A continuously cumulating meta-analysis of the relationship between perfectionism and orthorexia in exercisers

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Abstract

A recent meta-analysis found that perfectionism was related to orthorexia (obsessive healthy eating). However, the meta-analysis included only three samples from the sport and exercise domain so estimates were imprecise and, for perfectionistic concerns, unclear. We conducted a continuously cumulating meta-analysis to update these estimates. Following a pre-registered protocol, with open data and code, we recruited three samples – 255 gym members (age 32.92 years, *SD* = 8.58), 297 functional athletes (age 33.89 years, *SD* = 8.65), and 278 runners (age 41.15 years, *SD* = 13.14). Reanalysis of meta-analytical effects incorporating these samples (total *N* = 1,717) showed that orthorexia had a medium, positive, relationship with perfectionistic strivings (r^+ = .31, CI = .15, .46) and a small-to-medium, positive, relationship with perfectionistic concerns (r^+ = .26; CI = .11, .40). The findings confirm that both dimensions of perfectionism are potential risk factors for orthorexia in the sport and exercise domain.

Keywords: health, activity, disordered eating, diet, psychopathology, sport.

Introduction

Orthorexia refers to a pathological obsession with healthy eating (Koven & Abry, 2015). It is characterised by self-imposed rigid, inflexible, and strictly controlled dietary practices and strong emotional reactions following dietary transgressions (Donini et al., 2022). Orthorexia is not currently recognised as a distinct clinical eating disorder in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR). There is also some disagreement in regard to the degree to which orthorexia is different to other similar disorders (Meule & Voderholzer, 2021). However, recent consensus work examining the definition and diagnostic criteria for orthorexia suggests that it is most likely a distinct mental health disorder that falls within the DSM-5 category of Feeding and Eating Disorders, as a subtype of avoidant/restrictive food intake disorder (Donini et al., 2022).

Estimating the prevalence of orthorexia is difficult due to methodological differences between studies and, particularly, the use of different measures (Brytek-Matera, 2024; Carpita et al., 2024). General prevalence of orthorexia has been estimated to be as high as 27.3% in some reviews (e.g., Lopez-Gil et al., 2023). However, its prevalence varies considerably based on instrument used and population (Carpita et al., 2024; Lopez-Gil et al., 2023). Notably, the prevalence of orthorexia has also been estimated to be especially high in exercise populations in multiple studies (Hafstad et al., 2023; Lopez-Gil et al., 2023). Overall, though, caution is needed when considering these estimates based on the aforementioned issues and because they are substantially higher than estimates of the prevalence of more widely researched and better understood eating disorders such as anorexia and bulimia nervosa (see Pryke, 2018).

Factors linked to the development of orthorexia include a range of psychological (e.g., depressive symptoms and anxiety), social (e.g., excessive influence of social media platforms), and lifestyle variables (e.g., high levels of physical activity) (Donini et al., 2022).

Evidence regarding demographic characteristics like gender and age is mixed or suggests they are unrelated (McComb & Mills, 2019). Whether orthorexia precedes, coexists with, or follows other feeding and eating disorders also remains unknown (Pratt et al., 2024). However, a history of other feeding and eating disorders have also been identified as a risk factor for orthorexia (Donini et al., 2022). In addition, there appears to be a general set of transdiagnostic risk factors associated with orthorexia and other feeding and eating disorders, including personality factors such as perfectionism (see Limburg et al., 2017).

Perfectionism is a personality trait that is characterised by setting excessively high standards and by overly critical self-evaluation (Frost et al., 1990). A notable model of trait perfectionism is provided by Hewitt and Flett (1991). This model differentiates between three dimensions of trait perfectionism including self-oriented perfectionism (SOP; demanding perfection from oneself), other-oriented perfectionism (OOP; demanding perfection from others), and socially prescribed perfectionism (SPP; believing others expect perfection from oneself). As well as being viewed as important dimensions themselves, SOP and SPP are also considered key features of the broader concepts of perfectionistic strivings (PS; an internalised pressure to strive for perfection) and perfectionistic concerns (PC; being overly concerned with the implications of imperfection) (Hill et al., 2024). These concepts have become a key focus of perfectionism research, including in the sport and exercise domain where the differing qualities of the two dimensions have been shown to matter for motivation, wellbeing, and performance outcomes (see Hill et al., 2018).

Research has consistently shown that both PS and PC are positively related to eating disorder symptoms (see Stackpole et al., 2023), with similar findings evident in sport and exercise domains (e.g., St-Cyr et al.., 2024; Somasundaram & Burgess, 2018). The first meta-analysis of the relationship between perfectionism and orthorexia in sport and exercise and other domains (general populations and education) was recently published. Pratt et al. (2024)

meta-analysed twelve studies (including 13 samples; N = 4,984) and found that both PS and PC had positive, small-to-medium, sized relationships with orthorexia in all domains. However, in regard to sport and exercise, there were five studies and only three of those provided enough information to estimate meta-analytical effects. As a result, there was uncertainty regarding the effects, particularly for the PC-orthorexia relationship. While the point estimate for PC was similar in size to the effect of PS on orthorexia, the estimates lacked precision and implied possible null effects.

This uncertainty belies the fact that the sport and exercise domain is rife with pressure to perform, look, and eat perfectly (Pratt et al., 2024). This is evident in the accounts of athletes and exercisers themselves who have highlighted the need to manage multiple conflicting pressures in regard to how their bodies look and perform (e.g., Allan & Owen, 2019). How food control and weight and shape concerns are triggered by sporting environments has also been illustrated in research (e.g., Lichtenstein et al., 2022). Perhaps most insidious in these regards is how the dysfunctional nature of some of the behaviours adopted – such as obsessive healthy eating – is obscured in these domains and normalised (see Lewthwaite & LaMarre, 2022). As such, we would expect to find a relationship between perfectionism and orthorexia in a range of sport and exercise samples, from popular traditional exercise activities (e.g., runners) and typical gym members, to newer forms of competitive exercise (e.g., CrossFit).

To further our understanding of the relationship between perfectionism and orthorexia in a sport and exercise domain and address the ambiguity of PC, in particular, we revisited the estimates of Pratt et al. (2024). To do so, we adopt a continuously cumulating meta-analytical approach (Braver et al., 2014). This approach involves updating estimates of effects after adding new data and samples in a continual fashion. The approach has been used elsewhere, including in sport and exercise psychology, as an efficient way to provide the

latest, best possible, estimates of effects given existing research (e.g., Madigan et al., 2019). It is also an approach that is useful in determining when effects are stable and no more studies are needed and, as is the case here, ensuring estimates of effects are reliable in the early stages of research (see Muellerleile & Mullen, 2006; Yu et al., 2022). Here, we are able to re-estimate the effects of perfectionism, re-estimate confidence intervals for greater precision, and resolve uncertainty regarding the effects of PC. Specifically, whether PC is likely to be a risk factor for orthorexia in the sport and exercise domain or not.

Aims and Objectives

The first aim of the present study was to collect three independent samples from sport and exercise populations (gym members, functional athletes, and competitive/recreational runners) and examine the relationship between multidimensional perfectionism (PS and PC) and orthorexia. The second aim was to re-estimate meta-analytical effects of multidimensional perfectionism (PS and PC) on orthorexia in sport and exercise using a cumulating meta-analytical approach. It was hypothesized that PS and PC would have significant positive correlations with all aspects of orthorexia in all samples and in the updated meta-analysis.

Methods

Participants

The study was approved by the first author's university (approval code: ETH2425-0038). Informed consent was provided by all participants and no financial incentive/compensation was offered. The study was also pre-registered on PsychArchives (Pratt et al., 2025a) with data and code publicly available (Pratt et al., 2025b). There were no deviations from the pre-registered protocol. Supplementary materials include additional assessment of the psychometric properties of the instruments used (Tables S1 to S3) and

analyses of the partial effects of PS and PC equivalent to those in Pratt et al. (2024) (Table S4).

Our intention was to recruit three groups from within the sport and exercise domain that were comparable to samples used in the previous meta-analysis (see Pratt et al., 2024). As such, we targeted three distinct samples of adult exercisers using separate questionnaires and recruitment procedures: (1) gym members, (2) functional athletes (someone who takes part in specific forms of exercise training and competitions such as CrossFit and Hyrox), and (3) recreational/competitive runners. Participants self-identified as being part of these groups via self-report as part of the recruitment process ("Are you currently a member of a gym?" “Are you a recreational/competitive runner?" "Do you partake in CrossFit or functional style training?"). Note, though, the groups should not be considered mutually exclusive. Many of those we recruited engaged in multiple types of exercise (e.g., most functional athletes will need to be members of gyms to engage in their type of training). As such, the groups are best considered to be *primarily* gym members, functional athletes, or recreational/competitive runners. The overlap between the samples collected in these regards are reported in supplementary materials (Table S1).

We recruited participants using purposeful and convenience sampling via targeted advertisements whereby groups and individuals were identified as being members of one the three groups and contacted directly about the project via social media platforms (e.g., Instagram and Facebook), personal networks, gyms, running clubs, and other organising bodies. When an individual confirmed they were happy to receive participant information an online questionnaire was provided. Participants completed an online questionnaire via the Qualtrics platform (providing timestamped information that was inspected to help confirm veracity of completions). Each questionnaire was open for a 12-week recruitment period. All

participants needed to be adults (aged 18 years or older) and able to read and write English. There were no other inclusion or exclusion criteria.

A minimum target for each sample was set at 175 participants based on an a priori power calculation using correlations reported in Pratt et al. (2024): orthorexia-PC, r = .21, two-tailed, α = .05, power = .80 (Faul et al., 2007). The effect size used for power calculations was that of PC and orthorexia so the study is designed to detect an effect at least as large as is typical for the more ambiguous dimension of perfectionism. (i.e., if the same effect is observed in each sample, it will be statistically significant with CI not including zero).

For Sample one, a total of 258 gym members (29.5% female) with a mean age of 32.92 (*SD* = 8.58) were recruited. Participants reported that they exercised on average for 60 - 90 minutes per day and attended the gym on average 5 to 6 times per week. This sample included competitive and non-competitive bodybuilders, strongmen/strongwomen, and general gym members.

For Sample two, a total of 297 functional athletes (53.5% female) with a mean age of 33.89 (*SD* = 8.65) were recruited. Participants reported that they exercised on average for 60 - 90 minutes per day, on average 5 to 6 times per week. This sample included competitive and non-competitive CrossFit, Hyrox, and hybrid (multiple fitness disciplines such as weightlifting and running) athletes.

For Sample three, a total of 281 recreational/competitive runners (55.5% female) with a mean age of 41.15 (*SD* = 13.14) were recruited. Participants reported that they exercised on average for 30 - 60 minutes per day, on average 5 to 6 times per week. This included club-based runners and individual competitive and non-competitive runners.

Instruments

Perfectionism. The short form of the Hewitt and Flett Multidimensional Perfectionism Scale was used (HF-MPS; Cox et al., 2002). The HF-MPS short form is a 15-item questionnaire with three subscales; for the present study, we used the two subscales capturing self-oriented (SOP; 5 items; e.g., "I am perfectionistic in setting my goals") and socially prescribed perfectionism (SPP; 5 items; e.g., "People expect nothing less than perfection from me"). Responses are scored on a 7-point scale from 1-7 (*Disagree* to *Agree*). Evidence for validity and reliability has been demonstrated by Cox et al. (2002) including factor structure and internal reliability.

Orthorexia. The Eating Habits Questionnaire (EHQ; Gleaves et al., 2013) was used. The EHQ is a 21-item questionnaire with three subscales: knowledge of healthy eating (5 items, e.g., "I am more informed about healthy eating than others"), problems associated with healthy eating (12 items, e.g., "I am distracted by thoughts about healthy eating"), and positive feelings about healthy eating (4 items, e.g., "I feel great when I eat healthily"). Responses are scored on a 4-point scale from 1-4 (*False* to *Very true*). Gleaves et al. (2013) have provided evidence of reliability and validity of the scores provided by the EHQ in the form of factor structure, internal reliability, and test-retest reliability. Other versions of the instrument have also compared favourably to different measures of orthorexia (Meule et al., 2020).

Statistical Analysis

We inspected data for univariate (z-score exceeding +/- 3.29) and multivariate outliers at subscale level (Tabachnick & Fidell, 2007) and used McDonald's Omega to assess scores for internal consistency ($\omega > .70$). As additional supplementary analyses, we also conducted Confirmatory Factor Analysis (CFA) and Exploratory Structural Equation Modelling (ESEM) both with Robust Maximum Likelihood estimation and using target rotation for ESEM on the scores. Conventional criteria were used to evaluate fit: $\chi 2$ (df) $p > .05$,

comparative-fit index (CFI) and Tucker Lewis index (TLI) > .90, root mean square error of approximation (RMSEA) < .08, 90% confidence interval (CI) [< .05, < .08], standardized root mean square residual (SRMR) < .08, Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC) (smaller indicates better fit in model comparison; Marsh et al., 2004).

We then conducted the cumulating meta-analyses in two steps (Braver et al., 2014). First, a random-effects model was used to estimate relations between perfectionism and orthorexia using the three original samples reported in Pratt et al. (2024). Second, we added our three new samples to the meta-analysis and re-estimated the effects. The addition of three samples (versus one sample) in the cumulating meta-analysis has the advantages of increasing statistical power by reducing sampling error, boosting estimate precision, and providing less biased estimates of effects (Bornstein et al., 2009).

In line with Pratt et al. (2024), we also re-estimated the total unique effect of perfectionism specifically for sport and exercise samples. The total unique effect is a standardised change score (TUE = $\beta_{PS} + \beta_{PC}$) signalling the increase or decrease in orthorexia as both perfectionism dimensions increase (Hill et al., 2021). This is supplemented by estimates of the relative weights of PS and PC which is the amount of variance each dimension explains in the overall prediction of orthorexia (Tonidandel & LeBreton, 2011).

Meta-analyses were conducted using Meta-Essentials software (Suurmond et al., 2017) and the total unique effect and relative weights of perfectionism were calculated using web-based tools provided in the form of Shiny Apps (Hill, 2025; Tonidandel & Lebreton, 2015).

Results

Preliminary analysis

There were no missing values as participants were required to provide answers to all questions or opt out of completing the questionnaire (i.e., all starters completed the questionnaire in full). For Sample one, two univariate outliers and one multivariate outlier (Mahalanobis distance > $\chi^2_{[5]} = 20.52$, $p < .001$) were removed (final $N = 255$). For Sample two, no outliers were found (final $N = 297$). For Sample three, three univariate outliers but no multivariate outliers were removed (final $N = 278$).

McDonald's Omega showed all scores had satisfactory internal consistency ($\omega > .70$). In assessing the HF-MPS in each sample, the 10-item, two-factor model generally provided adequate fit for both CFA and ESEM, but particularly for the ESEM, and had few meaningful cross-loadings (≥.32; Costello & Osborne, 2005) on non-target items (4 of 15) in the ESEM. As such, we had no concerns regarding the reliability of the scores for the HF-MPS. In assessing the EHQ in each sample, the 21-item, three factor model provided inadequate fit when using CFA but adequate fit when using ESEM for two of the three samples. The ESEMs generally provided a small number of meaningful cross-loadings (≥.32) on non-target items (21 of 126) which we considered reasonable given the multidimensional structure of the scale. The misfit in sample 3 was the result of a lack of discernible third factor (positive feelings about healthy eating) with meaningful cross-loadings instead on the second factor (problems associated with healthy eating). This suggests a two rather than three-factor structure of the EHQ in this sample. Noting the satisfactory internal reliability of all subscales in this sample, and to be consistent across samples, we included all subscales in our analyses but have noted the implications in the discussion. Results of the CFA and ESEM are reported in full in supplementary materials (Tables S2 to S4).

Descriptive Statistics and Bivariate Correlation Coefficients

Descriptive statistics and bivariate correlations for the three samples are reported in Table 1. Based on response formats, levels of SOP, SPP, and orthorexia were moderate.

Across all three samples, PS showed significant medium-to-large positive correlations with total orthorexia and most orthorexia subscales. PC displayed a similar pattern of relationships but these were typically smaller in size and unrelated to one aspect of orthorexia (knowledge of healthy eating).

Continuously Cumulating Meta-Analysis

Results of the continuously cumulating meta-analysis are presented in Table 2. Estimates based on the original three samples showed that PS had a significant small-to-medium positive relationship with orthorexia (r^{+} = .22 [.07, .36]) whereas PC had a non-significant small-to-medium positive relationship with orthorexia (r^{+} = .21 [-.30, .63]). After inclusion of the additional three samples, re-estimates of the effects indicated that PS had a significant medium-sized positive relationship with orthorexia (r^{+} = .31 [.15, .46]) and PC had a significant small-to-medium positive relationship with orthorexia (r^{+} = .26 [.11, .40]). Supplementary materials include a continuously cumulating meta-analysis that include partial corelations (Table S5).

Total Unique Effect and Relative Weights of Perfectionism

The total unique effect of PS and PC was medium-sized and significant (TUE = .37 [.28, .45], n = 1717). Perfectionism explained 11% of the variance in orthorexia (R^2_{MODEL} = .11). Relative weight analysis showed that PS (RW^{PS} = .068; 63.25%) made a larger contribution to the variance explained in the model than PC (RW^{PC} = .040; 36.75%).

Discussion

The aims of the present study were to collect three independent samples from sport and exercise populations, to examine the relationship between multidimensional perfectionism and orthorexia, and to re-estimate effects of multidimensional perfectionism on orthorexia in sport and exercise using a cumulating meta-analytical approach. Consistent with

our hypotheses, both PS and PC were positively related to almost all aspects of orthorexia in the new samples and to total orthorexia in the meta-analyses.

Revisiting multidimensional perfectionism and orthorexia

The relationships between perfectionism and orthorexia in the three new samples were largely consistent in regard to the direction and size of effects. Both PS and PC were positively related to almost all subscales of orthorexia. In terms of total orthorexia, both PS and PC showed positive correlations ranging from small-to-medium to large in all three of the samples. In these regards, our findings were similar to those observed in the three previous studies in a sport and exercise domain (Domingues & Carmo, 2021; Mavrandrea & Gonidakis, 2022; Pratt et al., 2023). However, perhaps reflecting the use of the same instruments, the relationships appeared more consistent in our samples.

Notably, the subscale knowledge of healthy eating was unrelated to PC in all samples and unrelated to PS in the sample of primarily recreational and competitive runners. This aspect of orthorexia pertains to seeking a diet that is "more informed", "healthier" and "superior" to others. Based on these findings, it does not appear as central to the perfectionism-orthorexia relationship as orthorexia's other aspects. However, it is notable that PC has been found to predict increases in this subscale over time (Pratt et al., 2023). Therefore, further research is needed to better understand this relationship and establish whether perfectionism may or may not contribute to this aspect of orthorexia.

The overall relationships were confirmed when re-calculating the meta-analytical effects of Pratt et al. (2024) with the three new samples. Both PS and PC were positively and significantly related to orthorexia to a medium and small-to-medium degree, respectively. Previously, Pratt et al. (2024) found that orthorexia showed a significant small-to-medium positive correlation with PS and a non-significant relationship with PC in the sport and exercise domain. Our new estimates are more closely aligned with other meta-analytical

research on perfectionism and eating disorders which implicates both PS and PC (e.g., Stackpole et al., 2023), and helps to clarify and confirm the status of PC as a potential risk factor for orthorexia in a sport and exercise domain. While sport and exercise can offer considerable health benefits, then, it appears that if participation is underpinned by perfectionism, either PS or PC, it is a domain in which obsessive healthy eating may develop.

Of further note is the prominent role of PS in orthorexia. Overlapping confidence intervals means that differentiating between PS and PC is difficult, but the total unique effect of perfectionism did signal that PS is most responsible for the overall relationship. This is a noteworthy finding both because when examining eating disorders, generally, PC typically has the stronger relationship (Stackpole et al., 2023) and because PS is a dimension of perfectionism that has been identified as potentially adaptive for athletes (e.g., Stoeber, 2011). In regards to the former issue, it has been speculated that the prominent role of PS may relate to how irrational nutritional beliefs associated with orthorexia may be more closely, or at least just as closely, tied to "idealisation" than the negative self-evaluations that maintain other eating disorders (Pratt et al., 2023). Regardless, there appears to be a need for PS to be repositioned within a sport and exercise domain so that fuller consideration of its links to eating disorders and orthorexia is taken into account when describing its possible effects.

Additional implications of our findings relate to a need for further research in a sport and exercise domain to examine multidimensional perfectionism and eating disorders. This relationship is examined extensively in other domains and now includes multiple meta-analyses (see Hill et al., 2025). However, research in a sport and exercise domain lags behind. More research is sorely needed to better inform those who work in this domain and who will likely encounter perfectionism and eating disorders regularly among their clientele. In the meantime, we encourage researchers and practitioners to consider the utility of the

transdiagnostic model of eating disorders to inform their work (Fairburn et al., 2003). This model positions perfectionism ("clinical perfectionism" which is considered unidimensional) as a key risk factor across multiple eating disorders and has led to the development of interventions that have been shown to reduce both perfectionism and eating disorders (see Robinson & Wade, 2021). The effectiveness of these interventions for multidimensional perfectionism and orthorexia is currently unknown, but this model and the wider evidence-base provide an important starting point for testing and applying interventions in a sport and exercise domain.

In regards to the use of continuously cumulating meta-analyses, we note that this approach is not common in sport and exercise psychology but it is often used in other areas of psychology (Braver et al., 2014). Like all methodological and statistical approaches, it can be misused and has limitations. For example, Vosgerau et al (2019) have shown how the validity of meta-analyses of a similar kind ("internal meta-analyses") only holds in the absence of selective reporting and when all studies (or samples) are included in the analyses (as is the case in this pre-registered study). However, with these caveats in mind, in the current study we have shown one of its main benefits in how it can be used to revisit and clarify ambiguous relationships. We therefore encourage others to consider adopting this approach in sport and exercise psychology to ensure researchers and practitioners have the most accurate and up-to-date estimates of effects. It will also avoid redundancy and unnecessary work when effects no longer change. This approach is likely to continue to be useful in the perfectionism area – as new work emerges, the relationship between perfectionism and orthorexia can be further updated. It will also likely prove useful generally in sport and exercise psychology.

Limitations

The study has several limitations. First, when generalising the findings consideration should be given to the features of the samples. For example, eating disorders and disordered

eating symptoms can depend on age and our samples comprise only adults (e.g., Rohde et al., 2017). In addition, we did not record information on mental illness diagnoses among participants so the degree to which any pre-existing eating disorders were evident in the current sample is unknown. It is not common in this area to record this information. However, doing so would allow for examination of the possibility that the relationship between perfectionism and orthorexia is stronger in exercisers who have had or currently have a formally diagnosed eating disorder or that once this status is taken into account, the effect of perfectionism is diminished. These are interesting possibilities for future research. Second, consideration of the instruments used is also required. Other measures of perfectionism and orthorexia are available and may produce different effects (see Pratt et al., 2024). Of note, we were able to confirm reasonable factor structure and internal reliability of the EHQ in two of the three samples. However, in the sample that comprised primarily recreational and competitive runners there was evidence that one of the subscales (positive feelings about healthy eating) was not structurally independent of the other subscales. Therefore, some caution is needed when interpreting correlations in that sample along with further research to better determine the factorial validity of the instrument in these types of samples. Third, all data included in the meta-analyses were cross-sectional and therefore no inferences of causality can be made. Future work should consider adopting longitudinal designs to strengthen this aspect of the work. Finally, due to the small number of studies included, we did not explore moderation of meta-analytical effects (see Pratt et al., 2024). This type of analysis will be valuable when more studies become available.

Conclusion

We provide the first cumulating meta-analysis of perfectionism and orthorexia. In doing so, we have clarified the relationship between PC and orthorexia, in particular, and confirmed that both PS and PC are possible risk factors for orthorexia in sport and exercise.

While sport and exercise are advised, for some participants, it may be a domain in which perfectionism leads to obsessive healthy eating.

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Table 1. Descriptive statistics and bivariate correlations for all samples.

	1	2	3	4	5	M	SD	McDonald's ω
Sample 1								
1. Perfectionistic strivings						4.95	1.33	.91
2. Perfectionistic concerns	.57***					3.70	1.30	.83
3. Total orthorexia	.53***	.30***				2.36	0.54	.91
4. Knowledge of healthy eating	.33***	.05	.73***			2.72	0.79	.80
5. Problems associated with healthy eating	.53***	.34***	.96***	.57***		2.03	0.57	.88
6. Positive feelings about healthy eating	.39***	.22***	.76***	.51***	.61***	3.23	0.62	.74
Sample 2								
1. Perfectionistic strivings						4.48	1.48	.91
2. Perfectionistic concerns	.70***					3.63	1.33	.84
3. Total orthorexia	.41***	.35***				2.21	0.48	.89
4. Knowledge of healthy eating	.16**	.08	.64***			2.65	0.76	.80
5. Problems associated with healthy eating	.43***	.38***	.94***	.42***		1.84	0.51	.87
6. Positive feelings about healthy eating	.27***	.23***	.73***	.46***	.53***	3.14	0.61	.74
Sample 3								
1. Perfectionistic strivings						3.91	1.54	.93
2. Perfectionistic concerns	.73***					3.42	1.42	.89
3. Total orthorexia	.27***	.25***				1.90	0.40	.87
4. Knowledge of healthy eating	.03	.04	.66***			2.33	0.72	.81
5. Problems associated with healthy eating	.27***	.27***	.93***	.43***		1.58	0.40	.82
6. Positive feelings about healthy eating	.29***	.20**	.77***	.41***	.57***	2.71	0.62	.71

Note. Sample 1 $N = 255$. Sample 2 $N = 297$. Sample 3 $N = 278$. $**p < .01$. $***p. < .001$.

Table 2. Results of the continuously cumulating meta-analysis examining the relationship between perfectionism and orthorexia.

Study	*N*	Sample	Age (SD)	% Female	Orthorexia Instrument	Perfectionism Instrument	PS	PC	*r* PS-O	*r* PC-O
Domingues & Carmo (2021)	469	Yoga practitioners	35-54 (NR)	84.0%	TOS-ON	F-MPS	PSt	CM	.25	.42
Mavrandrea & Gonidakis (2022)	241	Gym members and CrossFit athletes	26.30 (NR)	48.5%	ORTO-15	APS	HS	D	.14	.07
Pratt et al. (2023)	177	Gym members	27.70 (9.61)	38.4%	EHQ	HF-MPS	SOP	SPP	.24	.11
Original r^+ (95% CI)	887								.22 (.07, .36)	.21 (-.30, .63)
Sample 1	255	Gym members	33.92 (8.58)	29.4%	EHQ	HF-MPS	SOP	SPP	.53	.30
Sample 2	297	Functional athletes	33.89 (8.65)	53.5%	EHQ	HF-MPS	SOP	SPP	.41	.35
Sample 3	278	Recreational/competitive runners	41.15 (13.14)	55.4%	EHQ	HF-MPS	SOP	SPP	.27	.25
Cumulating r^+ (95% CI)	1717								.31 (.15, .46)	.26 (.11, .40)

Note. r^+ = weighted mean *r*; 95% CI = 95% confidence interval; *N* = number; PS = perfectionistic strivings; PC = perfectionistic concerns; O = orthorexia; EHQ = Eating habits questionnaire (Gleaves, Ambwani, & Graham, 2013); NR = not reported; HF-MPS = Hewitt-Flett Multidimensional perfectionism scale (Hewitt & Flett, 1991); SOP = self-oriented perfectionism; SPP = socially prescribed perfectionism; PSt = perfectionistic standards; CM = concern over mistakes perfectionism; HS = high standards; D = discrepancy; PS-PC = correlation between perfectionistic strivings and perfectionistic concerns; PS-O = correlation between perfectionistic strivings and orthorexia; PC-O is correlation between perfectionistic concerns and orthorexia.

Supplementary Materials

Table S1. Overlap between samples in regards to types of exercise.

	Gym-goers	Functional athletes	Recreational/competitive runners
Are you currently a member of a gym?	258	272	177
Do you partake in CrossFit or functional style training?	0	297	47
Are you a recreational/competitive runner?	92	109	281
N	258	297	281

Table S2. Fit Indices for the CFA and ESEM models for perfectionism and orthorexia subscales.

Model	χ^2 (Correction)	*df*	RMSEA (90% CI)	SRMR	TLI	CFI	AIC	BIC
Sample 1								
HF-MPS CFA	101.47 (1.15)	34	0.09 (0.07-0.11)	0.08	0.92	0.94	8440.51	8550.29
HF-MPS ESEM	41.51 (1.13)	26	0.05 (0.02-0.08)	0.02	0.98	0.99	8480.15	8618.72
EHQ CFA	529.07 (1.06)	186	0.09 (0.08-0.09)	0.08	0.80	0.83	12328.30	12562.03
EHQ ESEM	295.35 (1.01)	150	0.06 (0.05-0.07)	0.04	0.90	0.93	12138.54	12499.75
Sample 2								
HF-MPS CFA	140.88 (1.21)	34	0.10 (0.09-0.12)	0.07	0.90	0.93	9986.253	10100.759
HF-MPS ESEM	57.92 (1.24)	26	0.06 (0.04-0.09)	0.03	0.96	0.98	9903.96	10048.01
EHQ CFA	526.42 (1.06)	186	0.08 (0.07-0.09)	0.08	0.80	0.83	13642.77	13886.56
EHQ ESEM	321.69 (0.99)	150	0.06 (0.05-0.07)	0.04	0.88	0.91	13471.80	13848.56
Sample 3								
HF-MPS CFA	192.67 (1.24)	34	0.13 (0.11-0.15)	0.06	0.88	0.91	8833.46	8945.92
HF-MPS ESEM	103.01 (1.21)	26	0.10 (0.08-0.12)	0.03	0.93	0.96	8822.06	8963.95
EHQ CFA	671.61 (1.12)	186	0.10 (0.09-0.11)	0.09	0.67	0.71	11760.65	12000.07
EHQ ESEM	536.84 (0.96)	150	0.10 (0.09-0.11)	0.06	0.76	0.77	11593.19	11963.20

Note. X^2 = Chi-Square, Correction = Scaling correction for robust maximum likelihood estimator, RMSEA = Root Mean Square Error of Approximation, CI = Confidence Interval, SRMR = Standardized Root Mean Residual, Tucker Lewis Index, CFI = Comparative Fit Index, AIC = Akaike Information Criteria, BIC = Bayes Information Criterion, HF-MPS = Hewitt-Flett Multidimensional Perfectionism Scale (1991), EHQ = Eating Habits Questionnaire (Gleaves, Graham, & Ambwani, 2013).

Table S3. Standardized factor loadings from CFA and ESEM models for the perfectionism subscales.

	Sample 1			Sample 2			Sample 3		
	CFA	ESEM		CFA	ESEM		CFA	ESEM	
Item	F1	F1	F2	F1	F1	F2	F1	F1	F2
SOP1	**.80**	-.00	**.81**	**.82**	-.00	**.83**	**.85**	-.01	**.87**
SOP2	**.82**	.02	**.82**	**.82**	.01	**.82**	**.86**	-.08	**.94**
SOP3	**.90**	-.02	**.82**	**.91**	-.00	**.91**	**.92**	.02	**.91**
SOP4	**.85**	.18	**.74**	**.86**	.17	**.73**	**.91**	.20	**.75**
SOP5	**.64**	.04	**.64**	**.67**	.27	**.47**	**.72**	.31	**.50**
SPP1	**.53**	**.24**	.46	**.61**	**.21**	.40	**.76**	**.35**	.51
SPP2	**.66**	**.53**	.19	**.68**	**.42**	.32	**.82**	**.61**	.25
SPP3	**.79**	**.82**	-.05	**.80**	**.94**	-.14	**.81**	**.95**	-.13
SPP4	**.88**	**.92**	-.04	**.88**	**.87**	.04	**.85**	**.90**	-.02
SPP5	**.61**	**.71**	-.15	**.58**	**.67**	-.11	**.70**	**.79**	-.12

Note. All target factor loadings are significant at $p < .05$ (two-tailed; denoted in bold). Underline loadings indicative significant cross-loading. SOP = self-oriented perfectionism; SPP = socially prescribed perfectionism.

Table S4. Standardized factor loadings from CFA and ESEM models for the orthorexia subscales.

	Sample 1				Sample 2				Sample 3			
	CFA	ESEM			CFA	ESEM			CFA	ESEM		
Item	F1	F1	F2	F3	F1	F1	F2	F3	F1	F1	F2	F3
K1	**.63**	**.43**	.25	.18	**.60**	**.57**	.04	.11	**.52**	**.52**	.06	.05
K2	**.83**	**.40**	.33	.15	**.84**	**.71**	.14	.09	**.86**	**.85**	.01	-.01
K3	**.73**	**.29**	.19	.28	**.79**	**.60**	.06	.20	**.87**	**.90**	-.08	.12
P1	**.62**	.31	**.62**	-.16	**.63**	.20	**.58**	-.06	**.58**	.12	**.49**	-.06
P2	**.73**	.42	**.45**	.12	**.55**	.28	**.27**	.30	**.65**	.35	**.47**	-.18
P3	**.86**	.36	**.68**	.04	**.74**	.23	**.77**	-.19	**.73**	-.05	**.83**	-.33
P4	**.34**	-.43	**.58**	.04	**.60**	-.22	**.62**	.18	**.42**	.05	**.36**	.45
P5	**.77**	.27	**.72**	-.08	**.74**	.11	**.84**	-.23	**.62**	-.07	**.70**	-.20
P6	**.67**	-.33	**.65**	-.08	**.49**	-.37	**.60**	.08	**.26**	-.25	**.37**	.49
P7	**.34**	-.06	**.33**	.10	**.38**	.13	**.38**	-.08	**.33**	.14	**.28**	-.10
P8	**.46**	-.17	**.58**	.02	**.53**	-.09	**.49**	.14	**.33**	.04	**.26**	.40
P9	**.46**	-.11	**.63**	-.09	**.57**	-.04	**.66**	-.12	**.66**	-.13	**.74**	-.14
P10	**.33**	-.18	**.49**	-.03	**.44**	-.10	**.53**	-.07	**.26**	-.08	**.27**	.24

P11	**.58**	-.03	**.58**	.07	**.48**	-.06	**.52**	.16	**.51**	.08	**.42**	.32
P12	**.38**	-.36	**.67**	-.07	**.54**	-.31	**.65**	.07	**.27**	-.11	**.30**	.49
P13	**.83**	.39	**.53**	.18	**.68**	.23	**.57**	.01	**.68**	-.01	**.69**	-.09
P14	**.71**	.27	**.30**	.40	**.57**	.28	.28	.31	**.50**	.18	.38	.03
F1	**.58**	-.04	.24	**.42**	**.49**	.03	-.05	**.59**	**.47**	.09	.29	.16
F2	**.67**	-.17	.24	**.57**	**.71**	-.03	.20	**.61**	**.76**	.15	.53	.11
F3	**.73**	.45	.10	**.58**	**.74**	.23	.17	**.50**	**.61**	.28	.34	.03
F4	**.59**	-.05	-.23	**.86**	**.56**	.10	.03	**.50**	**.59**	.12	.33	.24

Note. All target factor loadings are significant at $p < .05$ (two-tailed; denoted in bold). Underline loadings indicative significant cross-loading. K = knowledge of healthy eating subscale, P = problems associated with healthy eating subscale, F = positive feelings about healthy eating subscale.

Table S5. Continuously cumulating meta-analytical relationships between perfectionism dimensions and orthorexia.

Predictor variables	*k*	*N*	r^+	95% CI
Perfectionistic strivings	6	1717	.31	.15, .46
Perfectionistic concerns	6	1717	.26	.11, .40
Partial perfectionistic strivings	6	1717	.21	.06, .36
Partial perfectionistic concerns	6	1717	.10	-.06, .25

Note. k = number of studies; r^+ = weighted mean r; 95% CI = 95% confidence interval.