

Eating Disorders in Sport: Comparing Eating Disorder Symptomatology in Athletes and Non-Athletes During Intensive Eating Disorder Treatment

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The current study tested if athlete patients differed from non-athlete patients in measures of eating disorder (ED) and related pathology. Athlete ($n = 91$ in Study 1; $n = 39$ in Study 2) and non-athlete ($n = 76$ in Study 1; $n = 26$ in Study 2) patients completed self-report measures, and body mass index (BMI) was calculated. Athlete patients had significantly lower ED symptomatology and depression than non-athlete patients ($ps < .05$). ED impairment, worry, psychosocial functioning, BMI, obsessive-compulsiveness, and compulsive exercise did not significantly differ between groups ($ps > .08$). Greater ED symptomatology was associated with higher psychosocial functioning among athlete patients and higher obsessive-compulsive symptoms and compulsive exercise among non-athlete patients. This is a novel study comparing ED symptomatology and related measures of mental health in athlete and non-athlete patients engaged in residential or partial hospitalization ED treatment. Future research should further investigate how participation in high-level sport impacts the presentation, treatment, and outcome of individuals with EDs.

Keywords: athlete, eating disorder, outcomes, sport, treatment

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Eating disorders (EDs) are serious illnesses with the highest mortality rate among all psychiatric disorders (Harris & Barraclough, 1998). The prevalence of EDs has been found to be higher in athletes than non-athletes: non-athletes hold a lifetime prevalence rate of up to 4.6% (Sundgot-Borgen & Torstveit, 2004), while the lifetime prevalence rate of EDs among athletes has been shown to be as high as 13.5% (Sundgot-Borgen, 1993). Yet few studies have investigated whether differences in ED symptoms and related pathology exist between athletes and non-athletes, and no known study has examined comparisons between athlete and non-athlete patients with EDs specifically (Arthur-Cameselle, Sossin, & Quatromoni, 2017). An improved understanding of any differences in athlete and non-athlete patients with EDs is imperative for tailoring specialized treatment to the needs of each population and for informing ED treatment and recovery in general.

ED Symptoms in Athletes and Non-Athletes

Studies comparing athletes to non-athletes in the context of ED and related measures are sparse. Several studies have found that athletes have significantly fewer ED symptoms and less body image disturbance than non-athletes (DiBartolo & Shaffer, 2002; Hulley & Hill, 2001; Wollenberg, Shriver, & Gates, 2015), which may be due to the potential protective mental health benefits of sport and exercise (Goodwin, Haycraft, & Meyer, 2016; Jewett et al., 2014). Yet the comparatively high rates of EDs among athletes suggest that sport may increase rather than decrease ED risk (Gritti et al., 2016).

One explanation for these incongruities may be attributed to how athletes evaluate their ED symptoms. For instance, Thompson and Sherman (2010) found that athletes underreport ED symptoms due to the misperception that food restriction and excessive exercise will enhance sport performance and are not, in fact, problematic. Indeed, certain aspects of sport, such as mental toughness and commitment to training, may exacerbate ED risk and behaviors (i.e., food restriction, excessive exercise), yet these factors are often normalized and reinforced within the sport culture and might not be viewed as problematic (Thompson & Sherman, 1999; Plateau et al., 2017). Furthermore, several studies have demonstrated that athletes and coaches believe weight loss and thinness can elevate sport performance and are not areas of concern or potential risk (De Bruin, Oudejans, & Bakker, 2007; Jones, Glintmeyer, & McKenzie, 2005).

Another explanation for the discrepancies in ED symptoms among athletes and non-athletes may be the underlying basis for ED pathology. For example, fear of weight gain and drive for thinness are defining components of many EDs (Levinson et al., 2017; Penas-Lledo, Bulik, Lichtenstein, Larsson, & Baker, 2015), and participation in weight-related and aesthetic sports has been more highly associated with ED symptomatology (i.e., symptoms characteristic of EDs) and body dissatisfaction than sport without an emphasis on weight and appearance (Anderson, Reilly, Gorrell, & Anderson, 2016; De Bruin, Woertman, Bakker, & Oudejans, 2009; Sundgot-Borgen & Torstveit, 2004). Because of the paucity in research comparing athletes to non-athletes with ED diagnoses, it is challenging to draw any conclusions as to why differences between these populations exist.

Mood and Anxiety Disorders

Other differentiating markers of mental health, such as mood and anxiety disorders, are also poorly understood among athlete and non-athlete populations with EDs. Depression and anxiety are reportedly lower in athletes than non-athletes (Hainline, 2015; Pearlstein, 2016) but higher in individuals with EDs compared to the general population. In an NCAA Sport Science Institute report of 65,026 students, athletes were significantly less likely than non-athletes to report feelings of anxiety and depression; rates were still high, however, with 48% of female and 31% of male athletes reporting “overwhelming anxiety” (vs. 56% of non-athletes), and 28% of female and 21% of male athletes reporting depressive symptoms (compared to 33% of non-athletes; Hainline, 2015). Yet it is unclear if athletes with EDs have lower depression and anxiety than non-athletes with EDs. This uncertainty is exacerbated by the high rate of depression and anxiety among individuals with EDs: as many as 80% of individuals with EDs have depression (Green et al., 2009; Grilo, White, & Masheb, 2009) and up to 75% of women with EDs have anxiety (Aimé, Guitard, & Grousseau, 2017), compared to 11% (Carey et al., 2014) and 18% in the general population (Kessler et al., 2005) respectively.

Obsessive-compulsive disorder (OCD) has also been studied among ED populations, but prevalence rates have varied, with some studies finding OCD as low as 9.5% (Godart, Flament, Perdereau, & Jeammet, 2002) and others as high as 62% in ED populations (Kaye, Bulik, Thornton, Barbarich, & Masters, 2004). Rates of OCD in athlete populations are much lower—approximately 5% (Cromer, Kaier, Davis, Stunk, & Stewart, 2017)—though this is higher than the general population prevalence rate of approximately 2% (Ruscio, Stein, Chiu, & Kessler, 2010). Notably, rates of OCD among athlete patients and non-athlete patients with EDs have not been studied. Such findings may further inform the specifics of treatment for this population.

Compulsive Exercise

Compulsive exercise is another common comorbidity in EDs (Davis et al., 1997), yet literature regarding its presentation among athletes versus non-athletes with EDs is sparse and inconsistent. A recent study (Noetel et al., 2016) found that self-identified athletes (either a current or former athlete) did not differ from non-athletes on the Compulsive Exercise Test (CET; a measure of compulsive exercise specifically in EDs; Taranis, Touyz, & Meyer, 2011). CET results, however, were significantly associated with ED pathology, depression, anxiety, and OCD. Conversely, Goodwin et al. (2016) found greater levels of compulsive exercise on the CET in adolescent athletes versus non-athletes, while Turton, Goodwin, and Meyer (2017) found a high athletic identity (e.g., degree to which one identifies with the athletic role; Brewer, Van Raalte, & Linder, 1993; Hughes & Leavey, 2012) among long-distance runners to be more strongly associated with compulsive exercise, compared to those with a more multifaceted sense of self. Interestingly, athletic identity was not correlated with ED symptomatology. Research has identified compulsive exercise as an important mechanism in the development and maintenance of EDs, and compulsive exercise is associated with increased risk of relapse after treatment (Davis et al., 1997; Davis, Katzman, & Kirsh, 1999).

Therefore, replication of previous findings on the CET (Goodwin et al., 2016; Taranis et al., 2011) is warranted. Examining if differences exist in ED and related measures among athlete patient and non-athlete patient populations will allow treatment centers to more effectively adapt treatments to meet the needs of athletes.

Study Aims

The aim of the current study was to test if athlete patients with EDs differed from non-athlete patients with EDs (i.e., general ED patients who did not participate in high-level, competitive sport) and to replicate CET findings from previous studies (Goodwin et al., 2016; Taranis et al., 2011). In Study 1, ED symptomatology, ED impairment, depression, worry, and BMI (in AN) were measured and differences between athlete patients and non-athlete patients upon treatment admission were evaluated. In Study 2, ED pathology, obsessive-compulsive symptoms, and compulsive exercise were measured and differences were assessed between athlete and non-athlete patients at treatment admission.

Study 1: Methods

Participants

Participants were 91 male and female athlete patients and 76 male and female non-athlete patients entering either a residential or partial hospitalization (PHP) treatment program for EDs between December 2012 and June 2017. Participants were diagnosed with anorexia nervosa (AN; restricting or binge/purge subtype), bulimia nervosa (BN), eating disorder not otherwise specified (EDNOS), other specified feeding or eating disorder (OSFED; a diagnosis derived from the DSM-V revision which was used during the latter course of the study), binge-eating disorder (BED; also used in conjunction with the release of the DSM-V), avoidant/restrictive food intake disorder (ARFID; used in conjunction with the release of the DSM-V), or rumination disorder (used in conjunction with the release of the DSM-V). Diagnoses were made by board-certified psychiatrists using semi-structured interviews upon treatment admission. Demographic and clinical information is found in Table 1.

Procedures

This study was approved by the Institutional Review Board at Washington University in St. Louis. Participants (combined group $N=167$) completed the following assessments at the beginning of treatment via paper and pencil: Eating Disorder Examination Questionnaire (EDE-Q; Fairburn, 2008); Clinical Impairment Assessment (CIA; Bohn & Fairburn, 2008); Beck Depression Inventory II (BDI-II; Beck, Steer, & Brown, 1996); Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990); and World Health Organization Disability Assessment Schedule 2.0 (WHODAS; Ustün, Kostanjsek, Chatterji, & Rehm, 2010). Body mass index (BMI) was calculated upon admission by an approved treatment staff member.

Table 1 Study 1: Demographic and Clinical Characteristics of Athlete and Non-Athlete Patients Using PSM

	Athlete n = 91	Non-Athlete n = 76	Total n = 167
Gender, <i>n</i> (%)			
Female	80 (87.9)	70 (92.1)	150 (89.8)
Male	11 (12.1)	6 (7.9)	17 (10.2)
European American, <i>n</i> (%)	84 (92.3)	70 (92.1)	154 (92.2)
ED Diagnoses, <i>n</i> (%)			
AN	63 (69.2)	50 (65.8)	113 (67.7)
BN	11 (12.1)	12 (15.8)	23 (13.8)
EDNOS	6 (6.6)	10 (13.2)	16 (9.6)
OSFED	5 (5.5)	2 (2.6)	7 (4.2)
BED	4 (4.4)	1 (1.3)	5 (3.0)
ARFID	2 (2.2)	0 (0)	2 (1.2)
Rumination	0 (0)	1 (1.3)	1 (.6)
LOS in days, <i>M</i> (<i>SD</i>)	66.8 (37.8)	52.6 (33.9)	60.2 (36.7)
LOS range	13 to 210 days	9 to 180 days	8 to 210 days
Age in years, <i>M</i> (<i>SD</i>)	19.4 (3.0)	18.4 (4.2)	18.9 (3.6)
Age range	13 to 30 years	11 to 32 years	11 to 32 years
Duration of ED in years, <i>M</i> (<i>SD</i>)	4.3 (3.2)	4.4 (3.7)	4.3 (3.4)
Duration of ED range	0 to 15 years	0 to 15 years	0 to 15 years
Admit BMI < 18.5, <i>n</i> (%)	41 (45)	36 (47)	77 (46)

Note. PSM = Propensity Score Matching; AN = Anorexia Nervosa; BN = Bulimia Nervosa; EDNOS = Eating Disorder Not Otherwise Specified; OSFED = Other Specified Feeding or Eating Disorder; BED = Binge Eating Disorder; ARFID = Avoidant Restrictive Food Intake Disorder; Rumination = Rumination Disorder; LOS = Length of Stay in days for the total number of days in either residential and/or partial hospitalization programming; admit BMI = Admission Body Mass Index.

Outcome Measures

Eating Disorder Examination Questionnaire 16.0 (EDE-Q; Fairburn, 2008) is a 28-item self-report questionnaire designed to assess ED behaviors and thoughts. The global score of the EDE-Q, calculated by summing subscale totals and dividing by the number of subscales, was used to measure overall eating symptomatology. The EDE-Q has demonstrated excellent test-retest reliability and internal consistency (Luce & Crowther, 1999), and acceptable to good criterion validity and concurrent validity (Aardoom, Dingemans, Slof Op't Landt, & Van Furth 2012; Mond, Hay, Rodgers, Owen, & Beumont, 2004). Cronbach's α was .96 for the present study.

Clinical Impairment Assessment (CIA; Bohn & Fairburn, 2008) is a 16-item self-report questionnaire to be used in conjunction with the EDE-Q. The CIA assesses ED impairment on mood as well as cognitive and interpersonal functioning. The global score of the CIA was used and was calculated by summing item

totals. The CIA has demonstrated high internal consistency, test-retest reliability, and good construct and criterion validity (Vannucci et al., 2012). Cronbach's α was .95 for the present study.

Beck Depression Inventory II (BDI-II; Beck et al., 1996) is a 21-item self-report measure assessing the severity of depression and was used in the current study to measure depression. The BDI-II has demonstrated high internal consistency and concurrent validity (Storch, Roberti, & Roth, 2004). Cronbach's α was .94 for the present study.

Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990) is a 16-item self-report questionnaire measuring trait assessment of pathological worry. It has demonstrated high internal consistency, high test-retest reliability, and good convergent validity (Stöber, 1998). Cronbach's α was .72 for the present study.

World Health Organization Disability Assessment Schedule 2.0 (WHODAS; Üstün et al., 2010) is a 36-item, self-report measure designed to assess disability across six domains, including areas of communication and participation in society. The global score (scored by summing all items) was used to measure psychosocial functioning. The WHODAS has shown very good internal consistency and good test-retest reliability (Üstün et al., 2010). Cronbach's α was .97 for the present study.

Body Mass Index (BMI) was assessed at treatment admission by an approved staff using a medical grade Detecto precision scale and height tool. Participants were weighed in light clothing and were not informed of their weight.

Analyses

Propensity score matching (PSM; Rosenbaum & Rubin, 1983) was used to create a final dataset ($N = 167$) that accounted for the covariates of each treatment group (athlete and non-athlete) for the following variables: length of stay (LOS), ED diagnosis, age, duration of ED, gender, and admission BMI (see Table 1 for variable means). After using PSM, independent sample t-tests were conducted to test for differences in ED symptomatology and impairment, depression, worry, and BMI (in AN) between the athlete and non-athlete groups at treatment admission. Meng's test of differences (Meng, Rosenthal, & Rubin, 1992) was also conducted to test for differences among zero-order correlations of ED symptomatology, depression, worry, and psychosocial functioning between groups.

Study 1: Results

Athlete patients had significantly lower ED symptomatology and depression than non-athlete patients at treatment admission ($ps < .01$; see Table 2). ED impairment, worry, psychosocial functioning, and BMI (in Anorexia) did not significantly differ between groups at treatment admission ($ps > .1$). Higher ED symptomatology was more strongly associated with higher psychosocial functioning among athlete patients compared to non-athlete patients ($z(167) = 3.37, p < .001$), and higher ED symptomatology was marginally but not significantly associated with higher depression among athletes compared to non-athletes ($z(167) = 1.92$,

Table 2 Study 1: Independent t-Tests Comparing Athlete Patients to Non-Athlete Patients at Admission in Measures of ED Symptomatology and Impairment, Depression, Worry, and BMI in AN Using PSM

	Athlete, <i>M (SD)</i>	Non-Athlete, <i>M (SD)</i>	t-value	Sig	<i>n</i>
ED Symptomatology					
Admission	3.37 (1.60)	4.00 (1.51)	2.59	$p = .01$	167
ED Impairment					
Admission	29.96 (12.54)	33.54 (11.06)	1.68	$p = .10$	123
Depression					
Admission	26.38 (13.97)	33.42 (14.11)	-2.68	$p < .01$	127
Worry					
Admission	57.52 (14.14)	61.44 (12.38)	-1.02	$p = .31$	82
Psychosocial Functioning					
Admission	2.13 (.79)	2.44 (1.00)	1.25	$p = .22$	64
BMI (in AN)					
Admission	17.74 (2.64)	17.55 (2.49)	.38	$p = .71$	108

Note. Differences in *ns* were due to the implementation of outcomes measures at different time points within the treatment center. PSM = Propensity Score Matching; ED Symptomatology = Eating Disorder Examination Questionnaire; ED Impairment = Clinical Impairment Assessment; Depression = Beck Depression Inventory II; Worry = Penn State Worry Questionnaire; BMI = body mass index.

$p = .054$; see Table 3). ED symptomatology was not more strongly associated with worry in athletes than non-athletes ($r(167) = -1.59, p = .112$).

Study 2: Methods

Participants

Participants were 39 male and female athletes and 26 male and female non-athletes engaged in the same residential or PHP treatment program as those in Study 1. Study 2 was conducted between January and December of 2016 and included new outcome measures not previously utilized by the treatment center. Treatments for both groups did not differ from those in Study 1.

Procedures

This study was approved by the Institutional Review Board at Washington University in St. Louis. Participants (combined group $N = 65$) completed the following assessments at the beginning of treatment via paper and pencil: Eating Pathology Symptoms Inventory (EPSI; Forbush et al., 2013); Obsessive Compulsive Inventory Revised (OCI-R; Foa et al., 2002); and Compulsive Exercise Test (CET; Taranis et al., 2011).

Table 3 Meng's Test of Differences in Zero-Order Correlations in Studies 1 and 2

	ED Symptoms in Athletes	ED Symptoms in Non-Athletes	ED Symptoms in Full Sample	z-value	sig	n
Psychosocial Functioning	.72	.57	.68	3.37	$p < .001$	167
Worry	.64	.71	.66	-1.59	$p = .11$	167
Depression	.75	.68	.74	1.92	$p = .05$	167
OCD Symptoms	.51	.73	.55	-2.56	$p < .05$	65
Compulsive Exercise	.60	.84	.63	-3.72	$p < .001$	65

Note. ED Symptoms = Eating Disorder Examination Questionnaire; Psychosocial Functioning = World Health Disability Assessment Schedule 2.0; Worry = Penn State Worry Questionnaire; Depression = Beck Depression Inventory II; OCD Symptoms = Obsessive-Compulsive Inventory; Compulsive Exercise = Compulsive Exercise Test.

Outcome Measures

Eating Pathology Symptoms Questionnaire (EPSI; [Forbush et al., 2013](#)) was developed to serve as a comprehensive measure of eating pathology and consists of 45 items. The EPSI was added to the battery of assessments utilized by the treatment program to overcome limitations of other ED measures within specific populations, such as men or overweight individuals ([Forbush et al., 2013](#)). The eight subscales of the EPSI were used and calculated by summing items within each subscale: body dissatisfaction, binge eating, cognitive restraint, purging, restricting, exercise, negative attitudes toward obesity, and muscle building. The EPSI has been found to have good to excellent convergent and discriminant validity, excellent internal consistency, and acceptable to good test-retest reliability ([Forbush et al., 2013](#)). Cronbach's α was .91 for the present study.

Obsessive Compulsive Inventory Revised (OCI-R; [Foa et al., 2002](#)) is an 18-item self-report measure, shortened from the original 42-item measure, designed to assess symptoms of OCD. A total score is yielded by summing the six subscales (washing, checking, ordering, obsessing, hoarding, and neutralizing), and higher scores indicate more symptoms of OCD. The OCI-R has good to excellent convergent validity, test-retest reliability, and internal consistency ([Foa et al., 2002](#)). Cronbach's α was .89 in the current study.

Compulsive Exercise Test (CET; [Taranis et al., 2011](#)) was developed to assess the factors maintaining or operating compulsive exercise in EDs. The CET has 24 items that make up five subscales: avoidance and rule-driven behavior, weight control exercise, mood improvement, lack of exercise enjoyment, and exercise rigidity. Higher global CET scores (calculated by summing the five mean subscale scores) indicate greater compulsive exercise. The CET has demonstrated high internal consistency and concurrent and convergent validity ([Taranis et al., 2011](#)). Cronbach's α was .93 in the current study.

Analyses

Propensity score matching (PSM; Rosenbaum & Rubin, 1983) was used to create a final data set ($N = 65$) that accounted for length of stay and age of each treatment group (athletes and non-athletes; see Table 4 for a description of the sample). After using PSM, independent sample t-tests were conducted to test for differences between the athlete and non-athlete groups for the three outcome measures: eating disorder pathology, obsessive-compulsive symptoms, and compulsive exercise at treatment admission. Meng's test of differences was also conducted to test for differences among zero order correlations of ED pathology, obsessive-compulsive symptoms, and compulsive exercise between groups.

Table 4 Study 2: Demographic and Clinical Characteristics of Athlete and Non-Athlete Patients Using PSM

	Total (%)
	<i>n</i> = 65
Gender, <i>n</i> (%)	
Female	57 (87.7)
Male	8 (12.3)
European American, <i>n</i> (%)	60 (93.8)
ED Diagnoses, <i>n</i> (%)	
AN	44 (67.7)
BN	8 (12.3)
EDNOS	0 (0)
OSFED	6 (9.2)
BED	5 (7.7)
ARFID	1 (1.5)
Rumination	1 (1.5)
LOS in days, <i>M</i> (<i>SD</i>)	56.91 (25.46)
LOS range	13 to 107 days
Age in years, <i>M</i> (<i>SD</i>)	19.03 (4.73)
Age range	10 to 33 years
Duration of ED in years, <i>M</i> (<i>SD</i>)	3.97 (4.73)
Duration of ED range	0 to 21 years
Admit BMI < 18.5, <i>n</i> (%)	26 (40)

Note. PSM = Propensity Score Matching; AN = Anorexia Nervosa; BN = Bulimia Nervosa; EDNOS = Eating Disorder Not Otherwise Specified; OSFED = Other Specified Feeding or Eating Disorder; BED = Binge Eating Disorder; ARFID = Avoidant Restrictive Food Intake Disorder; Rumination = Rumination Disorder; LOS = Length of Stay in days for the total number of days in either residential and/or partial hospitalization programming; admit BMI = Admission Body Mass Index.

Study 2: Results

No significant differences were found in ED pathology, obsessive-compulsive symptoms, or compulsive exercise between athlete and non-athlete patients at treatment admission ($ps > .08$; see Table 5). Higher ED symptomatology was more strongly associated with higher obsessive-compulsive symptoms among non-athlete patients compared to athlete patients ($z(167) = -2.56, p < .05$; see Table 3). Interestingly, higher ED pathology was more strongly associated with higher compulsive exercise among non-athletes compared to athletes ($z(167) = -3.72, p < .001$; see Table 3).

Table 5 Study 2: Independent t-Tests Comparing Athlete Patients to Non-Athlete Patients at Admission in Eating-Related Pathology, OCD, and Compulsive Exercise Using PSM

	Athlete, <i>M (SD)</i>	Non-Athlete, <i>M (SD)</i>	t-Value	sig	<i>n</i>
Body Dissatisfaction					
Admission	16.60 (7.84)	18.09 (9.18)	-.65	$p = .52$	57
Binge Eating					
Admission	11.23 (11.35)	11.14 (9.90)	.03	$p = .98$	57
Cognitive Restraint					
Admission	8.43 (3.39)	8.36 (3.84)	.07	$p = .95$	57
Purging					
Admission	3.14 (4.09)	4.86 (4.87)	-1.45	$p = .16$	57
Restricting					
Admission	11.23 (6.70)	11.73 (7.42)	.67	$p = .79$	57
Exercise					
Admission	11.97 (6.77)	9.09 (7.50)	.62	$p = .14$	57
Negative Attitudes toward Obesity					
Admission	8.14 (6.32)	7.68 (6.97)	.63	$p = .80$	57
Muscle Building					
Admission	4.86 (4.75)	2.82 (3.06)	1.79	$p = .08$	57
OCD Symptoms					
Admission	13.17 (10.91)	18.36 (13.81)	.60	$p = .12$	57
Compulsive Exercise					
Admission	13.92 (4.36)	13.71 (5.13)	.16	$p = .87$	57

Note. Body Dissatisfaction, Binge Eating, Cognitive Restraint, Purging, Restricting, Exercise, Negative Attitudes toward Obesity, and Muscle Building comprise the eight Eating Pathology Symptoms Inventory subscales; OCD Symptoms = Obsessive Compulsive Inventory-Revised; Compulsive Exercise = Compulsive Exercise Test.

Discussion

The broad aim of this study was to test if athlete patients differed from non-athlete patients in ED symptomatology and related measures upon admission to an intensive ED treatment center. More specifically, the study's objective was to identify any differences that may occur between athletes and non-athletes to better understand the role of EDs in sport. Eating disorder symptomatology was found to be significantly lower in athletes than non-athletes. Eating disorder impairment (i.e., social impairment from EDs as measured by the CIA) and ED pathology (i.e., ED symptoms and thought processes as measured by the EPSI) did not differ between the two groups, suggesting that athletes and non-athletes with EDs have similar levels of impairment and pathology, even without high levels of reported ED symptoms.

Findings in the current study suggest that there may be certain ED symptoms which cause impairment in athletes that are not traditionally assessed in clinical ED settings, such as weight pressures in sport or sport-specific body dissatisfaction (De Bruin, Oudejans, Bakker, & Woertman, 2011; Galli, Reel, Petrie, Greenleaf, & Carter, 2011; Reel, SooHoo, Petrie, Greenleaf, & Carter, 2010). As noted above, the underreporting of ED symptoms by athletes on self-reported questionnaires is not uncommon (Sundgot-Borgen, 1993) and may explain the differences found in the current study. Unfortunately, clinical interviews, which lead to more accurate accounts of ED symptoms in athletes (Sundgot-Borgen, 1993), are often unfeasible in clinical settings given limitations of factors such as time, expense, and staffing. Additional research is called for to investigate alternative ED symptoms in athletes (such as weight pressures in sport or sport-specific body dissatisfaction) and to better understand how ED symptoms and cognitions in athletes are experienced.

Depression was also found to significantly differ between athlete and non-athlete groups. Athlete patients had significantly lower depression than non-athlete patients upon treatment admission. This finding is supported by previous research (Hainline, 2015) and suggests that certain components of sport may be protective against depression. Interestingly, however, higher ED symptomatology was associated with higher depression among athletes more strongly than in non-athletes. This finding indicates that athletes who are depressed are more likely to have higher ED pathology than non-athletes, or that athletes who have high ED pathology are more likely to be depressed than non-athletes. Therefore, depression should be targeted in ED treatment in both athlete and non-athlete patients, and athletes with high levels of ED symptomatology should especially be assessed and treated for depression to effectively aid in the reduction of ED symptoms.

Worry, psychosocial functioning, and OCD symptoms did not differ between athletes and non-athletes. Higher levels of ED symptomatology, however, were associated with higher levels of psychosocial functioning among athletes more strongly than non-athletes. One possible explanation for this finding is that aspects of sport (e.g., social relationships with sport family, support and oversight from sport personnel) may allow for improved psychosocial functioning for athletes compared to non-athletes without such relational opportunities. Higher levels of ED symptomatology were also marginally related to higher levels of obsessive-compulsive symptoms in non-athletes compared to athletes, suggesting that obsessive-compulsive symptoms may have a relationship to EDs in non-athletes,

but not in athletes when ED symptoms are more severe. This finding is reasonable in the context of viewing sport as either a protective barrier against OCD or as a maintaining factor in OCD, with the latter theory assuming that sports are fulfilling the obsessions or compulsions in athletes without awareness of a problem. However, a paucity of research regarding these variables make it difficult to make confident conclusions. Examining the relationship between OCD and sport, and how sport may influence the development or presentation of OCD, is warranted.

Interestingly, compulsive exercise did not significantly differ between groups. Higher levels of ED symptomatology, however, were associated with higher levels of compulsive exercise in non-athletes more strongly than in athletes. Though future research is needed to understand the mechanisms behind this construct in athletes, it is possible that exercise in the form of intensive training for sport, even if compulsive, is serving a more adaptive function in athletes than non-athletes. As a result, athletes and coaches may see compulsive exercise as a demonstration of a highly dedicated athlete rather than as problematic (De Bruin et al., 2007; Jones et al., 2005).

Finally, BMI in patients with AN did not differ between groups. Though elite athletes tend to have lower BMI's than non-elite athletes and control groups (Nemati, Rahmani-nia, & Mohebbi, 2018; Neves, Meireles, de Carvalho, Almeida, & Ferreira, 2016), our findings may be explained by the resources available to some athletes. For example, many athletes have access to weight monitoring and meal planning with a sports dietitian, performance decrements observed by a strength and conditioning coach, and/or changes in medical stability identified by a sports medicine physician. It is possible that these resources allow athletes to be identified with an ED earlier than non-athletes might be, which may prevent symptoms (e.g., BMI) from further deteriorating. More research is necessary to understand if the resources available to athletes relate to early ED detection or early referral to appropriate levels of ED care.

Limitations

There were several limitations to this study. First, this study had a low sample size of heterogenous patients. Though heterogeneous samples are common among ED treatment centers and reflect clinical populations (Fewell, Levinson, & Stark, 2017), results should be interpreted judiciously. Furthermore, because of the low sample size, we may have insufficient power needed to detect significant effects. For example, in Study 2, purging and exercise were approaching marginal significance between groups but did not reach significance (see Table 4). Future research should target a larger sample. Another limitation was the use of self-report questionnaires rather than structured clinical interviews, which could lead to inaccurate reporting as previously noted. Additionally, rather than utilizing structured diagnostic interviews for patient diagnoses, psychiatrists engaged in semi-structured clinical interviews to diagnose EDs as part of the admission process, increasing the potential for inconsistent diagnostic assessments (Miller, Dasher, Collins, Griffiths, & Brown, 2001). Finally, due to discharges and readmissions within the residential and PHP levels of care, this study did not document the percentages of patients in residential versus PHP care, which could have impacted study findings. For example, patients in the residential level of care may

have reported significantly higher levels of ED and related symptomatology if the ED was more progressed compared to patients in the PHP level of care. Additionally, patients at different levels of care or phases of recovery may have markedly different awareness of their health status and symptom picture and differing abilities to disclose symptom details with accuracy.

Conclusions

This study is the first to assess the differences and similarities between athlete and non-athlete patients in an intensive ED treatment setting. We found that ED symptomatology and depression differed between athletes and non-athletes. Impairment related to EDs (i.e., cognitive and interpersonal functioning), worry, OCD symptoms, psychosocial functioning, compulsive exercise, and BMI (in AN) did not significantly differ between the two groups. Interesting findings were presented on the relationships between ED symptoms and psychosocial functioning, OCD symptoms, and compulsive exercise among athletes and non-athletes that had not previously been explored. Additional research should investigate the role of sport and athletic status in EDs. Specifically, continued research is needed to better understand how participation in high-level sport influences the presentation, treatment, and outcome of individuals with EDs.

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