women practitioners were less likely to report body dissatisfaction than non-practitioners. No differences in eating behaviours between women practitioners and non-practitioners. Men practitioners were more likely to have extreme weight control behaviours than non-practitioners. |
| Martin et al. 2013 | Female exercisers (<i>n</i> = 159) | Participants practiced yoga and cardio-based exercise | Dietary intake Mindful eating Trait mindfulness Body responsiveness Proneness to disordered eating | Positive correlations between yoga practice and consumption of fruit and vegetables, mindful eating, trait mindfulness and body responsiveness. Negative correlation between yoga practice and proneness |

2. Disordered eating behaviours and correlates in yoga practitioners: a systematic review

| | | | | to disordered eating. |
|--|---|---|--|--|
| Valera et al. 2014 | Yoga practitioners (<i>n</i> = 136) | Ashtanga vinyasa yoga practitioners | Orthorexia Eating habits | 86% of participants classified as orthorexic. Association between orthorexia and vegetarianism. |
| Bratland-Sanda et al. 2015 | Group fitness instructors (<i>n</i> = 837) | Includes instructors of body/mind classes (yoga and Pilates) | Disordered eating symptomatology Exercise dependence | Correlation between ED symptomatology and exercise dependence. Instructors with self-reported ED were those with higher weekly volume of instructing body/mind classes (yoga/Pilates). Major difference between ED and non-ED instructors was the drive for thinness. |
| Mahlo & Tiggemann 2016 | Yoga practitioners (<i>n</i> = 193) and non-practitioners (<i>n</i> = 127) | Practitioners of Iyengar and Bikram yoga | Body image Embodiment Self-objectification | Yoga practitioners showed higher positive body image and embodiment, and lower self-objectification than non-practitioners. Reasons for practicing yoga were different between practitioners: Bikram practitioners reported more appearance-related reasons than Iyengar practitioners. |
| Neumark-Sztainer MacLehose, et al. 2018 | Yoga practitioners (<i>n</i> = 268) and non-practitioners (<i>n</i> = 1387) | Practitioners reported 30 min or more practicing yoga per week in the past year | Body satisfaction | Yoga practitioners reported higher levels of body satisfaction than non-practitioners. |
| Neumark-Sztainer, Watts, & Rydell, 2018 | Yoga practitioners (<i>n</i> = 46) | Participants practiced at least 30 min of yoga/week over the past year | Body image (via semi-structured interviews) | Yoga is perceived as having a positive impact on body image via perceived physical changes, gratitude for one's body, and sense of accomplishment within one's yoga practice. Yoga is perceived as having a negative impact on body image via comparisons with other and inner critique. |
| Watts et al. 2018 | Yoga practitioners (<i>n</i> = 297) and non-practitioners (<i>n</i> = 1523) | Practitioners reported 30 min or more practicing yoga per week in the past year | Healthy eating behaviours Moderate-to-vigorous physical activity (MVPA) | Yoga practitioners reported higher consumption of fruit and vegetables, and lower consumption of fast food and sugar-sweetened beverages than non-practitioners. Yoga practitioners also reported higher participation in and MVPA than non-practitioners. |

Note. Only statistically significant results ($p < .05$) are presented.

2.3.3 Eating behaviours in yoga practitioners

The occurrence and intensity of disordered eating behaviours and ED symptomatology in yoga practitioners in relation to non-practitioners were not consistent across studies. One study found that yoga practitioners reported fewer disordered eating attitudes in relation to aerobics practitioners, but did not differ from the baseline comparison group, composed by women not currently enrolled in physical activities (Daubenmier, 2005). Two other studies found no significant relationship between yoga practice and disordered eating in women (Neumark-Sztainer et al., 2011; Prichard & Tiggemann, 2008), but men participating in yoga and/or Pilates classes reported the use of more extreme weight control behaviours and binge eating than nonparticipants (Neumark-Sztainer et al., 2011). In contrast, two other studies reported higher levels of disordered eating in yoga practitioners (Bratland-Sanda et al., 2015; Valera et al., 2014). Specifically, the prevalence of orthorexia nervosa (ON) in a sample of ashtanga practitioners was 86%, with vegetarian practitioners scoring lower on the ON test (*i.e.*, more symptoms of ON) than other participants (Valera et al., 2014). Another study found an association between self-reported eating disorders, particularly in the drive for thinness, and a higher weekly volume of instructing yoga/Pilates classes in female group fitness instructors (Bratland-Sanda et al., 2015).

Several studies addressed specific eating behaviours of yoga practitioners, such as the consumption of healthy foods, vegetarianism and veganism. Overall, yoga practice was associated with a higher consumption of fruits and vegetables, and a lower consumption of unhealthy food (Martin, Prichard, Hutchinson, & Wilson, 2013). Compared with non-practitioners, yoga practitioners consumed significantly more vegetables and fruits, and less fast-food and sugar-sweetened beverages than non-practitioners (Watts, Rydell, Eisenberg, Laska, & Neumark-Sztainer, 2018). However, the healthy eating habits of yoga practitioners were also associated with a

2. Disordered eating behaviours and correlates in yoga practitioners: a systematic review

high prevalence of orthorexia nervosa, particularly in vegetarians (Valera et al., 2014).

Other ED-related variables, such as body satisfaction and self-objectification, were evaluated in several studies. In general, body satisfaction, body awareness, and body responsiveness were positively associated in yoga practitioners (Dittmann & Freedman, 2009; Martin et al., 2013), whereas body objectification and self-objectification were negatively associated with yoga practice (Prichard & Tiggemann, 2008). Comparisons of yoga practitioners and non-practitioners showed that yoga practitioners reported significantly lower levels of self-objectification than practitioners of other forms of physical activities and non-practitioners (Daubenmier, 2005; Mahlo & Tiggemann, 2016; Prichard & Tiggemann, 2008), and body objectification was negatively correlated with disordered eating attitudes in yoga practitioners (Delaney & Anthis, 2010). Likewise, body satisfaction was significantly higher in women practicing yoga/Pilates than in other exercisers or non-exercisers (Daubenmier, 2005; Neumark-Sztainer et al., 2011; Neumark-Sztainer, MacLehose, Watts, Pacanowski, & Eisenberg, 2018). Body responsiveness and body awareness were also significantly higher in yoga practitioners in relation to aerobics practitioners and non-practitioners (Daubenmier, 2005). A qualitative study indicated that practitioners believe that yoga practice has a positive impact on body image due to 'perceived physical changes, gratitude for one's body, a sense of accomplishment within one's, self-confidence, and witnessing different types of bodies practicing yoga', but it can also have a negative impact on body image due to comparisons with others and inner critique (Neumark-Sztainer, Watts, & Rydell, 2018).

Reasons to exercise, or to practice yoga, were evaluated in some studies. A comparison of different types of exercisers showed that participation in yoga classes was related to health and fitness reasons, rather than appearance-related reasons (Prichard & Tiggemann, 2008). However, practitioners of different yoga styles may

2. Disordered eating behaviours and correlates in yoga practitioners: a systematic review

have different reasons to practice; for instance, Bikram yoga practitioners reported more appearance-related reasons than Iyengar yoga practitioners (Mahlo & Tiggemann, 2016). It was also shown that individuals that practice for psychospiritual reasons reported higher body satisfaction than practitioners driven by physical appearance reasons (Dittmann & Freedman, 2009).

2.4 Discussion

2.4.1 Eating behaviours and correlates in yoga practitioners

Overall, yoga practitioners reported fewer disordered eating behaviours, higher consumption of healthy foods, and higher body satisfaction. However, comparisons between yoga practitioners and non-practitioners yielded diverse results, from no differences, fewer disordered eating behaviours, and higher disordered eating behaviours in yoga practitioners in relation to non-practitioners.

Female yoga practitioners enrolled in ashtanga and/or Iyengar yoga classes reported fewer disordered eating behaviours than women practicing aerobics classes, but no differences were found between practitioners and non-practitioners (Daubenmier, 2005). Other studies also reported no significant differences in disordered eating behaviours between yoga practitioners and non-practitioners (Neumark-Sztainer et al., 2011; Prichard & Tiggemann, 2008). In contrast, some studies found a higher prevalence of disordered eating behaviours in yoga practitioners, namely in instructors of body/mind classes and male yoga/Pilates practitioners (Bratland-Sanda et al., 2015; Neumark-Sztainer et al., 2011). The prevalence of orthorexia nervosa was also high (86%) in a sample of ashtanga yoga practitioners (Valera et al., 2014).

These differences across studies may be due to several factors; the most prominent is probably the dosage of yoga. Yoga practitioners with fewer self-

2. Disordered eating behaviours and correlates in yoga practitioners: a systematic review

reported disordered eating behaviours were also those who reported spending more time practicing yoga (almost 5 hours per week: Daubenmier, 2005). In contrast, women spending more time at aerobics classes presented more ED-attitudes than those practicing less (Daubenmier, 2005). Indeed, it has been shown that excessive physical activity is a common point among individuals suffering from an eating disorder (Le Grange & Eisler, 1993). Yoga practitioners, however, showed an inverse relationship between time spent practicing and disordered eating, suggesting that not all physical activities have the same relationship with eating disorders, and that more yoga practice may be related with better eating habits (Daubenmier, 2005).

However, results reported in a sample of ashtanga yoga practitioners indicate the contrary; in this sample, orthorexia nervosa was found in 86% of the practitioners (Valera et al., 2014). The average time spent practicing is not referred in the study, but, traditionally, ashtanga yoga is a 90 min/day, 6-day a week practice (Jois, 2010), which can sum up to 9 hours of practice per week. Another study found that female yoga instructors with self-reported ED were those with a higher teaching load of yoga classes per week (Bratland-Sanda et al., 2015). Therefore, can a higher dedication to the practice of yoga be associated with higher levels of disordered eating behaviours?

Yoga dosage is a key factor for experiencing the benefits of yoga practice; to obtain gains from the practice, a sustained practice is necessary (Jarry, Chang, & La Civita, 2017). For instance, ashtanga yoga is a 6-day per week practice (Jois, 2010), and daily practices are also advised for Iyengar yoga practitioners (Iyengar, 2015). However, the frequency of yoga classes and duration of yoga interventions in experimental studies is low, comparing to the dosages followed by the seasoned practitioners that exhibit inverse relationships between yoga practice and disordered eating behaviours. For instance, a study where yoga was practiced at a small dosage (45 minutes per week for 6 weeks) had no significant effects on eating disorder symptomatology (Mitchell, Mazzeo, Rausch, & Cooke, 2007). Interventions that

2. Disordered eating behaviours and correlates in yoga practitioners: a systematic review

offered higher yoga dosages (60 minutes per week for 12 weeks: McIver, O'Halloran, & McGartland, 2009; 2 hours per week for 8 weeks: Carei, Fyfe-Johnson, Breuner, & Brown, 2010; 60-90 minutes per week for 12 weeks: Hall, Ofei-Tenkorang, Machan, & Gordon, 2016) yielded positive results in decreasing disordered eating symptomatology or increasing positive body image.

Maintaining a healthy diet is a common concern in yoga practitioners, and this is why the consumption of fruit and vegetables tends to be correlated with yoga practice (Martin et al., 2013). In addition, yoga practitioners consume significantly more healthy foods and less fast-food and sugar-sweetened beverages than non-practitioners (Watts et al., 2018), further suggesting that the concern with healthy eating is associated with the practice of yoga. This concern has its roots on the ancient yoga texts and spiritual practices of the Indian subcontinent. For instance, the first self-restraint referred by Sage Patanjali in the Yoga Sutras is Ahimsa, translated as non-violence, non-killing, or harmlessness (Saraswati, 1976). Practitioners are advised to behave in a way that does not harm themselves or other living creatures; therefore, many follow and recommend a vegetarian or vegan diet as a way to comply with Ahimsa, supporting a more ethical and healthier yoga practice. A survey of yoga practitioners in Australia showed that 8.7% and 1.6% of female yoga practitioners between 19 and 25 years old are vegetarian or vegan, respectively (Cramer, Sibbritt, Park, Adams, & Lauche, 2017). In the USA, 10% of yoga practitioners are vegetarian, which is almost 4 times the prevalence of vegetarianism in the general population (Ross, Friedmann, Bevans, & Thomas, 2013).

The high prevalence of vegetarianism or healthy eating behaviours in yoga practitioners is probably triggered by yoga teachers that demonstrate such behaviours, thus potentially acting as role models for their students (Cramer et al., 2017). Indeed, many yoga lineages, schools and teachers advise their students to change their eating habits towards vegetarianism (Gannon, 2008; Sweeney, 2005). However, this psychological pressure on yoga students to change their eating habits

2. Disordered eating behaviours and correlates in yoga practitioners: a systematic review

should be refrained (Valera et al., 2014), to prevent disordered eating behaviours and attitudes that may develop into serious psychopathological problems. Differences in eating behaviours across yoga styles have been found in a sample of German yoga practitioners, with ashtanga, Iyengar and Sivananda yoga practitioners more likely to be vegetarians or vegans than practitioners of other yoga styles (Cramer et al., 2019). In addition, an association between orthorexia and vegetarianism was found in a sample of ashtanga yoga practitioners (Valera et al., 2014).

Other variables that were significantly associated with yoga practice were body dissatisfaction and self-objectification. Body dissatisfaction, considered a strong predictor of disordered eating behaviours, reflects the degree of dissatisfaction with body shape and weight (Bucchianeri et al., 2016; Stice, Marti, & Durant, 2011; Stice & Shaw, 2002). Body dissatisfaction was significantly lower in yoga practitioners in relation to non-practitioners (Daubenmier, 2005; Neumark-Sztainer et al., 2011), and it was associated with lower body awareness and body responsiveness, and higher levels of self-objectification and disordered eating attitudes (Daubenmier, 2005). Self-objectification is another construct that has been related to disordered eating and other psychopathological problems, particularly in women. According to the Objectification Theory (Fredrickson & Roberts, 1997), in social environments where women are viewed as aesthetic objects to be evaluated by others, they tend to view themselves as objects of evaluation; over time, self-objectification may lead to negative psychological outcomes and may contribute to disordered eating attitudes and behaviours in girls and women (Daubenmier, 2005; Schaefer & Thompson, 2018). Self-objectification was lower in yoga practitioners in the studies analysed (Daubenmier, 2005; Prichard & Tiggemann, 2008). Other studies found significant relationships between continued yoga practice and positive body image (Bąk-Sosnowska & Urban, 2017; Neumark-Sztainer, MacLehose, et al., 2018; Park, Riley, & Braun, 2016). These results support the potential of yoga practice in increasing individuals' self-image and its use for the prevention of disordered eating attitudes.

2.4.2 Methodological limitations

Despite the associations between yoga practice and disordered eating behaviours, body image and body satisfaction reported by the studies reviewed, several methodological limitations may also be discussed. To start with, most studies did not refer the style of yoga practiced by the participants; the studies that indicate which style is practiced include three different styles, namely ashtanga (Daubenmier, 2005; Valera et al., 2014), Iyengar (Daubenmier, 2005; Mahlo & Tiggemann, 2016) and Bikram (Mahlo & Tiggemann, 2016). Overall, specific information on the style of yoga, frequency and duration of the practice, years practicing and degree of immersion in the practice, and the relative proportion of yoga postures, breathing exercises and meditation, would allow a more thorough comparison across studies and, specifically, across yoga styles. This is highly relevant, given that specific yoga styles may influence different health indicators, such as body mass index, vegetarianism/veganism, mindfulness, and quality of life (Cramer et al., 2019).

Other concern worthy of discussion is causal effects *versus* selection regarding the relationship between yoga practice and disordered eating behaviours. We assumed in this review that yoga may affect the occurrence of disordered eating behaviours, but it is possible that individuals with such behaviours will feel attracted to yoga due to yoga's potential effects on body shape and weight control. Studies show that yoga practitioners have lower body mass indices (BMI) than non-practitioners (Birdee et al., 2008; Cramer et al., 2019; Park, Braun, & Siegel, 2015), but it is not clear whether yoga promotes weight loss or individuals with lower BMI are more attracted to yoga than people with higher BMI (Park et al., 2015). In U.S. practitioners, only 4.4% refer weight loss as the primary reason for adopting a yoga practice, but 27.2% and 33.9% mention weight loss as an additional reason to start the practice and to continue practice, respectively (Park, Riley, Bedesin, & Stewart, 2014).

Regarding the use of self-report questionnaires to evaluate ED-related variables, most instruments used in the articles reviewed possess well established

2. Disordered eating behaviours and correlates in yoga practitioners: a systematic review

psychometric qualities, except for ORTO-15, a 15-item questionnaire meant to diagnose orthorexia nervosa (Donini, Marsili, Graziani, Imbriale, & Cannella, 2004). ORTO-15 has consistently shown poor reliability, internal consistency and construct validity, and tends to overestimate the occurrence of ON (Missbach, Dunn, & König, 2017; Missbach et al., 2015; Moller, Apputhurai, & Knowles, 2018). Indeed, this instrument appears to be measuring a more normative focus on health and wellness, rather than a pathological behaviour (Heiss, Coffino, & Hormes, 2019). Therefore, the high prevalence (86%) of orthorexia nervosa found in a sample of ashtanga yoga practitioners (Valera et al., 2014) may have been overestimated by the use of ORTO-15 as diagnostic tool.

2.5 Conclusions

This systematic review showed that yoga practice is generally associated with healthier eating behaviours, lower disordered eating behaviours, and higher positive body image and body satisfaction, suggesting that yoga practitioners may be at a lower risk of developing eating disorders. However, some studies suggest that a high volume of yoga practice may be related with disordered eating behaviours. As yoga interventions are increasingly used as a complementary treatment for eating disorders, understanding the relationship between style and dosage of yoga, and ED behaviours is critical. Therefore, future research should focus on how much is too much yoga – is there an optimal level of involvement in yoga practice, whereas below or above that level practitioners are at higher risk for ED? In addition, are some styles of yoga, like ashtanga, more closely related with disordered eating behaviours? If so, how much yoga and which yoga should be offered as treatment for eating disorders? Answering these and other questions is essential to establish yoga as valuable and effective complementary therapy for eating disorders and to guide treatment recommendations.

Chapter 3

Orthorexia nervosa in yoga practitioners: relationship with personality, attitudes about appearance, and yoga engagement

Orthorexia nervosa in yoga practitioners: relationship with personality, attitudes about appearance, and yoga engagement

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Submitted to *Eating and Weight Disorders*

Abstract

Purpose Disordered eating symptoms and a high prevalence of orthorexia nervosa can be found in yoga practitioners. Given that yoga is increasingly used as a complementary treatment for eating disorders (ED), understanding the relationship between yoga practice and the development of disordered eating is crucial to guide treatment recommendations. The goal of this work is, therefore, to study the relationships between orthorexia nervosa (ON) and potential risk factors for ON, namely body and appearance-related factors (drive for thinness and beliefs about appearance), personality traits (perfectionism and self-discipline), and yoga engagement (passion and immersion), in an international sample of seasoned yoga practitioners.

Method An online questionnaire that included several psychometric instruments was responded by 469 yoga practitioners. Descriptive statistics, correlational analysis and hierarchical multiple regression were used to evaluate relationships between variables.

Results The main predictors of orthorexia nervosa were the drive for thinness and a healthy interest in diet, suggesting that, like in anorexia and bulimia, orthorexic individuals are also concerned with food quantity and physical appearance, rather than just food quality. Practitioners of Ashtanga Vinyasa yoga showed slightly higher tendencies for orthorexia nervosa and drive for thinness than practitioners of other styles of yoga.

3. Orthorexia nervosa in yoga practitioners: relationship with personality, attitudes about appearance, and yoga engagement

Conclusions The potential effects of yoga on eating behaviours and attitudes of long-term practitioners, particularly the high prevalence of orthorexia nervosa and the concern for physical appearance, should be taken into consideration when using yoga as prevention or treatment for eating disorders.

Keywords: orthorexia nervosa; yoga; risk factors; perfectionism; body image.

3.1 Introduction

Yoga is considered an effective complementary and even alternative practice for many physical and psychological problems (Büssing et al., 2012; Jeter et al., 2015; Khalsa, 2013), including eating disorders. Several disordered eating behaviours and attitudes have been associated with yoga practice, but orthorexia nervosa (ON) is becoming the most prominent – interestingly, the first reference to “orthorexia nervosa” was in the non-scientific *Yoga Journal* (Bratman, 1997). Orthorexia nervosa is described as a fixation on eating proper food (Bratman, 1997). The initial stage of choosing to eat a healthy diet is not pathological; ON sets in only when there is an intensification of that pursuit into an unhealthy obsession, with obsessive thinking about food, compulsive behaviours, self-punishment and escalating dietary restriction (Bratman, 2017), leading to nutritional deficits, affective problems and social isolation (Brytek-Matera, 2012). The prevalence of ON seems to be higher in individuals with health-related occupations (McComb & Mills, 2019), including yoga practitioners (Valera et al., 2014). In addition, several personality traits, such as perfectionism (Barrada & Roncero, 2018; Oberle, Samaghabadi, & Hughes, 2017) and neuroticism (Gleaves, Graham, & Ambwani, 2013) are significantly related to ON. Perfectionism in particular is a well-established risk factor for eating disorders (Craighead & Smith, 2010; Polivy & Herman, 2002), mainly for the development of full-blown ED such as anorexia nervosa and bulimia nervosa (Fairburn et al., 1999,

3. Orthorexia nervosa in yoga practitioners: relationship with personality, attitudes about appearance, and yoga engagement

1998). Other risk factors for ON include eating-related factors such as being vegetarian or vegan, lifestyle factors, such as exercise engagement or social media use, among others (for a review, see McComb & Mills, 2019).

Understanding the relationships between yoga practice and ED-related behaviours and attitudes is critical to establish yoga as a valuable complementary practice for ED, particularly given its increasing use and acceptance by clinicians and patients (Douglass, 2009). Due to its focus on the enhancement of the mind-body connection, yoga may potentially facilitate the acceptance of one's body, which is a critical issue for the prevention and treatment of ED (Boudette, 2006; Cook-Cottone et al., 2008; Douglass, 2009). Some studies support the use of yoga for ED prevention, as results suggest that yoga practitioners are at a lower risk of developing eating disorders, given that they present fewer disordered eating symptoms, higher positive body image, and higher body satisfaction (Daubenmier, 2005; Dittmann & Freedman, 2009; Martin et al., 2013). However, other studies indicate that the prevalence of ED such as orthorexia nervosa is higher in yoga practitioners (Erkin & Göl, 2019; Valera et al., 2014), and that a high dosage of yoga practice may be associated with a higher occurrence of ED-related behaviours (Domingues & Carmo, 2019). Therefore, if a long-term, well-established yoga practice may be associated with or facilitate the development of disordered eating, yoga interventions and treatment recommendations must be reframed, well guided and closely monitored.

In this context, the main goal of this work is to study the occurrence of orthorexia nervosa and its relationship with potential risk factors for ON, namely body and appearance-related variables (drive for thinness and beliefs about appearance), personality traits (perfectionism and self-discipline), and yoga engagement (passion and immersion), in experienced yoga practitioners.

3.2 Methods

3.2.1 Study design

We developed an anonymous, self-report questionnaire, in English, using the online platform Google Forms. Participants were recruited by emails sent to yoga schools in Portugal, UK and USA, asking to share the link of the study with their members; the link was also posted on yoga groups on Facebook. All yoga practitioners with a good command of English language were eligible. The questionnaire included questions to evaluate characteristics of yoga practice and yoga engagement, body and appearance-related variables, personality traits, orthorexia, and sociodemographic information. The questionnaire took approximately 15 minutes to complete and responses to all questions were mandatory, to avoid missing values. The questionnaire was available from October through December 2018.

3.2.2 Participants

Four-hundred sixty-nine yoga practitioners completed the online questionnaire (see Appendix 1 for sociodemographic characteristics). Most participants were female (84%) and 57% were between 35 and 54 years old. Participants came from 54 different countries and 6 continents; countries with the highest percentage of respondents were the United States (29.1%), Portugal (11.9%) and the United Kingdom (9.6%).

3.2.3 Characteristics of yoga practice and yoga engagement

Participants were asked about the characteristics of their yoga practice, namely practice frequency, duration, place of practice, reasons to start yoga, and

3. Orthorexia nervosa in yoga practitioners: relationship with personality, attitudes about appearance, and yoga engagement

style practiced. The level of immersion in yoga was measured with the Yoga Immersion Scale, designed to assess the importance of yoga in the self-concept of yoga practitioners (*e.g.*, “The wisdom of yoga affects how I perceive some other things of my everyday life”), using 10 Likert-type items responded on a 6-point rating scale (Gaiswinkler & Unterrainer, 2016; Gaiswinkler, Unterrainer, Fink, & Kapfhammer, 2015).

The type of passion for yoga was assessed using the Passion Scale (Vallerand et al., 2003), a 7-point Likert-type instrument that evaluates passion as a strong inclination toward an activity. Two different types of passion are measured with this instrument: harmonious passion, an autonomous internalisation that leads individuals to choose to engage in the activity (*e.g.*, “This activity allows me to live a variety of experiences”), and obsessive passion, a controlled internalisation that creates an internal pressure to engage in the activity (*e.g.*, “My mood depends on me being able to do this activity”) (Vallerand et al., 2003).

3.2.4 Body and appearance-related variables

Dysfunctional attitudes about appearance were assessed using the Beliefs About Appearance Scale, with 20 Likert-type items (*e.g.*, “My appearance influences my ability to do things”) responded on a 5-point rating scale (Spangler & Stice, 2001). The subscale Drive for Thinness of the Eating Disorders Inventory (Garner et al., 1983) was used to assess respondents’ excessive concern with dieting and weight, using 7 items on a 4-point rating scale (*e.g.*, “I am terrified of gaining weight”).

3.2.5 Personality traits

Perfectionist traits were evaluated using the Frost Multidimensional Perfectionism Scale (Frost, Marten, Lahart, & Rosenblate, 1990). Four of the six scales

3. Orthorexia nervosa in yoga practitioners: relationship with personality, attitudes about appearance, and yoga engagement

were used, namely personal standards (setting very high standards for personal evaluation; *e.g.*, “I set higher goals than most people”), organization (importance of and preference for order and organization; *e.g.*, “I am a neat person”), concern over mistakes (negative reactions to mistakes; *e.g.*, “I should be upset if I make a mistake”), and doubts about actions (feeling that projects are not completed in a satisfactory manner; *e.g.*, “I usually have doubts about the simple everyday things I do”), with 26 Likert-type items responded on a 5-point scale.

Self-discipline, a facet of consciousness considered in the Big Five personality traits model, was measured using the self-discipline subscale of the NEO-PI-R (Costa & McCrae, 1992). Self-discipline is defined as the ability of the individual to persist at difficult or unpleasant tasks until completion (*e.g.*, “Once I start a project, I almost always finish it”), and it was measured with 8 Likert-type items responded on a 5-point rating scale.

3.2.6 Orthorexia nervosa and healthy orthorexia

Orthorexia in yoga practitioners was assessed with the Teruel Orthorexia Scale (Barrada & Roncero, 2018), a new instrument that measures both a healthy, non-pathological interest in diet (healthy orthorexia), and the negative social and emotional impacts of the extreme preoccupation with eating food believed to be healthy by the individual (orthorexia nervosa). Healthy orthorexia is measured with 9 items (*e.g.*, “I feel good when I eat healthy food”), for a maximum score of 27, and orthorexia nervosa is measured with 8 items (*e.g.*, “I feel guilty when I eat food that I do not consider healthy”), for a maximum score of 24. Both dimensions are answered on a 4-point rating scale.

3.2.7 Data analysis

Descriptive statistics were used to summarize the data for each scale and subscale. Scale reliability was evaluated with Cronbach's alpha; coefficients $\geq .8$ indicate good internal consistency (Nunnally & Bernstein, 1994). After checking ANOVA assumptions, one-way ANOVA was used to compare mean values for each variable across groups established according to differences in their yoga practices (*e.g.*, yoga styles, practice frequency, etc.); effect sizes were assessed with partial eta squared values. For two-group comparisons, independent samples *t*-tests were used, and Cohen's *d* was computed as a measure of effect size. Associations among continuous variables were evaluated with Pearson's correlation coefficient. Finally, relationships between orthorexia nervosa and potential predictor variables were assessed with stepwise hierarchical multiple regression models. A significance level of .05 was considered and all analyses were performed with IBM SPSS Statistics v. 25.

3.3 Results

3.3.1 Characteristics of yoga practice and yoga engagement

Most participants have been practicing yoga for more than 2 years (87.6%) and most of them practice 3 or more times a week (86.2%), for more than 4 hours per week (61.6%). The practice happens mostly at home (26.7%) or mostly in class (26.2%). The yoga styles mostly used or with which the practitioners mostly identify themselves with were Ashtanga (54.4%), Hatha (11.1%), Iyengar (10.9%), and Ashtanga-derived styles such as Vinyasa Flow, Power, and Rocket yoga (9.6%). When asked about the two main reasons for starting yoga, participants reported the goal of increasing health and fitness (42.6%), personal development reasons (37.1%),

3. Orthorexia nervosa in yoga practitioners: relationship with personality, attitudes about appearance, and yoga engagement

and to reduce stress and anxiety (35.2%) (see Appendix 2 for characteristics of yoga practice).

Regarding practitioners' passion for yoga, participants reported a mean value of 5.82 ($SD = 0.93$) for the harmonious passion, and 3.63 ($SD = 1.45$) for the obsessive passion (Table 3.1). Significant differences were found in both types of passions with frequency and duration of practice. Harmonious (HP) and obsessive passion (OP) were higher in practitioners who practice more times per week (HP: $F(3,465) = 8.869$, $p < .001$, $\eta^2_p = .054$; OP: $F(3,465) = 8.096$, $p < .001$, $\eta^2_p = .050$) and more hours per week (HP: $F(3,465) = 3.663$, $p = .012$, $\eta^2_p = .023$; OP: $F(3,465) = 5.209$, $p = .002$, $\eta^2_p = .033$).

The level of yoga immersion (Table 3.1) presented a mean value of 4.73 ($SD = 0.91$) in our sample, with significantly higher values in practitioners who reported practicing more often ($F(3,465) = 4.551$, $p = .004$, $\eta^2_p = .029$) and for longer ($F(3,465) = 3.603$, $p = .013$, $\eta^2_p = .023$).

Table 3.1 – Descriptive statistics for the several scales.

| scales | alpha | mean | SD | min | max | skewness | kurtosis |
|------------------------------|-------|-------|-------|------|-------|----------|----------|
| Healthy orthorexia | .814 | 17.82 | 4.94 | 3.00 | 27.00 | -0.45 | -0.27 |
| Orthorexia nervosa | .823 | 5.89 | 4.56 | 0.00 | 22.00 | 0.78 | 0.06 |
| Drive for thinness | .857 | 3.81 | 4.65 | 0.00 | 21.00 | 1.53 | 1.80 |
| Beliefs about appearance | .955 | 23.83 | 16.70 | 0.00 | 80.00 | 0.72 | -0.08 |
| Perfect – concerns mistakes | .899 | 2.07 | 0.83 | 1.00 | 4.89 | 0.95 | 0.44 |
| Perfect - personal standards | .790 | 3.27 | 0.73 | 1.29 | 5.00 | -0.08 | -0.30 |
| Perfect - doubts actions | .736 | 2.33 | 0.86 | 1.00 | 5.00 | 0.48 | -0.29 |
| Perfect - organization | .886 | 3.70 | 0.78 | 1.33 | 5.00 | -0.39 | -0.20 |
| Self-discipline | .813 | 3.54 | 0.70 | 1.50 | 5.00 | -0.25 | -0.32 |
| Harmonious passion | .827 | 5.82 | 0.93 | 1.10 | 7.00 | -0.97 | 1.55 |
| Obsessive passion | .882 | 3.63 | 1.44 | 1.00 | 7.00 | -0.13 | -0.73 |
| Yoga immersion | .882 | 4.73 | 0.91 | 1.10 | 6.00 | -0.93 | 0.88 |

Note: n = 469. SD = standard deviation.

3.3.2 Body and appearance-related variables

Drive for thinness varied between 0 and 21, with a mean value of 3.81 ($SD = 4.65$). Scores for the beliefs about appearance scale presented a mean value of 23.83 ($SD = 16.70$) and ranged between 0 and 80 (Table 3.1). No significant differences were found for these variables across yoga styles (considering five yoga styles: Ashtanga, Hatha, Iyengar, Vinyasa Flow+Power+Rocket, others), place of practice (home *versus* in class), practice frequency (number of days), practice duration (hours per week) and practice experience (years practicing). However, when comparing ashtanga practitioners ($n = 255$) against all other practitioners ($n = 214$), significant differences emerged. Ashtanga practitioners scored significantly higher in their drive for thinness, in relation to the other practitioners, but the effect size associated with this difference was small (Cohen's $d = 0.20$).

3.3.3 Personality traits

Perfectionism scores varied between 2.07 ($SD = 0.83$) for “concern over mistakes” and 3.70 ($SD = 0.78$) for “organization” (Table 3.1). Mean self-discipline in the sample was 3.54 ($SD = 0.70$) and significant differences were found according to practice frequency and practice duration. Higher self-discipline values were reported by practitioners who practice more frequently ($F(3,465) = 4.656, p = .003, \eta^2_p = .029$) and for a longer time ($F(3,465) = 6.249, p < .001, \eta^2_p = .039$).

3.3.4 Orthorexia nervosa and healthy orthorexia

Scores for orthorexia nervosa (ON) varied between 0 and 22, with a mean value of 5.89 ($SD = 4.56$) (Table 3.1). Mean values for healthy orthorexia (HO) were 17.82 ($SD = 4.94$), ranging between 3 and 27. No significant differences were found for healthy orthorexia and orthorexia nervosa across yoga styles, place of practice,

3. Orthorexia nervosa in yoga practitioners: relationship with personality, attitudes about appearance, and yoga engagement

practice frequency, practice duration and practice experience. However, ashtanga practitioners scored higher in both ON and HO in relation to other practitioners, but these differences were small in magnitude (Cohen's $d = 0.20$)

3.3.5 Associations between variables

Several significant and moderate/strong ($r > .40$) correlations were found (Table 3.2). Orthorexia nervosa was moderately associated with drive for thinness, beliefs about appearance, perfectionism, and healthy orthorexia. Conversely, healthy orthorexia was not associated with any personality traits or body and appearance-related variables. Yoga immersion was significantly correlated with a harmonious passion for yoga.

Table 3.2 – Correlations between personality, eating behaviours and yoga attitudes variables.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|-----------------------------|---------------|---------------|---------------|--------|----------------|--------|--------|--------|--------|---------------|--------|
| 1. Drive for thinness | | | | | | | | | | | |
| 2. Beliefs about appearance | .477** | | | | | | | | | | |
| 3. Concerns mistakes | .396** | .557** | | | | | | | | | |
| 4. Personal standards | .269** | .292** | .426** | | | | | | | | |
| 5. Doubts actions | .253** | .404** | .593** | .213** | | | | | | | |
| 6. Organization | .138** | .116* | .035 | .334** | .015 | | | | | | |
| 7. Self-discipline | -.043 | -.204** | -.239** | .193** | -.455** | .345** | | | | | |
| 8. Healthy orthorexia | .089 | .058 | .003 | .205** | .033 | .186** | .135** | | | | |
| 9. Orthorexia nervosa | .542** | .435** | .421** | .253** | .379** | .154** | -.116* | .394** | | | |
| 10. Harmonious passion | -.064 | -.055 | -.082 | .069 | -.065 | .148** | .071 | .292** | .082 | | |
| 11. Obsessive passion | .183** | .248** | .282** | .154* | .249** | .099* | -.099* | .185** | .383** | .422** | |
| 12. Yoga immersion | -.058 | -.021 | -.109* | .053 | -.002 | .152** | .041 | .351** | .138** | .581** | .321** |

Note. Significant correlations are marked with * for $p < 0.05$ and ** for $p < 0.01$ (two-tailed). Moderate and strong correlations ($r > 0.40$) are in bold. $n = 469$.

3. Orthorexia nervosa in yoga practitioners: relationship with personality, attitudes about appearance, and yoga engagement

3.3.6 Predictors of orthorexia nervosa

Hierarchical multiple regression was used to evaluate the effect of 1) socio-demographic variables, 2) characteristics of yoga practice, 3) personality traits, 4) body and appearance-related variables, and 5) yoga engagement on orthorexia nervosa. The predictive effects of the models increased with each model. The final model (adjusted $R^2 = .516$) indicated that doubts about actions (sub-dimension of perfectionism), drive for thinness, beliefs about appearance, healthy orthorexia, and obsessive passion for yoga are significant predictors of orthorexia nervosa (Table 3.3). These predictors explained 51.6% of the variance in orthorexia nervosa. The strongest predictors of ON were the drive for thinness ($\beta = .366$; $p < .001$) and healthy orthorexia ($\beta = .323$, $p < .001$).

Table 3.3 – Predictors of orthorexia nervosa in a sample of yoga practitioners.

| | B | SD | β |
|--------------------------|----------|-----------|---------------------------|
| Constant | -5.082 | 1.129 | |
| Age | -.243 | .129 | -.062 |
| Concern over mistakes | .372 | .250 | .068 |
| Doubts about actions | .755 | .215 | .142** |
| Organization | .053 | .193 | .009 |
| Drive for thinness | .359 | .037 | .366** |
| Healthy orthorexia | .299 | .031 | .323** |
| Beliefs about appearance | .027 | .011 | .099* |
| Obsessive passion | .546 | .110 | .172** |

Note. Final model obtained through hierarchical multiple regression.

Adjusted $R^2 = .516$. B = unstandardized regression coefficient; SE = standard error; β = standardized regression coefficient. * $p < .05$; ** $p < .001$

3.4 Discussion

The main goal of this work was to understand the relationship between orthorexia nervosa (ON) and potential risk factors for the development of ON, namely personality traits, dysfunctional attitudes towards body and appearance, and yoga engagement, in experienced yoga practitioners. Overall, the occurrence of orthorexia nervosa in our sample was mostly associated with a drive for thinness and a healthy concern about diet (measured as healthy orthorexia). Differences driven by the characteristics of yoga practice were not relevant, except for small magnitude differences between Ashtanga practitioners and practitioners of other yoga styles in their drive for thinness and orthorexia, both healthy and nervosa, with ashtangis scoring higher on these variables.

Scores for orthorexia nervosa and healthy orthorexia in our sample of seasoned yoga practitioners were significantly higher than scores reported for Spanish university students (Barrada & Roncero, 2018; Depa, Barrada, & Roncero, 2019). A high prevalence of orthorexic behaviours was also found in a sample of Spanish Ashtanga yoga practitioners (Valera et al., 2014) and in Hungarian gym attendees practicing yoga (Bóna et al., 2019). Yoga practitioners belong to the health-related occupations that have been consistently linked to a high prevalence of ON, alongside gym-goers (Almeida, Vieira Borba, & Santos, 2018; Bóna et al., 2019), athletes (Segura-García et al., 2012), medical students (Bosi, Çamur, & Güler, 2007), or dieticians (Asil & Sürücüoğlu, 2015; Tremelling, Sandon, Vega, & McAdams, 2017). However, ON rates can also be high in the general population (Missbach et al., 2015; Turner & Lefevre, 2017), so it remains unclear whether yoga and other health-related occupations are relevant risk factors for the development of ON (McComb & Mills, 2019).

3. Orthorexia nervosa in yoga practitioners: relationship with personality, attitudes about appearance, and yoga engagement

Rather than the yoga practice itself, a factor that can promote the adoption of eating habits associated with orthorexia is the identification of the practitioner with yoga philosophy. Drawing from ancient yoga texts such as Patanjali's Yoga Sutras, many yoga schools and teachers advise their students to "eat clean", and preferably to adopt vegetarian or vegan diets to comply with the yogic principle of non-violence (Gannon, 2008; Sweeney, 2005). Certain yoga traditions dictate such consumption practices (Musial, 2016), and students may feel pressured to adopt specific eating habits. However, in individuals oriented towards body vigilance and body control, thus more susceptible to disordered eating, common yogic practices such as vegetarianism, cleanses, detoxes, or fasting, may trigger orthorexic thinking (Musial, 2016). Indeed, a healthy interest in diet, identified as "healthy orthorexia" in the Teruel Orthorexia Scale, was one of the strongest predictors of orthorexia nervosa in our sample of yoga practitioners.

Another strong predictor of ON in yoga practitioners was the drive for thinness. By definition, orthorexic individuals are concerned with the quality of food, rather than the quantity, and weight loss is not considered a primary motivation for ON (Barthels et al., 2015; Dunn & Bratman, 2016); however, the relationship between ON and the desire to be thin in our sample of yoga practitioners suggests otherwise. The criteria of food quantity and preoccupation with body weight *versus* food quality and preoccupation with food pureness to distinguish between anorexia/bulimia and orthorexia, respectively, may prove inaccurate. On one hand, anorectic individuals do care about the quality of their food (Kummer, Dias, & Teixeira, 2008), and preoccupation with food quality often emerges in anorectic and bulimic patients after treatment (Segura-Garcia et al., 2015). On the other hand, and contrary to the accepted definition of orthorexia nervosa, a desire to be thin and dysfunctional attitudes towards physical appearance can occur in individuals with orthorexic behaviours, as observed in a sample of Spanish university students (Parra-Fernández et al., 2018) and in our sample of yoga practitioners.

3. Orthorexia nervosa in yoga practitioners: relationship with personality, attitudes about appearance, and yoga engagement

Besides lifestyle, eating-related, and body and appearance-related risk factors, personality risk factors, particularly perfectionism, can also be linked to orthorexic tendencies. We found weak/moderate associations between perfectionism and orthorexia nervosa in our sample, and the sub-dimension “doubts about actions” emerged as a significant predictor of ON. We are not aware of other studies that have evaluated the relationship between ON and perfectionism in yoga practitioners, but in other populations, namely in Spanish (Barrada & Roncero, 2018; Parra-Fernández et al., 2018) and American (Hayles, Wu, De Nadai, & Storch, 2017; Oberle et al., 2017) university students, perfectionism was also associated with greater ON tendencies. Self-discipline was not related with any other personality trait or disordered eating variable, except for an inverse correlation with the “doubts about actions” sub-dimension of perfectionism. Practitioners who reported practicing more frequently and longer practices scored higher on self-discipline, but no relationship was found with other characteristics of yoga practice.

Despite the myriad of yoga styles available to practitioners, it has been claimed that all styles are similar in their components (physical postures, breathing techniques, meditation), differing only in the way they are practiced (Jeter et al., 2015). However, studies show that different yoga styles may yield different results (Cowen & Adams, 2005) and may even be practiced by individuals with distinct psychological characteristics (Domingues & Carmo, 2019). Different personality traits have been found in practitioners of different types of physical activities; for instance, swimmers are less social, less spontaneous, and more internally-motivated than team sports practitioners (Gavin, 2004). Thus, it is reasonable to assume that personality and attitudinal differences will also be found among practitioners of distinct yoga styles, for instance, between individuals practicing Ashtanga, considered the most athletic and physically demanding style of yoga, and Yin, a more quiet and relaxed style. Although small in magnitude, we found significant differences between Ashtanga practitioners and practitioners of other yoga styles in their drive for

3. Orthorexia nervosa in yoga practitioners: relationship with personality, attitudes about appearance, and yoga engagement

thinness and healthy orthorexia. Reverse causality may be in place here, as individuals with a stronger drive for thinness may feel attracted to Ashtanga rather than other yoga styles, given that weight loss and changes in body shape (together with the recommended vegetarian diet for Ashtanga practitioners) are common effects of a dedicated practice (Sweeney, 2005).

3.4.1 Methodological limitations

Although significant associations between orthorexia nervosa and risk factors were found in our study, the issue of reverse causality is worth mentioning as a potential pitfall. A descriptive, cross-sectional study does not allow discerning between causal effects (yoga triggers orthorexia nervosa due to yoga's dietary guidelines and associated peer-pressure) and selection (individuals with a tendency for orthorexic attitudes and behaviours will find a home in yoga, given yoga's emphasis on pureness and clean eating). Another limitation of our study is the bias towards Ashtanga practitioners, which represent more than half of the participants; this overrepresentation of Ashtanga practitioners may have hinder comparisons across yoga styles. Finally, official diagnostic criteria for orthorexia nervosa are still not available (Cena et al., 2019) and most scales that measure ON have been criticized due to their poor psychometric characteristics. We used a relatively new instrument, the Teruel Orthorexia Scale (TOS) (Barrada & Roncero, 2018), which has not yet been the target of criticism regarding its ability to detect ON (Cena et al., 2019; Valente, Syurina, & Donini, 2019); however, the TOS has only been used, to the best of our knowledge, with Spanish university students (Barrada & Roncero, 2018; Barthels, Barrada, & Roncero, 2019; Depa et al., 2019), which may hamper its representativeness and applicability to other populations. In addition, the TOS does not allow a clear distinction between an orthorexic and a non-orthorexic individual, as threshold values for ON diagnosis are not available.

Chapter 4

Final remarks

This work aimed to analyse the occurrence of disordered eating and orthorexia nervosa (ON) in yoga practitioners. A systematic review and a correlational cross-sectional study were conducted to achieve this goal.

Overall, yoga practice is associated with healthier eating behaviours, positive body image and high body satisfaction. However, the occurrence of disordered eating seems to be related with a high dosage of yoga practice. In our international sample of seasoned yoga practitioners, mean scores for ON were higher than for the general population, in agreement with previous studies that have found a high prevalence of ON in yoga users. The main predictors of ON were the drive for thinness and a healthy interested in diet, suggesting that individuals with orthorexic tendencies are concerned not only with food quality, but also with food quantity and physical appearance, as is anorectic and bulimic individuals. Finally, practitioners of Ashtanga Vinyasa Yoga showed higher tendencies for ON and drive for thinness, in relation with practitioners of other yoga styles.

Yoga has been increasingly used as a complementary practice for the prevention and treatment of disordered eating, but the long-term effects of the practice on disordered eating behaviours are still not clear. Future work should focus on:

- a) Disordered eating across yoga dosages – is there an optimal level of involvement with the practice, whereas below or above that threshold individuals are at a higher risk for ED?
- b) Disordered eating across yoga styles – are practitioners of specific styles of yoga, like Ashtanga Vinyasa, at a higher risk for the development of ED?
- c) The potential role of body, appearance and weight-related variables (such as drive for thinness) as mediators/moderators of orthorexia nervosa – preoccupation with body appearance, weight, and food quantity are also present in orthorexic individuals?

- d) The effects of peer-pressure (yoga community) to eat clean on the development of orthorexic thinking in yoga practitioners.

References

- Almeida, C., Vieira Borba, V., & Santos, L. (2018). Orthorexia nervosa in a sample of Portuguese fitness participants. *Eating and Weight Disorders, 23*(4), 443–451. <https://doi.org/10.1007/s40519-018-0517-y>
- American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.). Arlington, VA: American Psychiatric Association.
- Asil, E., & Sürücüoğlu, M. S. (2015). Orthorexia Nervosa in Turkish Dietitians. *Ecology of Food and Nutrition, 54*(4), 303–313. <https://doi.org/10.1080/03670244.2014.987920>
- Bak-Sosnowska, M., & Urban, A. (2017). Body image in women practicing yoga or other forms of fitness. *Archives of Psychiatry and Psychotherapy, 19*(3), 58–68. <https://doi.org/10.12740/APP/76338>
- Barrada, J. R., & Roncero, M. (2018). Bidimensional Structure of the Orthorexia: Development and Initial Validation of a New Instrument. *Anales de Psicología, 34*(2), 283–291. <https://doi.org/10.6018/analesps.34.2.299671>
- Barthels, F., Barrada, J. R., & Roncero, M. (2019). Orthorexia nervosa and healthy orthorexia as new eating styles. *Plos One, 14*(7), e0219609. <https://doi.org/10.1371/journal.pone.0219609>
- Barthels, F., Meyer, F., & Pietrowsky, R. (2015). Orthorexic eating behavior: a new type of disordered eating. *Ernährungs Umschau, 62*(10), 156–161. <https://doi.org/10.4455/eu.2015.029>
- Barthels, F., Meyer, F., & Pietrowsky, R. (2018). Orthorexic and restrained eating behaviour in vegans, vegetarians, and individuals on a diet. *Eating and Weight Disorders, 23*(2), 159–166. <https://doi.org/10.1007/s40519-018-0479-0>
- Birdee, G. S., Legedza, A. T., Saper, R. B., Bertisch, S. M., Eisenberg, D. M., & Phillips, R. S. (2008). Characteristics of yoga users: Results of a national survey. *Journal of General Internal Medicine, 23*(10), 1653–1658. <https://doi.org/10.1007/s11606-008-0735-5>
- Bóna, E., Szél, Z., Kiss, D., & Gyarmathy, V. A. (2019). An unhealthy health behavior: analysis of orthorexic tendencies among Hungarian gym attendees. *Eating and Weight Disorders, 24*(1), 13–20. <https://doi.org/10.1007/s40519-018-0592-0>
- Bosi, A. T. B., Çamur, D., & Güler, Ç. (2007). Prevalence of orthorexia nervosa in resident medical doctors in the faculty of medicine (Ankara, Turkey). *Appetite, 49*(3), 661–666. <https://doi.org/10.1016/j.appet.2007.04.007>
- Boudette, R. (2006). Question & answer: Yoga in the treatment of disordered eating and body image disturbance: How can the practice of yoga be helpful in recovery from an eating disorder? *Eating Disorders, 14*(2), 167–170. <https://doi.org/10.1080/10640260500536334>

- Bratland-Sanda, S., Nilsson, M. P., & Sundgot-Borgen, J. (2015). Disordered eating behavior among group fitness instructors: A health-threatening secret? *Journal of Eating Disorders*, 3(1), 1–8. <https://doi.org/10.1186/s40337-015-0059-x>
- Bratman, S. (1997). Health Food Junkie. *Yoga Journal*, September/, 42–50. Retrieved from <http://www.orthorexia.com/original-orthorexia-essay/>
- Bratman, S. (2017). Orthorexia vs. theories of healthy eating. *Eating and Weight Disorders*, 22(3), 381–385. <https://doi.org/10.1007/s40519-017-0417-6>
- Brytek-Matera, A. (2012). Orthorexia nervosa - An eating disorder, obsessive-compulsivedisorder or disturbed eating habit? *Archives of Psychiatry and Psychotherapy*, 14(1), 55–60. [https://doi.org/10.1016/S0924-9338\(14\)77967-2](https://doi.org/10.1016/S0924-9338(14)77967-2)
- Bucchianeri, M. M., Fernandes, N., Loth, K., Hannan, P. J., Eisenberg, M. E., & Neumark-Sztainer, D. (2016). Body dissatisfaction: Do associations with disordered eating and psychological well-being differ across race/ethnicity in adolescent girls and boys? *Cultural Diversity and Ethnic Minority Psychology*, 22(1), 137–146. <https://doi.org/10.1037/cdp0000036>
- Büssing, A., Michalsen, A., Khalsa, S. B. S., Telles, S., & Sherman, K. J. (2012). Effects of yoga on mental and physical health: A short summary of reviews. *Evidence-Based Complementary and Alternative Medicine*, 165410. <https://doi.org/10.1155/2012/165410>
- Carbonneau, N., Vallerand, R. J., & Massicotte, S. (2010). Is the practice of yoga associated with positive outcomes? the role of passion. *Journal of Positive Psychology*, 5(6), 452–465. <https://doi.org/10.1080/17439760.2010.534107>
- Carei, T. R., Fyfe-Johnson, A. L., Breuner, C. C., & Brown, M. A. (2010). Randomized Controlled Clinical Trial of Yoga in the Treatment of Eating Disorders. *Journal of Adolescent Health*, 46(4), 346–351. <https://doi.org/10.1016/j.jadohealth.2009.08.007>
- Cena, H., Barthels, F., Cuzzolaro, M., Bratman, S., Brytek-Matera, A., Dunn, T., ... Donini, L. M. (2019). Definition and diagnostic criteria for orthorexia nervosa: a narrative review of the literature. *Eating and Weight Disorders*, 24(2), 209–246. <https://doi.org/10.1007/s40519-018-0606-y>
- Cook-Cottone, C. (2013). Dosage as a critical variable in yoga therapy research. *International Journal of Yoga Therapy*, 23(2), 11–12.
- Cook-Cottone, C. (2015). Incorporating positive body image into the treatment of eating disorders: A model for attunement and mindful self-care. *Body Image*, 14, 158–167. <https://doi.org/10.1016/j.bodyim.2015.03.004>
- Cook-Cottone, C., Beck, M., & Kane, L. (2008). Manualized-group treatment of eating disorders: Attunement in mind, body, and relationship (AMBR). *Journal of Specialists in Group Work*, 33, 61–83. <https://doi.org/10.1080/01933920701798570>

- Cook-Cottone, C., & Phelps, L. (2003). Body Dissatisfaction in College Women: Identification of Risk and Protective Factors to Guide College Counseling Practices. *Journal of College Counseling, 6*(1), 80.
- Costa, P., & McCrae, R. R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual*. Odessa, FL: Psychological Assessment Resources.
- Cowen, V. S., & Adams, T. B. (2005). Physical and perceptual benefits of yoga asana practice: results of a pilot study. *Journal of Bodywork and Movement Therapies, 9*, 211–219. <https://doi.org/10.1016/j.jbmt.2004.08.001>
- Craighead, L. W., & Smith, L. (2010). Obesity and eating disorders. In M. M. Antony & D. H. Barlow (Eds.), *Handbook of Assessment and Treatment Planning for Psychological Disorders* (2nd ed., pp. 390–438). The Guilford Press.
- Cramer, H., Quinker, D., Pilkington, K., Mason, H., Adams, J., & Dobos, G. (2019). Associations of yoga practice, health status, and health behavior among yoga practitioners in Germany – Results of a national cross-sectional survey. *Complementary Therapies in Medicine, 42*(October 2018), 19–26. <https://doi.org/10.1016/j.ctim.2018.10.026>
- Cramer, H., Sibbritt, D., Park, C. L., Adams, J., & Lauche, R. (2017). Is the practice of yoga or meditation associated with a healthy lifestyle? Results of a national cross-sectional survey of 28,695 Australian women. *Journal of Psychosomatic Research, 101*(July), 104–109. <https://doi.org/10.1016/j.jpsychores.2017.07.013>
- Daubenmier, J. J. (2005). The relationship of yoga, body awareness, and body responsiveness to self-objectification and disordered eating. *Psychology of Women Quarterly, 29*(2), 207–219. <https://doi.org/10.1111/j.1471-6402.2005.00183.x>
- De Michelis, E. (2005). *A History of Modern Yoga*. London: Continuum.
- De Michelis, E. (2007). A Preliminary Survey of Modern Yoga Studies. *Asian Medicine, 3*(1), 1–19. <https://doi.org/10.1163/157342107X207182>
- Delaney, K., & Anthis, K. (2010). Is Women’s Participation in Different Types of Yoga Classes Associated with Different Levels of Body Awareness Satisfaction? *International Journal of Yoga Therapy, 20*(20), 28–37. <https://doi.org/10.1111/j.1471-6402.2005.00183.x>
- Depa, J., Barrada, J. R., & Roncero, M. (2019). Are the motives for food choices different in orthorexia nervosa and healthy orthorexia? *Nutrients, 11*(3), 1–14. <https://doi.org/10.3390/nu11030697>
- Dittmann, K. A., & Freedman, M. R. (2009). Body awareness, eating attitudes, and spiritual beliefs of women practicing Yoga. *Eating Disorders, 17*(4), 273–292. <https://doi.org/10.1080/10640260902991111>

- Domingues, R. B. (2018). Modern postural yoga as a mental health promoting tool: A systematic review. *Complementary Therapies in Clinical Practice, 31*, 248–255. <https://doi.org/10.1016/j.ctcp.2018.03.002>
- Domingues, R. B., & Carmo, C. (2019). Disordered eating behaviours and correlates in yoga practitioners: a systematic review. *Eating and Weight Disorders*. <https://doi.org/10.1007/s40519-019-00692-x>
- Donini, L. M., Marsili, D., Graziani, M. P., Imbriale, M., & Cannella, C. (2004). Orthorexia nervosa: A preliminary study with a proposal for diagnosis and an attempt to measure the dimension of the phenomenon. *Eating and Weight Disorders, 9*(2), 151–157. <https://doi.org/10.1007/BF03325060>
- Douglass, L. (2009). Yoga as an intervention in the treatment of eating disorders: Does it help? *Eating Disorders, 17*(2), 126–139. <https://doi.org/10.1080/10640260802714555>
- Dunn, T. M., & Bratman, S. (2016). On orthorexia nervosa: A review of the literature and proposed diagnostic criteria. *Eating Behaviors, 21*, 11–17. <https://doi.org/10.1016/j.eatbeh.2015.12.006>
- Erkin, Ö., & Göl, I. (2019). Determination of health status perception and orthorexia nervosa tendencies of Turkish yoga practitioners: A cross-sectional descriptive study. *Progress in Nutrition, 21*(1), 105–112. <https://doi.org/10.23751/pn.v21i1.7664>
- Fairburn, C. G., Cooper, Z., Doll, H. A., & Welch, S. L. (1999). Risk factors for anorexia nervosa: three integrated case-control comparisons. *Archives of General Psychiatry, 56*, 468–476. <https://doi.org/10.1001/archpsyc.56.5.468>
- Fairburn, C. G., Doll, H. A., Welch, S. L., Hay, P. J., Davies, B. A., & O'Connor, M. E. (1998). Risk Factors for Binge Eating Disorder: a community-based, case-control study. *Archives of General Psychiatry, 55*, 425–432. <https://doi.org/10.1001/archpsyc.55.5.425>
- Field, T. (2016). Yoga research review. *Complementary Therapies in Clinical Practice, 24*, 145–161. <https://doi.org/10.1016/j.ctcp.2016.06.005>
- Flament, M. F., Buchholz, A., Henderson, K., Obeid, N., Maras, D., Schubert, N., ... Goldfield, G. (2015). Comparative Distribution and Validity of DSM-IV and DSM-5 Diagnoses of Eating Disorders in Adolescents from the Community. *European Eating Disorders Review, 23*, 100–110. <https://doi.org/10.1002/erv.2339>
- Fredrickson, B. L., & Roberts, T.-A. (1997). Objectification Theory. *Psychology of Women Quarterly, 21*(2), 173–206. <https://doi.org/10.1111/j.1471-6402.1997.tb00108.x>
- Frost, R. O., Marten, P., Lahart, C., & Rosenblate, R. (1990). The dimensions of perfectionism. *Cognitive Therapy and Research, 14*(5), 449–468.

- <https://doi.org/10.1007/BF01172967>
- Gable, S. L., & Haidt, J. (2005). What (and why) is positive psychology? *Review of General Psychology, 9*(2), 103–110. <https://doi.org/10.1037/1089-2680.9.2.103>
- Gaiswinkler, L., & Unterrainer, H. F. (2016). The relationship between yoga involvement, mindfulness and psychological well-being. *Complementary Therapies in Medicine, 26*, 123–127. <https://doi.org/10.1016/j.ctim.2016.03.011>
- Gaiswinkler, L., Unterrainer, H. F., Fink, A., & Kapfhammer, H. P. (2015). Die Beziehung zwischen Yoga Immersion, psychologischem Wohlbefinden und psychiatrischer Symptomatik. *Neuropsychiatrie, 29*(1), 29–35. <https://doi.org/10.1007/s40211-015-0139-9>
- Gannon, S. (2008). *Yoga and Vegetarianism: The Diet of Enlightenment*. San Rafael, CA: Mandala Publishing.
- Garner, D. M., Olmstead, M. P., & Polivy, J. (1983). Multidimensional Eating Disorder Inventory for Anorexia Nervosa and Bulimia. *International Journal of Eating Disorders, 2*(2), 15–34. [https://doi.org/10.1002/1098-108X\(198321\)2:2<15::AID-EAT2260020203>3.0.CO;2-6](https://doi.org/10.1002/1098-108X(198321)2:2<15::AID-EAT2260020203>3.0.CO;2-6)
- Gavin, J. (2004). Pairing personality with activity: New tools for inspiring active lifestyles. *Physician and Sportsmedicine, 32*(12), 17–24. <https://doi.org/10.3810/psm.2004.12.671>
- Gleaves, D. H., Graham, E. C., & Ambwani, S. (2013). Measuring “orthorexia”: Development of the Eating Habits Questionnaire. *The International Journal of Educational and Psychological Assessment, 12*(2), 1–18. <https://doi.org/10.1017/CBO9781107415324.004>
- Hall, A., Ofei-Tenkorang, N., Machan, J., & Gordon, C. (2016). Use of yoga in outpatient eating disorder treatment: a pilot study. *Journal of Eating Disorders, 4*, 38. <https://doi.org/10.1186/s40337-016-0130-2>
- Hausenblas, H. A., & Downs, D. S. (2002). How much is too much? The development and validation of the exercise dependence scale. *Psychology and Health, 17*(4), 387–404. <https://doi.org/10.1080/0887044022000004894>
- Hayles, O., Wu, M. S., De Nadai, A. S., & Storch, E. A. (2017). Orthorexia Nervosa: An Examination of the Prevalence, Correlates, and Associated Impairment in a University Sample. *Journal of Cognitive Psychotherapy, 31*(2), 124–135. <https://doi.org/10.1891/0889-8391.31.2.124>
- Heiss, S., Coffino, J. A., & Hormes, J. M. (2019). What does the ORTO-15 measure? Assessing the construct validity of a common orthorexia nervosa questionnaire in a meat avoiding sample. *Appetite, 135*, 93–99. <https://doi.org/10.1016/j.appet.2018.12.042>

- Hendriks, T., de Jong, J., & Cramer, H. (2017). The Effects of Yoga on Positive Mental Health Among Healthy Adults: A Systematic Review and Meta-Analysis. *The Journal of Alternative and Complementary Medicine*, 23(7), 505–517. <https://doi.org/10.1089/acm.2016.0334>
- Iyengar, B. K. S. (2015). *Light on Yoga: The Definitive Guide to Yoga Practice*. London: Harper Thorsons.
- Jarry, J. L., Chang, F. M., & La Civita, L. (2017). Ashtanga Yoga for Psychological Well-being: Initial Effectiveness Study. *Mindfulness*, 2012, 1–11. <https://doi.org/10.1007/s12671-017-0703-4>
- Jeter, P. E., Slutsky, J., Singh, N., & Khalsa, S. B. S. (2015). Yoga as a Therapeutic Intervention: A Bibliometric Analysis of Published Research Studies from 1967 to 2013. *The Journal of Alternative and Complementary Medicine*, 21(10), 586–592. <https://doi.org/10.1089/acm.2015.0057>
- Jois, K. P. (2010). *Yoga Mala* (2nd ed.). New York: North Point Press.
- Khalsa, S. B. S. (2013). Yoga for Psychiatry and Mental Health: An Ancient Practice with Modern Relevance. *Indian Journal of Psychiatry*, 55(Suppl 3), 334–336.
- Klein, J., & Cook-Cottone, C. (2013). The effects of yoga on eating disorder symptoms and correlates: a review. *International Journal of Yoga Therapy*, 23(23), 41–50. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/24165522>
- Koven, N. S., & Wabry, A. (2015). The clinical basis of orthorexia nervosa: Emerging perspectives. *Neuropsychiatric Disease and Treatment*, 11, 385–394. <https://doi.org/10.2147/NDT.S61665>
- Kummer, A., Dias, F. M. V., & Teixeira, A. L. (2008). On the concept of orthorexia nervosa. *Scandinavian Journal of Medicine and Science in Sports*, 18(3), 395–396. <https://doi.org/10.1111/j.1600-0838.2008.00809.x>
- Le Grange, D., & Eisler, I. (1993). The link between anorexia nervosa and excessive exercise: A review. *European Eating Disorders Review*, 1(2), 100–119. <https://doi.org/10.1002/erv.2400010205>
- Machado, P. P. P., Calaldo Otero, M., Gonçalves, S. F., Martins, C., & Lameiras Fernández, M. (2004). Eating related problems amongst Iberian female college students. *International Journal of Clinical and Health Psychology*, 4(3), 495–504.
- Machado, P. P. P., Machado, B. C., Gonçalves, S., & Hoek, H. W. (2007). The prevalence of eating disorders not otherwise specified. *International Journal of Eating Disorders*, 40, 212–217. <https://doi.org/10.1002/eat>
- Mahlo, L., & Tiggemann, M. (2016). Yoga and positive body image: A test of the Embodiment Model. *Body Image*, 18, 135–142. <https://doi.org/10.1016/j.bodyim.2016.06.008>

- Martin, R., Prichard, I., Hutchinson, A. D., & Wilson, C. (2013). The Role of Body Awareness and Mindfulness in the Relationship between Exercise and Eating Behavior. *Journal of Sport and Exercise Psychology, 35*(6), 655–660. <https://doi.org/10.1123/jsep.35.6.655>
- McCall, M. M. (2014). In search of yoga: Research trends in a western medical database. *International Journal of Yoga, 7*, 4–8. <https://doi.org/10.4103/0973-6131.123470>
- McComb, S. E., & Mills, J. S. (2019). Orthorexia nervosa: A review of psychosocial risk factors. *Appetite, 140*(April), 50–75. <https://doi.org/10.1016/j.appet.2019.05.005>
- McIver, S., O'Halloran, P., & McGartland, M. (2009). Yoga as a treatment for binge eating disorder: A preliminary study. *Complementary Therapies in Medicine, 17*(4), 196–202. <https://doi.org/10.1016/j.ctim.2009.05.002>
- Missbach, B., Dunn, T. M., & König, J. S. (2017). We need new tools to assess Orthorexia Nervosa. A commentary on “Prevalence of Orthorexia Nervosa among College Students Based on Bratman’s Test and Associated Tendencies.” *Appetite, 108*, 521–524. <https://doi.org/10.1016/j.appet.2016.07.010>
- Missbach, B., Hinterbuchinger, B., Dreiseitl, V., Zellhofer, S., Kurz, C., & König, J. (2015). When eating right, is measured wrong! A validation and critical examination of the ORTO-15 questionnaire in German. *PLoS ONE, 10*(8), 1–15. <https://doi.org/10.1371/journal.pone.0135772>
- Mitchell, K. S., Mazzeo, S. E., Rausch, S. M., & Cooke, K. L. (2007). Innovative interventions for disordered eating: evaluating dissonance-based and yoga interventions. *The International Journal of Eating Disorders, 40*(2), 120–128. <https://doi.org/10.1002/eat>
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., Altman, D., Antes, G., ... Tugwell, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine, 6*(7), e1000097. <https://doi.org/10.1371/journal.pmed.1000097>
- Moller, S., Apputhurai, P., & Knowles, S. R. (2018). Confirmatory factor analyses of the ORTO 15-, 11- and 9-item scales and recommendations for suggested cut-off scores. *Eating and Weight Disorders, 24*(1), 1–8. <https://doi.org/10.1007/s40519-018-0515-0>
- Musial, J. (2016). “Work off that holiday meal ladies!” - Body vigilance and orthorexia in yoga spaces. In B. Berilla, M. Klein, & C. J. Roberts (Eds.), *Yoga, the Body, and Embodied Social Change - An Intersectional Feminist Analysis* (pp. 141–154). Lexington Books.
- Neumark-Sztainer, D. (2014). Yoga and eating disorders: is there a place for yoga in

- the prevention and treatment of eating disorders and disordered eating behaviours? *Advances in Eating Disorders*, 2(2), 136–145.
<https://doi.org/10.1080/21662630.2013.862369>
- Neumark-Sztainer, D., Eisenberg, M. E., Wall, M., & Loth, K. A. (2011). Yoga and pilates: Associations with body image and disordered-eating behaviors in a population-based sample of young adults. *International Journal of Eating Disorders*, 44(3), 276–280. <https://doi.org/10.1002/eat.20858>
- Neumark-Sztainer, D., MacLehose, R. F., Watts, A. W., Pacanowski, C. R., & Eisenberg, M. E. (2018). Yoga and body image: Findings from a large population-based study of young adults. *Body Image*, 24, 69–75.
<https://doi.org/10.1016/j.bodyim.2017.12.003>
- Neumark-Sztainer, D., Watts, A. W., & Rydell, S. (2018). Yoga and body image: How do young adults practicing yoga describe its impact on their body image? *Body Image*, 27, 156–168. <https://doi.org/10.1016/j.bodyim.2018.09.001>
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory* (3rd ed.). New York, NY: McGraw-Hill.
- Oberle, C. D., Samaghabadi, R. O., & Hughes, E. M. (2017). Orthorexia nervosa: Assessment and correlates with gender, BMI, and personality. *Appetite*, 108, 303–310. <https://doi.org/10.1016/j.appet.2016.10.021>
- Park, C. L., Braun, T., & Siegel, T. (2015). Who practices yoga? A systematic review of demographic, health-related, and psychosocial factors associated with yoga practice. *Journal of Behavioral Medicine*, 38(3), 460–471.
<https://doi.org/10.1007/s10865-015-9618-5>
- Park, C. L., Riley, K. E., Bedesin, E., & Stewart, V. M. (2014). Why practice yoga? Practitioners' motivations for adopting and maintaining yoga practice. *Journal of Health Psychology*, 17(3), 161–171. <https://doi.org/10.1177/1359105314541314>
- Park, C. L., Riley, K. E., & Braun, T. D. (2016). Practitioners' perceptions of yoga's positive and negative effects: Results of a National United States survey. *Journal of Bodywork and Movement Therapies*, 20(2), 270–279.
<https://doi.org/10.1016/j.jbmt.2015.11.005>
- Parra-Fernández, M. L., Rodríguez-Cano, T., Onieva-Zafra, M. D., Perez-Haro, M. J., Casero-Alonso, V., Fernández-Martínez, E., & Notario-Pacheco, B. (2018). Prevalence of orthorexia nervosa in university students and its relationship with psychopathological aspects of eating behaviour disorders. *BMC Psychiatry*, 18(1), 1–8. <https://doi.org/10.1186/s12888-018-1943-0>
- Polivy, J., & Herman, C. P. (2002). Causes of eating disorders. *Annual Review of Psychology*, 53, 187–213. <https://doi.org/10.1146/annurev.psych.53.100901.135103>

- Prichard, I., & Tiggemann, M. (2008). Relations among exercise type, self-objectification, and body image in the fitness centre environment: The role of reasons for exercise. *Psychology of Sport and Exercise, 9*(6), 855–866. <https://doi.org/10.1016/j.psychsport.2007.10.005>
- Ross, A., Friedmann, E., Bevans, M., & Thomas, S. (2013). National survey of yoga practitioners: Mental and physical health benefits. *Complementary Therapies in Medicine, 21*(4), 313–323. <https://doi.org/10.1016/j.ctim.2013.04.001>
- Saraswati, S. S. (1976). *Four Chapters on Freedom: Commentary on the Yoga Sutras of Sage Patanjali*. Bihar, India: Yoga Publications Trust.
- Schaefer, L. M., Burke, N. L., & Thompson, J. K. (2019). Thin-ideal internalization: How much is too much? *Eating and Weight Disorders, 24*(5), 933–937. <https://doi.org/10.1007/s40519-018-0498-x>
- Schaefer, L. M., & Thompson, J. K. (2018). Self-objectification and disordered eating: A meta-analysis. *International Journal of Eating Disorders, 51*(6), 483–502. <https://doi.org/10.1002/eat.22854>
- Segura-García, C., Papaiani, M. C., Caglioti, F., Procopio, L., Nisticò, C. G., Bombardiere, L., ... Capranica, L. (2012). Orthorexia nervosa: A frequent eating disordered behavior in athletes. *Eating and Weight Disorders, 17*(4), 226–233. <https://doi.org/10.3275/8272>
- Segura-Garcia, C., Ramacciotti, C., Rania, M., Aloï, M., Caroleo, M., Bruni, A., ... De Fazio, P. (2015). The prevalence of orthorexia nervosa among eating disorder patients after treatment. *Eating and Weight Disorders, 20*(2), 161–166. <https://doi.org/10.1007/s40519-014-0171-y>
- Shafran, R., Cooper, Z., & Fairburn, C. G. (2002). Clinical perfectionism: A cognitive-behavioural analysis. *Behaviour Research and Therapy, 40*(7), 773–791. [https://doi.org/10.1016/S0005-7967\(01\)00059-6](https://doi.org/10.1016/S0005-7967(01)00059-6)
- Shroff, H., Reba, L., Thornton, L. M., Tozzi, F., Klump, K. L., Berrettini, W. H., ... Bulik, C. M. (2006). Features associated with excessive exercise in women with eating disorders. *International Journal of Eating Disorders, 39*, 454–461. <https://doi.org/10.1002/eat>
- Singleton, M. (2010). *Yoga Body: The Origins of Modern Posture Practice*. Oxford University Press.
- Spangler, D. L., & Stice, E. (2001). Validation of the beliefs about appearance scale. *Cognitive Therapy and Research, 25*(6), 813–827. <https://doi.org/10.1023/A:1012931709434>
- Stice, E., Marti, C. N., & Durant, S. (2011). Risk factors for onset of eating disorders: Evidence of multiple risk pathways from an 8-year prospective study. *Behaviour*

- Research and Therapy*, 49(10), 622–627. <https://doi.org/10.1016/j.brat.2011.06.009>
- Stice, E., & Shaw, H. E. (2002). Role of body dissatisfaction in the onset and maintenance of eating pathology: A synthesis of research findings. *Journal of Psychosomatic Research*, 53, 985–993. [https://doi.org/10.1016/s0022-3999\(02\)00488-9](https://doi.org/10.1016/s0022-3999(02)00488-9)
- Sweeney, M. (2005). *Ashtanga Yoga As It Is*. The Yoga Temple.
- Tremelling, K., Sandon, L., Vega, G. L., & McAdams, C. J. (2017). Orthorexia Nervosa and Eating Disorder Symptoms in Registered Dietitian Nutritionists in the United States. *Journal of the Academy of Nutrition and Dietetics*, 117(10), 1612–1617. <https://doi.org/10.1016/j.jand.2017.05.001>
- Turner, P. G., & Lefevre, C. E. (2017). Instagram use is linked to increased symptoms of orthorexia nervosa. *Eating and Weight Disorders*, 22(2), 277–284. <https://doi.org/10.1007/s40519-017-0364-2>
- United Nations. (n.d.). International Day of Yoga. Retrieved June 11, 2019, from <https://www.un.org/en/events/yogaday/>
- United Nations. (2015). Resolution adopted by the General Assembly on 11 December 2014.
- Valente, M., Syurina, E. V., & Donini, L. M. (2019). Shedding light upon various tools to assess orthorexia nervosa: a critical literature review with a systematic search. *Eating and Weight Disorders*, 24(4), 671–682. <https://doi.org/10.1007/s40519-019-00735-3>
- Valera, J. H., Ruiz, P. A., Valdespino, B. R., & Visioli, F. (2014). Prevalence of orthorexia nervosa among ashtanga yoga practitioners: a pilot study. *Eating and Weight Disorders*, 19(4), 469–472. <https://doi.org/10.1007/s40519-014-0131-6>
- Vallerand, R. J., Blanchard, C., Mageau, G. A., Koestner, R., Ratelle, C., Léonard, M., ... Marsolais, J. (2003). Les Passions de l'Âme: On Obsessive and Harmonious Passion. *Journal of Personality and Social Psychology*, 85(4), 756–767. <https://doi.org/10.1037/0022-3514.85.4.756>
- Varga, M., Dukay-Szabó, S., Túry, F., & Van Furth Eric, F. (2013). Evidence and gaps in the literature on orthorexia nervosa. *Eating and Weight Disorders*, 18(2), 103–111. <https://doi.org/10.1007/s40519-013-0026-y>
- Watts, A. W., Rydell, S. A., Eisenberg, M. E., Laska, M. N., & Neumark-Sztainer, D. (2018). Yoga's potential for promoting healthy eating and physical activity behaviors among young adults: A mixed-methods study. *International Journal of Behavioral Nutrition and Physical Activity*, 15(1), 1–11. <https://doi.org/10.1186/s12966-018-0674-4>

Appendix 1 - Sociodemographic characteristics of participants ($n = 469$).

| | % (n) |
|--|------------|
| Gender | |
| Female | 84.2 (395) |
| Male | 14.7 (69) |
| Other/prefer not to say | 1.1 (5) |
| Age | |
| <18 years | 0 |
| 18-24 | 2.6 (12) |
| 25-34 | 21.1 (99) |
| 35-44 | 32.4 (152) |
| 45-54 | 25.6 (120) |
| 55-64 | 14.3 (67) |
| ≥ 65 years | 4.0 (19) |
| Marital status | |
| Single | 24.7 (116) |
| Married/domestic partnership | 65.9 (309) |
| Widowed | 1.1 (5) |
| Divorced/separated | 8.3 (39) |
| Occupation | |
| Working full-time | 52.9 (248) |
| Working part-time | 26.2 (123) |
| Full-time caregiver | 3.4 (16) |
| Full-time student | 4.1 (19) |
| Temporarily unemployed | 4.1 (19) |
| Retired | 8.3 (39) |
| Permanently unemployed | 1.0 (5) |
| Educational level | |
| Primary/elementary education | 0.2 (1) |
| Secondary education | 6.0 (28) |
| Incomplete college or university education | 8.1 (38) |
| Complete college or university education | 42.0 (197) |
| Masters | 32.4 (152) |
| Doctorate | 11.3 (53) |
| Household size | |
| 1 | 18.6 (87) |
| 2 | 39.4 (185) |
| 3 | 17.0 (80) |
| ≥4 | 25.0 (117) |
| Continent of residence | |
| Europe | 42.4 (199) |
| North America | 38.4 (180) |
| Asia | 9.4 (44) |
| Oceania | 5.3 (25) |
| South America | 3.2 (15) |
| Africa | 1.1 (5) |

Appendix 2 - Characteristics of yoga practice (n = 469).

| | % (n) |
|---|------------|
| <i>For how long have you been practicing yoga?</i> | |
| Less than 6 months | 2.1 (10) |
| 6 months – 1 year | 3.0 (14) |
| 1 – 2 years | 7.2 (34) |
| More than 2 years | 87.6 (411) |
| <i>How often do you practice yoga?</i> | |
| Once a week or less | 4.2 (20) |
| 1 - 2 times a week | 9.6 (45) |
| 3 - 4 times a week | 26.9 (126) |
| More than 4 times a week | 59.3 (278) |
| <i>How many hours a week do you practice yoga?</i> | |
| 1 hour or less | 5.8 (27) |
| 1 – 2 hours | 18.1 (85) |
| 3 -4 hours | 14.5 (68) |
| More than 4 hours | 61.6 (289) |
| <i>Proportion of practice at home and in class</i> | |
| Only at home | 14.1 (66) |
| Mostly at home | 26.7 (125) |
| More at home than in class | 13.0 (61) |
| More in class than at home | 11.7 (55) |
| Mostly in class | 26.2 (123) |
| Only in class | 8.3 (39) |
| <i>Yoga styles</i> | |
| Ashtanga vinyasa | 54.4 (255) |
| Hatha | 11.1 (52) |
| Iyengar | 10.9 (51) |
| Vinyasa flow, power, rocket | 9.6 (45) |
| Other styles | 14.1 (66) |
| <i>Reasons to start practicing yoga</i> | |
| Increase health and fitness | 42.6 (200) |
| Personal development | 37.1 (174) |
| Reduce stress or anxiety | 35.2 (165) |
| Spiritual path | 26.9 (126) |
| Increase flexibility, muscle tone | 24.1 (113) |
| Specific health reason or medical condition | 11.3 (53) |
| Enhance performance in another activity | 5.5 (26) |
| Pregnancy, childbirth | 1.3 (6) |
| Trendy, in vogue | 0.4 (2) |
| Menopause, women's health issues | 0.2 (1) |