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A longitudinal study of perfectionism and orthorexia in exercisers

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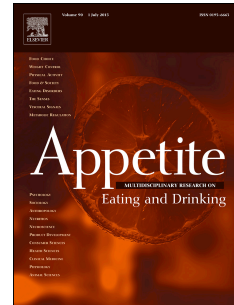
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7   **A Longitudinal Study of Perfectionism and Orthorexia in Exercisers**

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26 **Abstract**

27 Research suggests that trait perfectionism and perfectionistic self-presentation are related to

28 orthorexia – a pathological obsession with correct nutrition. However, no studies have

29 examined these relationships over time or compared the influence of the two aspects of

30 perfectionism on orthorexia. In the present study we sought to address these two issues. Gym

31 members who engaged in high degrees of exercise were recruited via social media

32 platforms. They completed an online questionnaire that included the

33 Multidimensional Perfectionism Scale-Short Form, Perfectionistic Self-Presentation Scale,

34 and the Eating Habits Questionnaire on two occasions: 177 participants (Mean age = 31.6

35 years) initially completed the questionnaire and 82 completed the questionnaire six weeks

36 later. A series of multiple regression analyses revealed that (i) trait perfectionism predicted an

37 increase in orthorexia symptomatology over time with socially prescribed perfectionism and

38 other-oriented perfectionism unique predictors of orthorexia, (ii) perfectionistic self-

39 presentation predicted orthorexia over time with nondisplay of imperfection a unique

40 predictor of orthorexia, and (iii) when considered alongside each other, only trait dimensions

41 of perfectionism were unique predictors of orthorexia. The present study provides further

42 evidence that perfectionism is related to orthorexia. In addition, the study also provides

43 preliminary evidence that more engrained trait aspects of perfectionism are more predictive

44 of intensifying orthorexia over time than the self-presentational aspects of perfectionism.

45

46 *Keywords:* disordered eating, eating disorder, perfectionism, perfectionistic self-presentation,

47 exercise, orthorexia

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1. Introduction

Diet is an important aspect of maintaining a healthy lifestyle. A healthy diet is associated with longevity and reduced risk of diseases, such as cancer, heart disease, and diabetes (McComb & Mills, 2019). However, because pressures to eat, exercise, and look a certain way pervade modern society (e.g., Braun, Park, & Gorin, 2016), there is evidence that an obsession with healthy eating – known as orthorexia – is on the rise (Plichta & Jezewska-Zychowicz, 2019). In the present study, we aimed to further understand the factors implicated in the development of orthorexia and do so by focusing on perfectionism. To build on previous research, we provide the first test of (i) whether trait perfectionism predicts orthorexia over time, (ii) whether perfectionistic self-presentation predicts orthorexia over time, and (iii) whether trait perfectionism or perfectionistic self-presentation is most important in predicting orthorexia over time.

1.1. Orthorexia

Orthorexia is a pathological obsession with correct nutrition that is characterised by restrictive dietary practices, ritualised patterns of eating, and rigid avoidance of foods believed to be unhealthy or impure (Koven & Abry, 2015). Orthorexia was first defined by physician Steven Bratman (1997) and is derived from a Greek neologism (ὀρθός, right and ὄρεξις, appetite) meaning "correct appetite." Orthorexia is not officially recognized as an eating disorder or obsessive-compulsive classification in either the DSM-5 or the ICD-11. However, diagnostic criteria have been proposed by Dunn and Bratman (2016) based on an extensive review of research, existing criteria, case studies, and available measures. The narrative description of orthorexia he provides is of an "Obsessive focus on "healthy" eating, as defined by a dietary theory or set of beliefs whose specific details may vary; marked by exaggerated emotional distress in relationship to food choices perceived as unhealthy; weight loss may ensue as a result of dietary choices, but this is not the primary goal" (p. 16).

75   The exclusion of orthorexia from the DSM-5 and ICD-11 reflects uncertainty in

76 whether orthorexia is an antecedent, a maintaining factor, or a consequence of eating

77 disorders (Brytek-Matera et al. 2020). Some of the possibilities include that orthorexia is a

78 subthreshold eating disorder or becomes evident in recovery from an eating disorder (Bartel

79 et al., 2020). Alternatively, orthorexia may be a distinct eating disorder itself or be indictive

80 of an existing eating disorder with particular and additional symptoms (e.g., claiming health

81 reasons to camouflage restrictive eating behaviour; Bartel et al., 2020). Work is ongoing to

82 resolve this uncertainty. At this point, it seems that ascribing orthorexia solely to anorexia

83 nervosa would be a misnomer and that orthorexia is relevant in clinical domains.

84   There are a number of ways to measure orthorexia. In the current study we use

85 Gleaves, Graham, and Ambwani (2013) multidimensional model of orthorexia. This captures

86 orthorexia via three dimensions. The first is *problems associated with healthy eating* that

87 measures behaviours linked with a pathological fixation with healthy eating. The second is

88 *knowledge of healthy eating,* which assesses cognitions associated with an obsessive fixation

89 of healthy eating. The third is *feeling positively about healthy eating* that measures feelings

90 related to a morbid preoccupation with healthy eating. All orthorexia dimensions have been

91 related to eating disorder symptomology and body dissatisfaction (e.g., Brytek-Matera,

92 Plasonja & Decamps, 2020). The use of this particular measure is advantageous as there is

93 strong evidence that orthorexia is multidimensional whereas most other measures are

94 unidimensional or bidimensional (Hallit, Brytek-Matera & Obeid, 2021).

95   In regard to the development of orthorexia, a growing number of studies have

96 identified factors that place people at risk to higher orthorexia scores. These include personal

97 factors (e.g., depressive symptoms; Lasson & Raynal, 2021) and lifestyle factors (e.g., yoga

98 practice; Zickgraf & Barrada, 2022). Of note for the current study, research suggests that

99 personality is important with neuroticism and narcissism positively correlated with orthorexia

100   (e.g., Martinovic et al., 2022; Strahler, 2020). Exercise engagement (participation and

101   frequency), too, continues to be positively correlated with orthorexia in research (e.g.,

102   Martinovic et al., 2022). This includes exercise addiction or dependence which suggests that

103   exercise is a salient context in which to study orthorexia and identify risk factors (Strahler,

104   Wachten & Mueller-Alcazar, 2021). In the present study we build on this research by

105   focusing on aspects of perfectionism as risk factors to orthorexia in regular exercisers.

106   **1.2. Trait Perfectionism and Orthorexia**

107   Trait perfectionism is characterized by setting high standards of performance and

108   overly critical self-evaluation (Frost et al., 1990). As a trait, it represents a stable and

109   engrained way of thinking, feeling, and behaving. One of the most prominent models of trait

110   perfectionism is provided by Hewitt and Flett (1991). This model differentiates among three

111   dimensions of trait perfectionism: self-oriented perfectionism (demanding perfection from

112   oneself), socially prescribed perfectionism (believing others expect perfection from oneself),

113   and other-oriented perfectionism (demanding perfection from others). The two former

114   dimensions are intrapersonal aspects of perfectionism (i.e., focused on the self), while the

115   latter is an interpersonal aspect of perfectionism (i.e., focused on others).

116   Trait perfectionism has long been recognised as a risk factor for eating disorders, with

117   several models including it (e.g., Fairburn's transdiagnostic model of eating disorders;

118   Fairburn, Cooper & Shafran, 2003). Evidence of the relationship between trait perfectionism

119   and eating disorders has been provided a meta-analysis by Limburg et al. (2017) who found

120   that perfectionistic strivings (inclusive of self-oriented perfectionism) had a positive, small-

121   to-medium, relationship (based on Cohen's [1992] benchmarks of small, $r \geq .10$, medium, r

122    $\geq .30$, and large, $r \geq .50$) with both anorexia nervosa and bulimia nervosa. They also found

123   that perfectionistic concerns (inclusive of socially prescribed perfectionism) had a positive,

124   large, relationship with anorexia nervosa and a positive, medium, relationship with bulimia

125 nervosa. Self-oriented perfectionism and socially prescribed perfectionism have also been

126 found to be positively related to eating disorders themselves (e.g., Stoeber et al., 2017).

127   As unrealistically high standards and self-critical appraisals guide behaviour in trait

128 perfectionism, it is possible that they play a role in orthorexia if their focus becomes a healthy

129 diet (viz. orthorexia). Popular commentary has even characterised orthorexia as the pursuit of

130 the "perfect diet" (Schwartz, 2015). In regard to empirical evidence, consistent with what has

131 been found for eating disorders, there is an emerging body of research that links trait

132 perfectionism with orthorexia. To date, two of these studies have used Hewitt and Flett's

133 (1991) measures of trait perfectionism to examine the relationship between trait

134 perfectionism and orthorexia (Barnes & Caltabiano, 2017; Myrissa, Jackson, & Kelaiditi,

135 2021). Both studies found evidence that these dimensions of trait perfectionism have positive,

136 small-to-medium, relationships with orthorexia (for Barnes & Caltabiano, 2017, all

137 dimensions, and for Myrissa, Jackson, and Kelaiditi (2021), just other-oriented

138 perfectionism).

139 **1.3. Perfectionistic Self-Presentation and Orthorexia**

140   Perfectionism can also manifest as a self-presentational style. Perfectionistic self-

141 presentation is conceptually distinct from trait perfectionism as it focuses on a need to *appear*

142 *perfect* in the eyes of others rather than *be perfect* (Sherry et al., 2007). Hewitt et al. (2003)

143 conceptualised perfectionistic self-presentation as three distinct dimensions of perfectionistic

144 self-promotion (promoting a perfect image of oneself to others), nondisplay of imperfection

145 (avoidance of behavioural displays of imperfection), and nondisclosure of imperfection

146 (avoidance of verbal disclosure of imperfection; Sherry et al., 2007). All perfectionistic self-

147 presentation dimensions are interpersonal in focus. In distinguishing between trait

148 perfectionism and perfectionistic self-presentation, a further useful distinction is that trait

149   perfectionism captures who people are, whereas perfectionistic self-presentation captures

150   how people would like to be viewed.

151   Like trait perfectionism, perfectionistic self-presentation is associated with various

152   adverse mental health outcomes (Hewitt et al., 2003). Relevant to the current study is work

153   that evidences that perfectionistic self-presentation is positively related to eating disorder

154   symptoms, body image, and exercise dependence (e.g., Ferreria et al., 2018; Paixao et al.,

155   2020; Hill, Robson, & Stamp, 2015). Importantly, there is also research that has shown all

156   dimensions of perfectionistic self-presentation to predict eating disorder symptomatology

157   (i.e., dieting, bulimia, and oral control) alongside trait perfectionism (Stoeber et al., 2017).

158   Fundamentally, perfectionistic self-presentation may be an important risk factor for eating

159   disorders, and possibly orthorexia, independent of trait perfectionism.

160   There are reasons to suspect that perfectionistic self-presentation may be particularly

161   important in the development of orthorexia. This is because the potential for the need to

162   appear perfect to others to include the body and dietary practices – looking the "right" way

163   and appearing to make the "right" choices. To date, one study has examined the relationship

164   between perfectionistic self-presentation and orthorexia. In this study, Pratt, Madigan, and

165   Hill (2021) found that two dimensions of perfectionistic self-presentation – perfectionistic

166   self-promotion and nondisplay of imperfection – were positively related to orthorexia in

167   exercisers with perfectionistic self-promotion the strongest unique predictor. Accordingly, in

168   the same way that wanting to be perfect (trait perfectionism) is linked to increased orthorexia,

169   so is wanting to appear perfect (perfectionistic self-presentation).

170   **1.4. Trait Perfectionism, Perfectionistic Self-presentation, and Orthorexia**

171   The present study extends previous research in three ways. First, all previous studies

172   examining trait perfectionism and orthorexia, and perfectionistic self-presentation and

173   orthorexia, have been cross-sectional in design. However, longitudinal designs are required in

174   order to introduce temporal precedence, examine prediction over time, and provide stronger

175   evidence for causation (Wang et al., 2017). Second, as yet, no studies examine whether trait

176   perfectionism or perfectionistic presentational style is more important in predicting

177   orthorexia. While the two aspects are distinct, they are positively related, which makes

178   identifying their particular importance more difficult. In practical terms, this will help

179   identify whether interventions should focus on addressing trait perfectionism, perfectionistic

180   presentational styles, or both. Third, to date, research examining the aforementioned

181   relationships has largely relied on unidimensional measures of orthorexia and has been

182   unable to examine whether different symptoms have different predictors.

183   **1.5. The Present Study**

184   The aim of the present study was to provide the first test of (i) whether trait

185   perfectionism predicts orthorexia over time, (ii) whether perfectionistic self-presentation

186   predicts orthorexia over time, and (iii) whether trait perfectionism or perfectionistic self-

187   presentation is most important at predicting orthorexia over time. It was hypothesised that

188   both trait perfectionism dimensions and perfectionistic self-presentational dimensions would

189   predict orthorexia over time but, with a focus on how one appears to others, perfectionistic

190   self-presentation would be the most important predictor of orthorexia over time.

2. Methods

192   **2.1. Participants and Procedure**

193   Approval was gained from an Institutional Ethics Review Board for the study and

194   informed consent was obtained from all participants prior to taking part. The study was

195   advertised via social media platforms over a period of two months (September to November

196   2021). After responding to the advertisement, a sample of 177 exercisers completed an online

197   questionnaire at Time 1 (T1) and later 82 exercisers also completed an online questionnaire at

198   Time 2 (T2). All participants were members of community and private gyms and had

199   backgrounds in past/current gym-based sports (e.g., Strongman, CrossFit, Bodybuilding) (see

200   Table 1 for participant information). Participants were administrated measures twice six

201   weeks apart, once in February 2021 (T1) and then again in March 2021 (T2). A 6-week

202   interval was chosen based on previous longitudinal research examining eating disorders over

203   a similar time period (e.g., Puccio et al., 2018; Mackinnon et al., 2011; Smith et al., 2017).

204   Note, during this time, all participants remained members of gyms but were training from

205   home due to UK restrictions placed on these facilities as a consequence of COVID-19. No a

206   priori power analysis was conducted. Sample size was determined by response rates during

207   the recruitment period.

208

209   **Table 1.** Participant information

	Time 1	Time 2
N	177	82
Mean Age (years)	31.6 (SD = 7.9)	31.2 (SD = 8.4)
Average Weight (kg)	82.5 (SD = 21.3)	82.9 (SD = 19.9)
Average Height (cm)	173.6 (SD = 10.0)	172.8 (SD = 21.4)
Average hours of exercise (per day)		
Average number of times attended the gym (per week)		
Male (N)	109	52
Female (N)	68	29

210   Note. There was one missing response for gender at time 2.

211   **2.2. Measures**

212   **2.2.1. Trait perfectionism.** To measure trait perfectionism, we used the short form of

213   the Multidimensional Perfectionism Scale (MPS; Hewitt & Flett, 1991; short form: Cox,

214   Enns, & Clara, 2002). The MPS short form (Cox, Enns, & Clara, 2002) is a 15-item self-

215   reported questionnaire that captures self-oriented (SOP; 5 items; e.g., "I am perfectionistic in

216   setting my goals"), other-oriented (OOP; 5 items; e.g., "I do not have very high standards for

217   those around me," reverse-scored), and socially prescribed perfectionism (SPP; 5 Items; e.g.,

218   "People expect nothing less than perfection from me"). Responses are scored on a 7-point

219   Likert scale from 1 (disagree) to 7 (agree). There is evidence for the validity and reliability of

220   the short form MPS including better factorial validity than the original 45-item MSP and

221   acceptable internal consistency (Stoeber, 2015).

222   **2.2.2. Perfectionistic Self-Presentation.** To measure perfectionistic self-presentation,

223   we used the Perfectionistic Self-Presentation Scale (PSPS; Hewitt et al., 2003). The PSPS is a

224   27-items self-reported questionnaire that measures the three facets of perfectionistic self-

225   presentation. These include perfectionistic self-promotion (PSP; 10 items; "I strive to look

226   perfect to others"), nondisplay of imperfection (ND; 10 items; "I hate to make errors in

227   public"), and nondisclosure of imperfection (NDCI; 7 items; "Admitting failure to others is

228   the worst possible thing"). Responses are scored on a 7-point Likert scale from 1 (strongly

229   disagree) to 7 (strongly agree). There is evidence for the validity and reliability of the PSPS

230   including high internal validity (Hewitt et al., 2003).

231   **2.2.3. Orthorexia.** To measure orthorexia, we used the Eating Habits Questionnaire

232   (EHQ; Gleaves, Graham, & Ambwani, 2013). The EHQ is a 21-item self-reported

233   questionnaire and combines three different factors: Knowledge of healthy eating (5 items,

234   e.g., "I am more informed about healthy eating than others"), Problems associated with

235   healthy eating (12 items, e.g., "I am distracted by thought about healthy eating"), and Positive

236   feelings about healthy eating (4 items, e.g., "I feel great when I eat healthily"). Responses are

237   scored on a 4-point Likert-type scale from 1 (false) to 4 (very true). There is evidence for the

238   validity and reliability of the EHQ including good internal consistency (Brytek-Matera,

239   Plasonja, & Decamps, 2020).

240   **2.3. Data Analysis Strategy**

241   Following preliminary analyses, descriptive statistics, internal consistency

242   (McDonald's Omega), and bivariate correlations were calculated. We ran three series of

243   multiple regressions. First, we ran a series of multiple regressions to examine whether Time 2

244   orthorexia dimensions were predicted by Time 1 trait perfectionism dimensions. We then

245 tested to see whether Time 2 orthorexia dimensions were predicted by Time 1 perfectionistic

246 self-presentation dimensions using a second series of multiple regressions. Third, we entered

247 all perfectionism dimensions simultaneously in a final series of multiple regressions to assess

248 whether Time 2 orthorexia dimensions were better predicted by Time 1 trait perfectionism

249 dimensions or Time 1 perfectionistic self-presentation dimensions. These analyses allow us to

250 examine whether aspects of perfectionism predict variability in later orthorexia scores once

251 initial scores have been controlled for. The statistical analyses were not pre-registered.

<center>**3. Results**</center>

253 **3.1. Preliminary analyses**

254   We inspected the data for missing values. Because there were few missing responses

255 ($i = 2$), the missing values were replaced with the average of the remaining items. Then, the

256 data were screened for univariate and multivariate outliers. No participant showed a Z score >

257 ± 3.29 or Mahalanobis distance larger than the critical value of $\chi^2 (9) = 27.88$, $p < .001$

258 (Tabachnick & Fidell, 2007). Next, we computed McDonald's Omega for our variables (see

259 Table 3) which were all satisfactory.

260 **3.2. Descriptive statistics and bivariate correlations**

261   Descriptive statistics and bivariate correlations are reported in Tables 2 and 3. In

262 regards to descriptive statistics, note there are currently no clear cut-offs or thresholds that are

263 diagnostically meaningful for orthorexia. However, levels of orthorexia for the current

264 sample would be considered the low-to-moderate range based on the response format, and

265 depending on the particular aspect. The levels reported here are similar to those reported by

266 others in similar samples (e.g., Domingues & Carmo, 2021). Comparing Time 1 and Time 2

267 means and 95% CI, there were no statistically significant differences in reported orthorexia

268 between the time points (at overall group level). Note, this does not preclude examination of

269 residual variation between individuals' later orthorexia (once we have controlled for initial

270   scores). In regards to bivariate correlations, at Time 1, knowledge was positively related to

271   SOP and OOP; problems were positively related to all dimensions of trait perfectionism and

272   perfectionistic self-presentation; and positive feelings was positively related to SOP, SPP,

273   and OOP. At Time 2, knowledge was positively related to SOP, OOP, PSP and NDCI.

274   Problems was positively related to SOP, OOP, PSP and NDCI, and positive feelings was

275   positively related to SOP, OOP, PSP and NDCI.

276 **Table 2.** Means, 95% confidence intervals, and standard deviations

		Time 1 (all)				Time 1 (completers)				Time 2			
Variable	Response Format	N	Mean	95% CI	SD	N	Mean	95% CI	SD	N	Mean	95% CI	SD
Knowledge	1 to 4	177	2.75	[2.65, 2.85]	0.67	82	2.70	[2.55, 2.86]	0.70	82	2.62	[2.48, 2.77]	0.65
Problems	1 to 4	177	1.80	[1.72, 1.87]	0.52	82	1.73	[1.64, 1.83]	0.43	82	1.67	[1.58, 1.76]	0.43
Positive feel.	1 to 4	177	3.14	[3.06, 3.23]	0.60	82	3.11	[2.98, 3.24]	0.60	82	3.08	[2.96, 3.20]	0.55
SOP	1 to 7	177	4.44	[4.23, 4.65]	1.40	82	4.34	[4.01, 4.66]	7.43	82	4.39	[4.27, 4.70]	1.43
OOP	1 to 7	177	3.64	[3.45, 3.82]	1.23	82	3.51	[3.23, 3.79]	6.36	82	3.62	[3.35, 3.89]	1.23
SPP	1 to 7	177	3.15	[3.34, 3.87]	1.18	82	3.33	[3.09, 3.56]	5.34	82	3.58	[3.33, 3.83]	1.13
PSP	1 to 7	177	3.63	[3.44, 3.82]	1.29	82	3.57	[3.27, 3.87]	1.37	82	3.71	[3.43, 4.00]	1.30
ND	1 to 7	177	3.80	[3.59, 4.01]	1.41	82	3.68	[3.36. 4.00]	1.47	82	3.76	[3.45, 4.07]	1.40
NDCI	1 to 7	177	3.02	[2.85, 3.19]	1.16	82	2.95	[2.69, 3.20]	1.17	82	3.15	[2.89, 3.41]	1.17

277 *Note.* Time 1 N = 177, Time 2 N = 82. Knowledge = knowledge of healthy eating, Problems = Problems associated with healthy eating, Positive Feel. = Positive feelings
278 about healthy eating, SOP = self-oriented perfectionism, OOP = other-oriented perfectionism, SPP = socially prescribed perfectionism, PSP = perfectionistic self-promotion,
279 ND = nondisplay of imperfection, NDCI = nondisclosure of imperfection.

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287 **Table 3.** Bivariate correlations and McDonald's Omegas.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Time 1																		
1. Knowledge																		
2. Problems	.44**																	
3. Positive feel.	.39**	.47**																
4. SOP	.20**	.35**	.34**															
5. OOP	.29**	.34**	.21**	.63**														
6. SPP	.09	.28**	.16*	.59**	.52**													
7. PSP	.08	.39**	.14	.68**	.62**	.61**												
8. ND	-.02	.31**	.02	.52**	.45**	.53**	.82**											
9. NDCI	.07	.34**	.03	.46**	.47**	.49**	.72**	.74**										
Time 2																		
10. Knowledge	.80**	.45**	.30**	.25*	.41*	.17	.29*	.08	.25*									
11. Problems	.46**	.75**	.44**	.23*	.43*	.15	.29**	.09	.28*	.62**								
12. Positive feel.	.30**	.43**	.60**	.14	.28*	-.01	.12	-.05	.01	.37**	.57*							
13. SOP	.17	.29**	.21	.86**	.62**	.52**	.77**	.66**	.57**	.23**	.29*	.16						
14. OOP	.23*	.22*	.11	.52**	.76**	.47**	.48**	.37**	.41**	.35**	.35*	.23*	.61*					
15. SPP	-.03	.22	-.07	.47**	.43**	.77**	.56**	.51**	.51**	.12	.15	-.07	.57*	.53**				
16. PSP	.12	.28*	.11	.73**	.65**	.54**	.90**	.78**	.69**	.25**	.29*	.15	.84*	.52**	.56*			
17. ND	-.04	.17	-.03	.55**	.47**	.46**	.74**	.91**	.69**	.06	.12	.05	.69*	.42**	.55*	.81**		
18. NDCI	.15	.30**	.03	.46**	.48**	.44**	.66**	.70**	.83**	.29**	.28*	-.16	.58**	.40**	.53**	.73**	.74**	
McDonald's ω	.73	.79	.62	.90	.82	.77	.86	.90	.71	.73	.79	.62	.90	.82	.77	.86	.90	.71

288 *Note.* Time 1 N = 177, Time 2 N = 82. T2 = Time 2. ** Correlations are significant at the .01 level (two-tailed). * Correlations are significant at the .05 level (two-tailed).
289 Knowledge = knowledge of healthy eating, Problems = Problems associated with healthy eating, Positive Feel. = Positive feelings about healthy eating, SOP = self-oriented
290 perfectionism, OOP = other-oriented perfectionism, SPP = socially prescribed perfectionism, PSP = perfectionistic self-promotion, ND = nondisplay of imperfection, NDCI =
291 nondisclosure of imperfection.
292

293   **Longitudinal Multiple Regressions**

294   A series of multiple regressions were carried out to examine whether perfectionism

295   predicts orthorexia over time (see Tables 4, 5 and 6).

296   In the first series of multiple regressions, we entered Time 1 trait perfectionism

297   dimensions (self-oriented perfectionism, other-oriented perfectionism, and socially prescribed

298   perfectionism) to examine whether they predict Time 2 orthorexia dimensions, while

299   controlling for Time 1 orthorexia (knowledge, problems, and positive feelings). All three

300   models were statistically significant and accounted for 39.9% to 69.1% of variance in

301   orthorexia dimensions. Problems and positive feelings at Time 2 were significantly predicted

302   by orthorexia and other-oriented perfectionism at Time 1. Knowledge at Time 2 was

303   significantly predicted by orthorexia and socially prescribed perfectionism at Time 1.

304   In the second series of multiple regressions, we simultaneously entered Time 1

305   perfectionistic self-presentation dimensions (perfectionistic self-promotion, nondisplay of

306   imperfection and nondisclosure of imperfection) to examine whether they predict separate

307   Time 2 orthorexia dimensions, while controlling for Time 1 levels (knowledge, problems,

308   and positive feelings). All three models were statistically significant and accounted for 35.1%

309   to 67.4% of variance in orthorexia. Knowledge, and positive feelings at Time 2 were

310   significantly predicted by orthorexia at Time 1. Problems at Time 2 was significantly

311   predicted by orthorexia at Time 1 and nondisplay of imperfection at Time 1.

312   In the third series of multiple regressions, we entered Time 1 trait perfectionism

313   dimensions (self-oriented perfectionism, other-oriented perfectionism, and socially prescribed

314   perfectionism) and Time 1 perfectionistic self-presentation dimensions (perfectionistic self-

315   promotion, nondisplay of imperfection and nondisclosure of imperfection) to examine

316   whether they predict separate Time 2 orthorexia dimensions, while controlling for Time 1

317   orthorexia (knowledge, problems, and positive feelings). All three models were statistically

318   significant and accounted for 39.5% to 69.2% of variance in orthorexia. Problems and

319   positive feelings at Time 2 were significantly predicted by orthorexia at Time 1 and other-

320   oriented perfectionism at Time 1. Knowledge at Time 2 was significantly predicted by

321   orthorexia and socially prescribed perfectionism at Time 1.

322   **Table 4.** Multiple regression analysis of trait perfectionism and orthorexia.

Model	B	SE	β	*p*
Knowledge T2				
$F(4, 77) = 46.207$, p = <.001, R^2 = .71, R^2_{adj} = .69				
Knowledge T1	.74	.06	.79	<.001
Self-oriented perfectionism T1	- .01	.01	-.12	.172
Other-oriented perfectionism T1	.02	.01	.16	.052
Socially prescribed perfectionism T1	.03	.01	.21	.008
Problems T2				
$F(4, 77) = 31.226$, p = <.001, R^2 = .62, R^2_{adj} = .60				
Problems T1	.68	.07	.68	<.001
Self-oriented perfectionism T1	-.01	.01	-.08	.401
Other-oriented perfectionism T1	.02	.01	.30	.002
Socially prescribed perfectionism T1	-.003	.01	-.04	.670
Positive feel. T2				
$F(4, 77) = 14.472$, p = <.001, R^2 = .43, R^2_{adj} = .40				
Positive feelings T1	.54	.08	.60	<.001
Self-oriented perfectionism T1	-.01	.01	-.18	.128
Other-oriented perfectionism T1	.03	.01	.34	.003
Socially prescribed perfectionism T1	-.01	.01	-.08	.432

323   *Note.* Knowledge = knowledge of healthy eating, Problems = Problems associated with healthy eating, Positive
324   Feel. = Positive feelings about healthy eating, T1 = time 1, T2 = time 2. N = 82. All *p* values two-tailed.
325

326 **Table 5**

327 Multiple regression analysis of perfectionistic self-presentation and orthorexia.

Model	B	SE	β	*p*
Knowledge T2				
$F(4, 77) = 42.804$, p = <.001, $R^2 = .69$, $R^2_{adj} = .67$				
Knowledge T1	.71	.06	.76	<.001
Perfectionistic self-presentation T1	.08	.06	-.17	.151
Nondisplay of imperfection T1	-.05	.05	-.11	.363
Nondisclosure of imperfection T1	.10	.05	.17	.079
Problems T2				
$F(4, 77) = 28.662$, p = <.001, ($R^2 = .60$, $R^2_{adj} = .58$				
Problems T1	.68	.07	.69	<.001
Perfectionistic self-presentation T1	.07	.04	.24	.073
Nondisplay of imperfection T1	-.08	.04	-.29	.033
Nondisclosure of imperfection T1	.05	.04	.15	.186
Positive feel. T2				
$F(4, 77) = 11.942$, p = <.001, $R^2 = .38$, $R^2_{adj} = .35$				
Positive feelings T1	.52	.08	.57	<.001
Perfectionistic self-promotion T1	.11	.06	.27	.102
Nondisplay of imperfection T1	-.08	.06	-.02	.220
Nondisclosure of imperfection T1	-.01	.06	-.02	.904

328 *Note.* Knowledge = knowledge of healthy eating, Problems = Problems associated with healthy eating, Positive
329 Feel. = Positive feelings about healthy eating, T1 = time 1, T2 = time 2. N = 82. All *p* values two-tailed.

330 **Table 6**

331 Multiple regression analysis of trait perfectionism, perfectionistic self-presentation and

332 orthorexia.

Model	B	SE	β	*p*
Knowledge T2				
$F(7, 74) = 26.953$, p = <.001, $R^2 = .72$, $R^2_{adj} = .69$				
Knowledge T1	.73	.07	.77	<.001
Self-oriented perfectionism T1	-.01	.01	-.15	.106
Other-oriented perfectionism T1	.01	.01	.11	.206
Socially prescribed perfectionism T1	.02	.01	.17	.043
Perfectionistic self-promotion T1	.04	.07	.09	.534
Nondisplay of perfection T1	-.03	.05	-.07	.565
Nondisclosure of imperfection T1	.07	.05	.13	.165
Problems T2				
$F(7, 77) = 18.492$, p = <.001, $R^2 = .64$, $R^2_{adj} = .60$				
Problems T1	.65	.08	.66	<.001
Self-oriented perfectionism T1	-.004	.01	-.07	.490
Other-oriented perfectionism T1	.02	.01	.28	.007
Socially prescribed perfectionism T1	-.003	.01	-.04	.647
Perfectionistic self-promotion T1	.04	.05	.13	.432
Nondisplay of imperfection T1	-.07	.04	-.24	.068
Nondisclosure of imperfection T1	.04	.04	.12	.290
Positive feeling T2				
$F(7, 74) = 8.541$, p = <.001, $R^2 = .45$, $R^2_{adj} = .40$				
Positive feelings T1	.54	.09	.56	<.001
Self-oriented perfectionism T1	-.12	.01	-.24	.084
Other-oriented perfectionism T1	.03	.01	.29	.019
Socially prescribed perfectionism T1	-.01	.01	-.12	.306
Perfectionistic self-promotion T1	.12	.08	.30	.135

Nondisplay of imperfection T1	-.06	.06	-.15	.343
Nondisclosure of imperfection T1	-.02	.06	-.05	.704

333 *Note.* Knowledge = knowledge of healthy eating, Problems = Problems associated with healthy eating, Positive
334 Feel. = Positive feelings about healthy eating, T1 = time 1, T2 = time 2. N = 82. All *p* values two-tailed.

19. Discussion

335

336   The aim of the present study was to provide the first test of (i) whether trait

337 perfectionism predicts orthorexia over time, (ii) whether perfectionistic self-presentation

338 predicts orthorexia over time, and (iii) whether trait perfectionism or perfectionistic self-

339 presentation is most important at predicting orthorexia over time. We found that some

340 dimensions of trait perfectionism (other-oriented perfectionism and socially prescribed

341 perfectionism) and perfectionistic self-presentation (nondisplay of imperfection) predicted

342 increases in orthorexia symptomatology over time. In addition, we found that trait

343 perfectionism (other-oriented perfectionism and socially prescribed perfectionism), and not

344 perfectionistic self-presentation, was the most important predictor of orthorexia over time.

19.1.   Trait Perfectionism and Orthorexia

345

346   The results support previous research on the relationship between trait perfectionism

347 and orthorexia, as well as extend our understanding of this relationship. In the first study to

348 examine the relationship between these dimensions of perfectionism and orthorexia, Barnes

349 and Caltabiano (2017) found all three dimensions of perfectionism to be related to higher

350 orthorexia. In keeping with this study, we also found that trait dimensions of perfectionism

351 are generally related to higher orthorexia. However, in extending previous research, we show

352 that these relationships vary depending on the dimensions of orthorexia measured. Here, self-

353 oriented perfectionism and other-oriented perfectionism were typically related to higher

354 orthorexia across all its dimensions (problems associated with healthy eating, knowledge of

355 healthy eating, and feeling positively about healthy eating) whereas socially prescribed

356 perfectionism tended to be related only to problems associated with healthy eating. These

357 findings illustrate the importance of distinguishing between different dimensions of

358 perfectionism and different dimensions of orthorexia when examining their relationship and,

359 in turn, when considering who may be most at risk to orthorexia.

360   In regard to the notion of differing risk, other-oriented perfectionism emerged as the

361   only unique predictor of two of the dimensions of orthorexia over time – higher problems

362   associated with healthy eating and feeling positively about healthy eating. At first glance, this

363   may not be an intuitive finding – the tendency to impose the need for perfection on others

364   predicting increases in a personal focus on healthy eating. However, we note that in one of

365   the two previous studies to examine the relationship between trait perfectionism and

366   orthorexia, Myrissa, Jackson, and Kelaiditi (2021) also found only other-oriented

367   perfectionism to predict dimensions of orthorexia. We offer two speculative explanations for

368   their and our finding. The first explanation is that because both other-oriented perfectionism

369   and orthorexia share a relationship with narcissism, it is possible that this finding reflects

370   underlying self-interest and narcissistic qualities of this dimension of perfectionism (e.g.,

371   Smith et al., 2016; Stoeber, 2015; Miley et al., 2022). The second explanation is that the

372   findings may reflect general dysregulation, or a lack of self-control, that is common to people

373   being overzealous and forthright in their demands of others and in those with difficulties

374   maintaining healthy eating habits (see Stoeber, 2015; Obeid et al., 2021). Future research is

375   required to test both of these interesting possibilities.

376   Socially prescribed perfectionism also emerged as the only unique predictor of one of

377   the dimensions of orthorexia over time – higher knowledge of healthy eating. This finding is

378   much more in keeping with perfectionism research that has illustrated that this dimension of

379   perfectionism carries significant risks of personal difficulties that includes eating disorders

380   (e.g., Smith et al., 2016). Individuals higher in socially prescribed perfectionism are thought

381   to adopt various self-protective and self-corrective behaviours in response to perceived

382   demands from others and obsessive healthy eating may be a further such behaviour. In

383   support of this explanation, others have argued that the avoidance of social shame is central

384   to the behaviours associated with this dimension of perfectionism (e.g., Stoeber, Sherry &

385   Nealis, 2015) and recent research has found that higher levels of internal and external shame

386   are related to orthorexia (Ferreria & Coimbra, 2021). In this sense, seeking a diet that is

387   "more informed", "healthier" and "superior" to others (as captured by this dimension of

388   orthorexia) may be part of an effort to compensate for social fears of rejection for those

389   higher in this dimension of perfectionism.

390   **19.2.   Perfectionistic Self-Presentation and Orthorexia**

391   We also examined the predictive ability of perfectionism via perfectionistic self-

392   presentation. Notable in this regard is that only one dimension of orthorexia was related to

393   dimensions of perfectionistic self-presentation across both time points - problems associated

394   with healthy eating. With this in mind, problems associated with healthy eating is the

395   dimension of orthorexia that is most central to the pathology associated with orthorexia as

396   evidenced by its closer association with measures of eating disorders (Gleaves et al., 2013). It

397   is also the dimension of orthorexia that most references others, interpersonal interactions, and

398   interference with routine social situations (e.g., going out less, avoiding restaurants, affecting

399   employment options). In this regard, the close link between dimensions of perfectionistic

400   self-presentation, an impression management style, and this particular dimension of

401   orthorexia is understandable. Research that has found problems associated with heathy eating

402   to be related to interpersonal insecurity and interpersonal alienation support this explanation

403   (Novara et al., 2021).

404   When examining unique predictors of orthorexia over time, nondisplay of

405   imperfection was the only dimension of perfectionistic self-presentation to predict any

406   dimension of orthorexia (specifically problems associated with healthy eating). In addition,

407   this dimension predicted lower, rather than higher, levels of orthorexia. It is possible that

408   because obsessive eating behaviours could be viewed as unusual, odd, or extreme, those

409   seeking to project an image of perfection by hiding imperfections may shun behaviours that

410 could be viewed negatively by others (McComb and Mills, 2019). However, in comparing the

411 bivariate correlations with the regression results there is evidence that this finding is the result

412 of suppression (the direction the relationship differs in the two analyses). Similar cases of

413 suppression when examining perfectionistic self-presentation have been observed by others

414 (e.g., Stoeber et al., 2017). Consequently, this unexpected finding is more likely the result of

415 the higher correlations between dimensions of perfectionistic self-presentation and the

416 difficulty this creates when examining unique effects. We therefore encourage caution in

417 interpreting this finding.

19.3.   Trait Perfectionism versus Perfectionistic Self-Presentation

419   When we considered the predictive ability of trait perfectionism and perfectionistic

420 self-presentation alongside each other, only trait perfectionism dimensions – other-oriented

421 perfectionism and socially prescribed perfectionism – predicted dimensions of orthorexia.

422 Other-oriented perfectionism predicted increases in all dimensions of orthorexia and socially

423 prescribed perfectionism predicted increases in knowledge of healthy eating. These findings

424 suggest that it is the more engrained aspects of perfectionism that is most important in regard

425 to the development of orthorexia. In other words, wanting to *appear perfect* appears to be

426 secondary to wanting to *be perfect* when it comes to obsessional healthy eating. On the

427 distinction between the two, Hewitt, Flett, and Mikail (2017) have previously described how

428 they consider the traits of perfectionism to capture content (who people are) whereas self-

429 presentation reflects how this expressed (what people do). In this regard, it is understandable

430 that trait perfectionism would be more relevant to predicting orthorexia which itself is likely

431 to be, at least in part, an expression of deeper underlying traits and characteristics. The main

432 implication is that the most effective interventions for orthorexia are likely to be those that

433 target perfectionism traits as opposed self-presentation styles.

19.4.   Limitations and Future Research

The present study has several limitations. First, our findings and their generalisability may have been affected by the high dropout rate. Notably, the main analyses are based only on participants who completed both questionnaires. Consequently, although our findings provide preliminary evidence for the relationship between trait perfectionism, perfectionistic self-presentation, and orthorexia over time, future research should re-examine these relations using longitudinal designs and utilise strategies to reduce dropout (e.g., incentives; Gustavson et al., 2012). Second, we recruited a sample of adult exercisers. It is unclear whether the findings of the present study are generalisable beyond this population. The participants' exercise regimens were also altered by COVID-19 at the time of data collection so may also have influenced the results. Future research may wish to replicate the current work in different populations (and under more normal circumstances). This could include samples that have been previously examined such as clinical populations, students, and other non-clinical populations. Third, we used Cox et al.'s (2002) short version of the HF-MPS (Hewitt & Flett, 1991). Although the measure has acceptable factorial structure, it has been criticised for its use of reversed items in the other-oriented subscale (Stoeber, 2018). Therefore, researchers may wish to use alternative versions of the scale to verify the findings (e.g., Hewitt & Flett, 1991). Fourth, in the statistical analyses we did not control for multiplicity, despite multiple analyses. Multiplicity refers to the increased possibility of type I error as a result of multiple testing. Exact p values are reported to aid interpretation. Finally, the measure used to examine EHQ measure used to assess orthorexia does not have norms, thresholds, or cut-off values. Therefore, the extent to which orthorexia is evident to any clinically or diagnostically meaningful level is unknown in this study (and other studies). Future studies are required to establish these features of the instrument so this issue can be revisited in this sample and other samples that have used the instrument.

20. Conclusion

459

460   The present study provides further evidence that perfectionism is related to orthorexia.

461 This includes trait aspects of perfectionism and aspects that pertain to how people seek to

462 present themselves to others. The study also provides preliminary evidence that more

463 engrained trait aspects of perfectionism are more predictive of intensifying orthorexia over

464 time than the self-presentational aspects of perfectionism.

465 **Author contributions**

466 All authors have approved the final article for publication.

467 **Disclosure**

468 The authors of this review have no conflict of interest to declare.

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474

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The work described meets all ethical publication standards and follows the latest guidelines of the APA manual, 7th edition. I and my co-authors declare that the submission fully follows these ethical guidelines.