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Teammate Influences and Relationship Quality are Associated with Eating and Exercise

Psychopathology in Athletes

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Abstract

Teammates have a powerful influence on athletes' eating attitudes / behaviours, but less is known about the relative importance of teammate influence mechanisms. The primary aim of this study was to explore the relationships and predictive associations between teammate influences (e.g., modelling of teammates' disordered eating; supportive teammate friendships) and athletes' eating and exercise attitudes and behaviours. A further aim was to identify the presence of any gender differences. Athletes (N = 1172, mean age 24 years, n = 727 female) completed a survey exploring multiple teammate influences, eating and exercise attitudes and behaviours, and psychological wellbeing (anxiety, depression, self-esteem). Many significant relationships were identified between teammate influences and eating / exercise psychopathology. Stepwise regression analysis revealed that a perceived pressure from teammates to lose weight / change shape and perceptions that teammates engaged in disordered eating practices were the best predictors of *higher* eating and exercise psychopathology. Supportive teammate friendships was the best predictor of *lower* eating psychopathology and higher levels of healthy exercise behaviours. Encouragement / discouragement to eat healthily were also significant predictors. Teammate influences explained more variance in exercise than eating psychopathology, and total variance explained by teammates was higher for females compared to males. Teammates may have a positive and negative influence on the eating and exercise attitudes / behaviours of athletes; however, gender differences are apparent. Understanding teammate influences on the eating and exercise practices of athletes is important for the development of team-based interventions to reduce or prevent disordered eating and exercise. Future research should explore these relationships longitudinally, considering the role of moderating factors (e.g., sport type, stage of season).

Key words: athlete; sport; social influence; disordered eating; compulsive exercise; teammate

Teammate Influences and Relationship Quality are Associated with Eating and Exercise

Psychopathology in Athletes

Disordered eating and exercise attitudes and behaviours such as binge eating, exercising to alter weight and shape, and dieting (Sundgot-Borgen & Torstveit, 2010) have been estimated to occur in 20-45% of female athletes (e.g., Anderson & Petrie, 2012; Martinsen, Bratland-Sanda, Eriksson, & Sundgot-Borgen, 2010; Nichols, Rauh, Barrack, Barkai, & Pernick, 2007), and 10-19% of male athletes (Greenleaf, Petrie, Carter, & Reel, 2009; Martinsen, Bratland-Sanda, Eriksson & Sundgot-Borgen, 2010; Petrie, Greenleaf, Reel, & Carter, 2008).

Thompson and Sherman (2011) have suggested that pressures from the sport environment (e.g., from judges, spectators, team weigh ins) may contribute to a body-focused rather than performance-focused outlook and that sport pressures may exacerbate unhealthy relationships with weight, body shape and food, eliciting subsequent disordered eating and compulsive exercise behaviours. In particular, pressures and expectations from teammates and coaches may be instrumental in the development of disordered eating behaviours among athletes, as they may emphasise or endorse leanness and muscularity and overtly or covertly exert pressure to diet (Filaire, Rouveix, Pannafieux, & Ferrand, 2007).

Petrie and Greenleaf's (2007, 2012) sociocultural model of disordered eating in athletes conceptualises the potential contribution of weight, size and appearance pressures from coaches, teammates and the wider sporting environment in the development of eating psychopathology (e.g., dietary restraint, bulimic symptomatology). Indeed sport-specific pressures such as strict weight requirements, revealing team uniforms and judging based on aesthetics have been found to uniquely contribute to athletes' eating psychopathology beyond the generic sociocultural pressures experienced by the wider population (Reel, Petrie, Soohoo, & Anderson, 2013). In particular, teammates are uniquely positioned to influence

athletes' disordered eating and exercise behaviours given the large amount of time spent in each other's company, with sport friendships found to be particularly strong (Smith, Ullrich-French, Walker, & Hurley, 2006). Furthermore, evidence suggests that as an athlete matures, sport peers replace parents as the primary source of social influence (Chan, Lonsdale, & Fung, 2012) and social support (Helsen, Vollebergh, & Meeus, 2000). A deeper understanding of the mechanisms through which teammates can be influential is therefore vital. However, research exploring the validity of Petrie and Greenleaf's sociocultural model specifically in relation to teammates is limited by the use of single items to investigate the prevalence of a general "teammate pressure" to lose weight / change shape (Petrie, Greenleaf, Carter & Reel, 2007; Petrie, Greenleaf, Reel & Carter, 2009a). This prohibits a deeper understanding of the different social influence mechanisms that may constitute such pressure, how they relate to specific aspects of disordered eating (i.e., restriction, bulimic tendencies) or, indeed, the *positive* influence teammates may have.

A wide body of empirical and theoretical research has suggested that people primarily influence each other's attitudes and behaviours around food via the following mechanisms: (1) modelling - the imitation of attitudes and behaviours towards food (Cruwys, Bevelander & Herman, 2015); (2) social facilitation – increasing food intake as a result of eating with others (Herman, 2015); and, (3) social norms – implicit rules around what attitudes and behaviours toward food are socially acceptable (Higgs, 2015). In athletic populations, a recent systematic review revealed that teammates may both positively and negatively impact on athletes' eating attitudes and behaviours via such social influence mechanisms (Scott, Haycraft, & Plateau, 2019).

With regard to negative teammate influence, evidence suggests that observing and *modelling* of disordered eating attitudes or pathogenic weight control behaviours among teammates (Greenleaf, Petrie, Reel, & Carter, 2010; Petrie et al., 2007), may promote the

development of unhealthy social norms for eating among athlete groups. Indeed, Engel et al. (2003) suggested that athletes may unwittingly encourage disordered eating in team members via the “false consensus effect” (Krueger & Clement, 1994), whereby athletes are likely to overestimate the frequency of disordered eating attitudes and behaviours among their peers and adopting such behaviours themselves. Additionally, if relationships with teammates are characterised by conflict and distrust, this may facilitate the development of disordered eating behaviours (Shanmugam, Jowett & Meyer, 2014).

Teammate subcultures can have both a positive and negative impact on athletes’ disordered eating. Existing evidence has primarily focused on the aforementioned negative impact, however, it is important to note that teammates can play an important role in the *prevention* of disordered eating – an area that warrants further research attention. For example, athletes may provide anti-dieting advice and employ effective within-team identification strategies / social norms around the acceptability of seeking professional support / treatment where necessary (Kroshus, Goldman, Kubzansky, & Austin, 2014; Kroshus, Kubzansky, Goldman, & Austin, 2015). Teammates have also been found to engage in the *promotion* of healthy eating. For instance, teammates can have positive influences in relation to food quality (e.g., encouragement to eat fruit and vegetables), quantity (encouragement to eat more), and maintaining healthy routines (e.g., adequately fuelling before a match) (Hausenblas & Carron, 2000). Furthermore, having teammate relationships characterised by support, warmth and trust has been prospectively related to lower levels of disordered eating behaviours (Shanmugam et al., 2014).

It is likely that susceptibility to sport-related pressures from teammates (e.g., around food intake or dieting) and disordered eating and exercise may vary according to the psychological wellbeing and gender of the athlete. For example, low self-esteem is related to food restriction, drive for thinness and increased risk of compulsive exercise (Brannan,

Petrie, Greenleaf, Reel, & Carter, 2009; Engel et al., 2003, McNamara & McCabe, 2012), and high levels of depression and anxiety are more likely to be found in athletes with eating psychopathology (Giel et al., 2016). Furthermore, although not identified with teammates, negative affect (e.g., low self-esteem, high depression and / or anxiety) played a mediating role in the relationship between coach / parent influences and eating psychopathology in athletes (Shanmugam, Jowett, & Meyer, 2013). Additionally, the internalisation of body ideals (e.g., “thin” or “athletic”) is more prevalent in females (Flament et al., 2012) and a risk factor for disordered eating and compulsive exercise in female athletes (Homan, 2010), while physical appearance is more important for teammate acceptance in female athletes compared to males (Jones, 2004; Jones & Crawford, 2006).

These additional pressures potentially increase female athletes’ susceptibility to appearance related teammate influences (e.g., pressure to lose weight). In light of this, when investigating the mechanisms by which teammates may contribute towards and / or protect against the development of eating and exercise psychopathology, it is essential that gender and psychological wellbeing differences are taken into account.

In summary, in order to accurately inform future team-based disordered eating and exercise prevention strategies, it is vital that researchers disentangle different mechanisms of teammate influence and establish the relative importance of various teammate influences (both positive *and* negative) on athletes’ disordered eating and exercise behaviours. Research to date is limited by small and unrepresentative samples (e.g., Berry & Howe, 2000; Kroshus et al., 2015) and has not accounted for psychological wellbeing / gender differences. Furthermore, investigations have often only tested the relationship between a single mechanism of teammate influence (e.g., modelling, Engel et al., 2003) and a global measure of disordered eating (e.g., global EDEQ scores; Shanmugam et al., 2013) or disordered exercise (e.g., global EDEAS scores; McNamara & McCabe, 2012), which severely limits the

understanding of how teammates may differentially impact upon the more discreet constructs that comprise eating/exercise psychopathology (e.g., body dissatisfaction vs drive for thinness or exercise to control weight vs exercise to improve mood). To address these literature gaps, the primary aim of the present study was to comprehensively assess the relationships and predictive associations between multiple teammate influence mechanisms and multiple indices of disordered eating and exercise in a large and representative sample of athletes. A further aim was to identify whether these relationships differed by gender given the aforementioned differences in the prevalence of eating/exercise psychopathology and susceptibility to teammate influence.

It was hypothesised that (after accounting for psychological wellbeing) positive influences from teammates (e.g., supportive friendships, anti-dieting advice, encouragement of healthily eating) would significantly predict lower levels of eating and exercise psychopathology, whereas negative influences from teammates (e.g., bulimia modelling, perceived pressure to lose weight / change shape, discouragement of healthy eating, conflicting friendships) would significantly predict higher levels of eating and exercise psychopathology. It was predicted these relationships would be more evident for female than male athletes.

Method

Participants

The inclusion criteria required participants to be athletes aged 15 years and over competing in any Olympic, International Olympic Committee (IOC) or British Universities and Colleges Sport (BUCS) recognised sport (circa 90 different sports). To be included, participants had to be actively training in a group and / or competing as part of a team in a sport at local, regional, national or international level. Teammates were defined as fellow

athletes that the participant regularly trains and / or competes with. Currently injured athletes were permitted to take part and were asked to report how long they had been injured for.

The present sample comprised 1172 athletes ($n = 727$ female; 92% white ethnicity) with a mean age of 24.04 years ($SD = 9.96$) and a mean BMI of $22.66\text{kg} / \text{m}^2$ ($SD = 3.37$, range 15.60-41.10). Twenty-two percent of the athletes reported currently competing at an elite level (international or national standard), while the remaining 78% reported currently competing at county, regional, club or university/school level. However, 40% of the overall sample reported having *previously* competed at elite level. The athletes represented a range of sports (49% competed as part of a team), with 61% engaging in lean sports (e.g., aesthetic, endurance, weight-class) and the remaining 39% competing in non-lean sports (e.g., ball-game, power, technical). The athletes had been participating in their sport for an average of 6.53 years ($SD = 5.69$) and trained an average of 8.10 hours ($SD = 5.54$) per week. At the time of participating, 20% of athletes were in a pre-season phase, 48% were in their competitive season and 32% were in a post-season phase. Five percent of athletes ($n = 56$) reported being currently injured / ill for a mean duration of 7.3 months ($SD = 11.44$).

Procedure

Ethical approval was obtained from the Institutional Ethics Approvals (Human Participants) Sub-Committee. Different procedures were employed to recruit adult (aged 18 years and above) and adolescent (aged 15-17 years) athletes. Adults were recruited via adverts about the study which were sent by email to local sport clubs, posted on social media or distributed in person at training sessions / competitions. Adolescents were recruited via key gatekeepers (e.g., PE teachers, coaches, sport club chairpersons) in the local area (East Midlands, UK). After obtaining parental consent, paper versions of the questionnaire were administered to adolescent athletes by their coaches or PE teachers at the beginning of a training session or during a school PE lesson. All participants were required to read the study

information sheet and provide informed consent (adults) or assent (adolescents) prior to completing the survey online ($n = 921$; 78%) or on paper ($n = 255$; 22%) between April 2017 and January 2018.

Measures

The following section provides an overview of the measures used and their reliability in the present study.

Demographics. Participants reported their age, gender, ethnicity, self-reported weight and height and English-speaking status, as well as providing information about their sporting involvement.

Eating and exercise psychopathology.

Eating Disorder Inventory-2 (EDI-2; Garner, 1991). The EDI-2 was used to assess disordered eating attitudes and had been widely used with athlete populations (e.g., Plessow et al., 2018; Ringham et al., 2006). For the present study, only the three subscales comprising the short form of the EDI were used: (1) Drive for Thinness (EDI-DT; 7 items), (2) Body Dissatisfaction (EDI-BD; 9 items), and (3) Bulimia (EDI-BU; 7 items). Participants respond according to a 6-point Likert scale ranging from “never” to “always”. Responses were totalled for each subscale with higher scores indicating higher levels of eating psychopathology. Internal consistency was good for females (EDI-DT; $\alpha = 0.85$, EDI-BD; $\alpha = 0.88$, EDI-BU; $\alpha = 0.80$), acceptable for males (EDI-DT; $\alpha = 0.74$, EDI-BD; $\alpha = 0.79$, EDI-BU; $\alpha = 0.71$) and similar to other athlete populations (e.g., Ringham et al., 2006).

Compulsive Exercise Test - athlete version (CET-A; Plateau et al., 2014). The CET-A assesses compulsive exercise behaviours. Participants respond to 15 questions via a 6-point Likert scale ranging from “never true” (0) to “always true” (5). The measure comprises three subscales: (1) avoidance of negative affect (CET-A; 6 items), (2) mood improvement (CET-MI; 5 items) and (3) weight control (CET-WC; 4 items). Responses were averaged for each

subscale and higher scores indicate higher levels of compulsive exercise. Internal reliability of the three subscales ranged from $\alpha = 0.87 - 0.91$ for females and $\alpha = 0.82 - 0.92$ for males, which is a slight improvement compared to its use with other athlete populations (Madigan, Stoeber, & Passfield, 2017).

Teammate influence.

Friends Anti-Dieting Scale (FADS; Shroff, 2004). The FADS was used to assess the frequency of receipt of anti-dieting advice. This 5-item scale has been validated for use with athletes (Kroshus et al., 2015). In the current study, the wording of the items was slightly modified to assess 'weight-control behaviours' in addition to dieting. For example, "How often do your teammates tell you not to diet *or engage in weight control behaviours* because it's unhealthy?" Participants responded on a 5-point Likert scale from "never" (1) to "very often" (5). Higher total scores indicate a higher frequency of receipt of anti-dieting and anti-weight control advice from teammates. Internal consistency in the present sample was ($\alpha = 0.74$) for females and ($\alpha = 0.66$) for males, which is on par with other studies (Kroshus et al., 2015).

Social Support for Healthy Eating Habits Scale (SSES; Sallis, Grossman, Pinski, Patterson & Nader, 1987). The SSES measures perceived encouragement (e.g., "Complimented me on my healthy eating habits") and discouragement/sabotage (e.g., "Offered me foods I'm trying not to eat") from friends to eat healthily via 10 items and two subscales (encouragement; discouragement). It has been validated in a variety of populations (e.g., Walker, Pullen, Hertzog, Boeckner, & Hageman, 2006) although it has yet to be validated with athletes. To tailor the SSES to the athlete population, participants were instructed to answer in relation to their teammates and two additional items were added to the scale: "Encouraged me to eat unhealthy foods before or after training" (discouragement subscale) ; "Offered me healthy foods before or after training" (encouragement subscale). A 5-point Likert scale was used

ranging from “never” (1) to “very often” (5). Higher total scores on each subscale indicated greater levels of encouragement or discouragement to eat healthily from teammates.

Bulimic Modelling Scale (BMS; Stice, 1998). The BMS assesses modelling of unhealthy eating behaviours. One item addressed each of the following: (1) dietary restraint, (2) preoccupation with body dimensions, (3) extreme weight control behaviours, (4) binge eating, and (5) vomiting to control weight. For the present study, athletes were instructed to think about their teammates when answering the questions. An additional item was added to address the modelling of nutritional supplement use, and where relevant, items were altered to improve relevance to male athletes. For example, “One or more of my teammates has vomited to lose weight *and / or change their shape*”. A 5-point Likert scale was used ranging from “never” (1) to “very often” (5). Higher mean scores indicated higher levels of modelling behaviours. Internal consistency in the present sample was good for females ($\alpha = 0.82$), acceptable for males ($\alpha = 0.77$; males) and comparable to other studies which have used the original version (Stice, 1998).

Sport Specific Quality of Relationship Inventory (SSQRI; Jowett, 2009). The 12-item SSQRI assesses perceptions of teammate relationship quality. A 4-point Likert scale ranging from “not at all” (1) to “very much” (4) was used to assess social support (SSQRI-S; 6 items) and interpersonal conflict (SSQRI-C; 6 items). Scores were averaged for each subscale, with higher scores reflecting higher levels of support and conflict in the relationship. Internal consistency was good for both subscales (females: SSQRI-S; $\alpha = 0.87$, SSQRI-C $\alpha = 0.87$; males: SSQRI-S; $\alpha = 0.85$, SSQRI-C $\alpha = 0.85$) and comparable to other athlete samples (Shanmugam, 2011).

Perceived Sociocultural Pressures Scale (PSPS; Stice & Bearman, 2001). The PSPS assesses perceived pressure to lose weight / change shape and has been previously validated in athlete samples (e.g., Galli, Petrie, Reel, Chatterton, & Baghurst, 2014). Three items specifically

assess pressure from teammates and participants responded using a 5-point Likert scale ranging from “none” (1) to “a lot” (5). The items were as follows: (1) “My teammates tease me about my weight or body shape”, (2) “I’ve noticed a strong message from my teammates to have a thin body”, and (3) “I’ve felt pressure from my teammates to lose weight”. A higher mean score reflects greater perceived pressure to lose weight / change shape from teammates. The internal consistency for the PSPS-Teammate was $\alpha = 0.63$ for females and $\alpha = 0.65$ for males which is slightly lower in comparison to other studies using similar samples (Galli et al., 2014).

Psychological wellbeing.

Rosenberg’s Self Esteem Scale (RSES; Rosenberg, 1965). The 10-item RSES measures global self-esteem and has previously been successfully employed with athlete populations (e.g., Holm-Denoma, Scaringi, Gordon, Van Orden, & Joiner, 2009). Participants respond via a 4-point Likert scale ranging from “strongly agree” (1) to “strongly disagree” (4). A total score was calculated, with higher scores reflecting greater self-esteem. Internal reliability for the RSES was good for males ($\alpha = 0.89$), excellent for females ($\alpha = 0.91$) and in line with previous athlete research (e.g., Shanmugam, 2011).

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983). The HADS measures anxiety (7 items) and depression (7 items) symptoms and has been widely used with athletes (e.g., Goodwin, Haycraft, Willis, & Meyer, 2011; Weber et al., 2018). Participants are asked to indicate the degree to which the statements are reflective of how they have been feeling and responses are made on a 4-point scale (e.g., “not at all” (0) to “most of the time” (3)). Total scores were calculated for each subscale to provide a measure of anxiety and depression (mild case = 8-10, moderate case = 11-14, severe case = 15+; Stern, 2014). For the present study, internal consistency was good / acceptable for anxiety

(females; $\alpha = 0.84$, males: $\alpha = 0.79$) and acceptable / low for depression (females: $\alpha = 0.77$, males: $\alpha = 0.68$).

Data Analysis

All analyses were conducted using IBM SPSS 24.0. Shapiro-Wilk tests indicated that very few of the variables were normally distributed, therefore, non-parametric tests were employed where appropriate. Confirmatory Factor Analysis confirmed that the two items added to the SSES loaded onto the subscales as expected, and the internal consistency of the subscales was found to be good for the Encouragement subscale (females: $\alpha = 0.83$, males: $\alpha = 0.82$) and acceptable for the Discouragement subscale (females: $\alpha = 0.77$, males: $\alpha = 0.74$). Mann Whitney U tests were conducted to explore gender differences on study variables and to inform the correlations and stepwise regressions.

To address the first part of the aim, Spearman's two-tailed correlations were conducted separately by gender between teammate influences and eating / exercise psychopathology to assess whether significant relationships existed between these variables. Two-tailed Spearman's *rho* correlations were also run to examine whether covariates (self-esteem, anxiety, depression, age and BMI) significantly correlated with eating and exercise variables. Where significant associations were identified, these were controlled for in the first step of the subsequent regression analyses, given that age, BMI and psychological wellbeing have been widely associated with elevated eating psychopathology (e.g., Neumark-Sztainer, Story, Hannan, Perry, & Irving, 2002; Shanmugam, Jowett, & Meyer, 2012). To address the second part of the aim, hierarchical regressions were conducted separately by gender to identify which teammate influences were predicted eating and exercise psychopathology, after accounting for covariates. In addition to age, BMI and psychological wellbeing, sport type (dummy coded; lean vs non-lean) and competitive level (dummy coded: elite (national and international) vs non-elite (school, club, university, regional)) were entered into the first

step of all regressions, given evidence to suggest these variables are associated with differential levels of eating/exercise psychopathology (e.g., Rosendahl, Bormann, Aschenbrenner, & Strauss, 2009). To reduce the risk of a Type 1 error, a p value of $p < 0.01$ was employed for all analyses.

Results

Descriptive statistics

Descriptive statistics and tests of difference between male and female participants are presented in Table 1. Eating and exercise psychopathology scores for the current sample were broadly comparable to existing research conducted with athletes (e.g., Hausenblas & McNally, 2004). In terms of psychological wellbeing, mean scores on HADS-Depression (whole sample) and HADS-Anxiety (male athletes only) indicated low levels of depression and anxiety within the sample, which is comparable with other athlete populations (e.g., Halfdanardottir, 2016; Weber et al., 2018). However, for female athletes, mean HADS-Anxiety scores indicated mild anxiety symptoms within the sample (Stern, 2014), which is higher than found previously with athletes (e.g., Halfdanardottir, 2016; Weber et al., 2018).

Significant gender differences with small effect sizes (medium for EDI-body dissatisfaction) were identified for all eating and exercise psychopathology and psychological variables aside from HADS-Depression. Gender differences with small effect sizes were also apparent for Encouragement of Healthy Eating (Social Support for Eating Survey-Encouragement), Bulimia Modelling (Bulimia Modelling Scale) and Supportive Friendships (Sport-Specific Quality of Relationship Inventory-Support), where females scored higher than males.

342 Table 1. Participant characteristics and tests of difference between males and females (N = 1172).

Measure	Total (N = 1172) Mean (SD)	Males (n = 445) Mean (SD)	Females (n = 727) Mean (SD)	Mann-Whitney U		
				Z	p	Effect size (r)
Age (years)	24.04 (10.09)	23.07 (9.70)	24.62 (10.10)	4.21	0.01	0.12
BMI	22.66 (3.37)	22.98 (3.47)	22.46 (3.28)	2.94	0.01	0.09
Eating Disorder Inventory- Drive for Thinness	3.06 (4.17)	1.92 (3.06)	3.76 (4.60)	7.60	<0.001	0.22
Eating Disorder Inventory- Bulimia	2.45 (3.60)	1.53 (2.74)	3.01 (3.94)	8.44	<0.001	0.25
Eating Disorder Inventory- Body Dissatisfaction	7.64 (6.47)	5.13 (4.96)	9.16 (6.78)	10.45	<0.001	0.30
Compulsive Exercise Test- Avoidance of Negative Affect	2.38 (1.31)	2.18 (1.31)	2.49 (1.29)	3.66	<0.001	0.11
Compulsive Exercise Test- Mood Improvement	3.78 (1.20)	3.57 (1.31)	3.90 (1.10)	3.89	<0.001	0.11
Compulsive Exercise Test- Weight Control	2.03 (1.30)	1.71 (1.23)	2.23 (1.30)	6.70	<0.001	0.20
Friends Anti-Dieting Advice Scale	9.19 (3.45)	8.88 (3.14)	9.39 (3.63)	1.87	0.06	0.06
Social Support for Eating Survey- Encouragement	12.20 (4.75)	12.01 (4.58)	12.33 (4.84)	4.52	<0.001	0.13
Social Support for Eating Survey- Discouragement	11.05 (3.85)	10.44 (3.62)	11.43 (3.95)	0.82	0.28	0.02
Bulimia Modelling Scale	2.16 (0.77)	2.03 (0.72)	2.23 (0.79)	4.17	<0.001	0.12
Sport-Specific Quality of Relationship Inventory (SSQRI) - Support	2.91 (0.68)	2.80 (0.66)	2.97 (0.69)	4.19	<0.001	0.12
Sport-Specific Quality of Relationship Inventory (SSQRI) - Conflict	1.46 (0.52)	1.47 (0.52)	1.45 (0.52)	0.84	0.67	0.02
Perceived Sociocultural Pressure Scale- Teammates	1.34 (0.55)	1.32 (0.55)	1.35 (0.55)	0.30	0.48	0.01
Rosenberg Self-Esteem Scale	29.90 (6.02)	31.26 (5.75)	29.10 (6.02)	6.23	<0.001	0.18
Hospital Anxiety and Depression Scale- Anxiety	8.22 (4.14)	7.14 (3.80)	8.89 (4.21)	6.94	<0.001	0.20
Hospital Anxiety and Depression Scale- Depression	3.78 (3.05)	3.62 (2.82)	3.85 (3.13)	0.75	0.21	0.02

Two-tailed Spearman's correlations were conducted separately for males and females to explore relationships between demographic variables, teammate influences and psychological wellbeing with eating and exercise psychopathology variables (see Tables 2 and 3). Inter-correlations between all variables employed in this study are presented in Supplementary Tables 1 and 2.

Females (Table 2). Most associations identified between teammate influences and eating / exercise psychopathology were small. Anti-dieting/anti-weight control advice (Friends Anti-Dieting Advice Scale) and Encouragement of Healthy Eating positively correlated with all eating / exercise variables aside from EDI-Body Dissatisfaction and CET-Mood Improvement. Discouragement of Healthy Eating (Social Support for Eating Survey – Discouragement) and Bulimia Modelling positively correlated with all eating and exercise variables. Conflicting Friendships (Sport-Specific Quality of Relationships Inventory – Conflict) and Teammate Pressure (Perceived Sociocultural Pressure Scale – Teammates) positively correlated with all eating and exercise variables aside from CET-Mood Improvement. Supportive Friendships negatively correlated with EDI-Drive for Thinness, EDI-Body Dissatisfaction and CET-Weight Control, and positively correlated with CET-Mood Improvement.

362 **Table 2.** Spearman's correlations between teammate influences, psychological wellbeing and eating and exercise variables for females ($n=727$)

	Eating Disorder Inventory (EDI)						Compulsive Exercise Test (CET)					
	Drive for thinness		Bulimia		Body dissatisfaction		Avoidance		Mood Improvement		Weight Control	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>P</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Age	-0.03	0.43	-0.09	0.01	-0.04	0.30	0.11	0.002	0.13	<0.001	0.03	0.39
BMI	0.17	<0.001	0.15	<0.001	0.28	<0.001	-0.03	0.43	-0.02	0.66	0.16	<0.001
Friends Anti-dieting Advice Scale	0.15	<0.001	0.18	<0.001	0.08	0.04	0.20	<0.001	0.10	0.01	0.18	<0.001
Social Support for Eating Survey - Encouragement	0.17	<0.001	0.18	<0.001	0.07	0.08	0.25	<0.001	0.10	0.01	0.19	<0.001
Social Support for Eating Survey - Discouragement	0.23	<0.001	0.27	0.001	0.12	0.001	0.24	<0.001	0.12	0.001	0.27	<0.001
Bulimia Modelling Scale	0.36	<0.001	0.35	<0.001	0.27	<0.001	0.32	<0.001	0.20	<0.001	0.33	<0.001
Sport-Specific Quality of Relationship Inventory - Conflict	0.15	<0.001	0.21	<0.001	0.15	<0.001	0.13	<0.001	0.01	0.83	0.21	<0.001
Sport-Specific Quality of Relationship Inventory - Support	-0.15	<0.001	-0.07	0.06	-0.11	0.001	0.01	0.82	0.15	<0.001	-0.13	0.001
Perceived Sociocultural Pressures Scale - Teammates	0.32	<0.001	0.31	<0.001	0.29	<0.001	0.23	<0.001	0.07	0.08	0.32	<0.001
Rosenberg Self-Esteem Scale	-0.42	<0.001	-0.36	<0.001	-0.51	<0.001	-0.24	<0.001	-0.01	0.88	-0.21	<0.001
Hospital Anxiety and Depression Scale – Anxiety	0.39	<0.001	0.38	<0.001	0.38	<0.001	0.29	<0.001	0.08	0.06	0.29	<0.001
Hospital Anxiety and Depression Scale - Depression	0.37	<0.001	0.37	<0.001	0.40	<0.001	0.19	<0.001	-0.02	0.61	0.24	<0.001

Males (Table 3). Most associations identified between teammate influences and eating / exercise psychopathology were small. Anti-dieting/anti-weight control advice positively correlated with all eating and exercise variables aside from EDI-Body Dissatisfaction and CET-Weight Control. Encouragement of Healthy Eating and Bulimia Modelling positively correlated with all eating and exercise variables aside from EDI-Body Dissatisfaction. Conflicting Friendships positively correlated with EDI-Body Dissatisfaction, while Supportive Friendships negatively correlated with EDI-Body Dissatisfaction and positively correlated with CET-Mood Improvement. Teammate Pressure positively correlated with all eating and exercise variables, while no significant relationships were identified for Discouragement of Healthy Eating.

Table 3. Spearman's correlations between teammate influences, psychological wellbeing and eating and exercise variables for males ($n = 445$)

	Eating Disorder Inventory (EDI)						Compulsive Exercise Test (CET)					
	Drive for Thinness		Bulimia		Body Dissatisfaction		Avoidance		Mood Improvement		Weight Control	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>P</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Age	-0.003	0.95	0.06	0.20	0.02	0.67	0.28	<0.001	0.27	<0.001	0.12	0.01
BMI	0.21	<0.001	0.09	0.06	0.21	<0.001	0.13	0.01	0.12	<0.01	0.31	<0.001
Friends Anti-dieting Advice Scale	0.14	0.001	0.15	0.001	0.07	0.16	0.22	<0.001	0.15	0.001	0.13	0.01
Social Support for Eating Survey - Encouragement	0.19	<0.001	0.17	<0.001	0.05	0.27	0.32	<0.001	0.19	<0.001	0.21	<0.001
Social Support for Eating Survey - Discouragement	0.08	0.08	0.12	0.01	-0.01	0.91	0.13	0.01	0.05	0.28	0.13	0.01
Bulimia Modelling Scale	0.24	<0.001	0.26	<0.001	0.11	0.02	0.35	<0.001	0.20	<0.001	0.26	<0.001
Sport-Specific Quality of Relationship Inventory - Conflict	0.06	0.22	0.11	0.03	0.15	0.001	0.07	0.13	-0.13	0.01	0.12	0.02
Sport-Specific Quality of Relationship Inventory - Support	-0.05	0.27	-0.01	0.84	-0.25	<0.001	0.06	0.24	0.21	<0.001	0.02	0.67
Perceived Sociocultural Pressures Scale - Teammates	0.28	<0.001	0.23	<0.001	0.23	<0.001	0.28	<0.001	0.15	0.001	0.24	<0.001
Rosenberg Self-Esteem Scale	-0.26	<0.001	-0.21	<0.001	-0.41	<0.001	-0.17	<0.001	0.04	0.44	-0.25	<0.001
Hospital Anxiety and Depression Scale – Anxiety	0.28	<0.001	0.26	<0.001	0.29	<0.001	0.30	<0.001	0.10	0.04	0.32	<0.001
Hospital Anxiety and Depression Scale – Depression	0.30	<0.001	0.21	<0.001	0.29	<0.001	0.05	0.27	-0.13	0.01	0.19	<0.001

Next, hierarchical regressions were conducted (separately by gender) to determine which teammate influences predicted eating and exercise psychopathology. Covariates (i.e. age, BMI, self-esteem, anxiety and depression) which were significantly correlated with the eating and exercise psychopathology variables were controlled for and entered at the first step of the regression. Sport type and competitive level were also entered into the first step. Teammate influences which were significantly correlated with eating and exercise variables were entered into the second step (see Tables 4-7).

Females. The regression models to assess the predictive role of covariates and teammate influences on eating and exercise variables were significant for all three EDI subscales (Table 4). Covariates explained 26% (EDI-Drive for thinness), 21% (EDI-Bulimia) and 36% (EDI-Body Dissatisfaction) of the total variance. Teammate influences explained an additional 8% (EDI-Drive for Thinness), 7% (EDI-Bulimia) and 4% (EDI-Body Dissatisfaction) of the total variance. For both EDI-Drive for thinness and EDI-Body Dissatisfaction, Teammate Pressure made the largest contribution, followed by Bulimia Modelling for EDI-Drive for Thinness. Bulimia Modelling made the largest contribution to EDI-Bulimia followed by Teammate Pressure.

The regression models were also significant for all CET subscales (Table 5), with covariates explaining 12% (CET-Avoidance) and 13% (CET-Weight Control) of the total variance. Teammate influence variables explained 8% of the total variance in CET-Mood Improvement and an additional 7% and 10% of the variance explained for CET-Avoidance and CET-Weight Control, respectively. Bulimia Modelling made the largest contribution to CET-Avoidance followed by Discouragement of Healthy Eating, Supportive Friendships made the largest contribution to CET-Mood Improvement followed by Bulimia Modelling, and Bulimia Modelling made the largest contribution to CET-Weight Control followed by

402 Discouragement of Healthy Eating and Teammate Pressure.

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404 **Table 4.** Hierarchical regression analysis predicting disordered eating scores from covariates and teammate influences for females ($n=727$)

Predictor	Drive for Thinness			Bulimia			Body Dissatisfaction		
	β	Adj R ²	F change	β	Adj R ²	F change	β	Adj R ²	F change
Step 1									
BMI	0.13**			0.20**			0.26**		
Sport type									
Competitive level									
Self-Esteem	-0.18**			-0.16**			-0.44**		
Anxiety	0.18**			0.23**					
Depression	0.25**								
Step 2									
		0.34	12.26**		0.28	0.07**		0.40	10.15**
BMI	0.13**			0.16**			0.24**		
Sport type							0.08*		
Competitive level									
Self-Esteem	-0.24**			-0.12**			-0.35**		
Anxiety	0.16**			0.20**					
Depression	0.17**								
Anti-dieting Advice									
Encouragement of Healthy Eating									
Discouragement of Healthy Eating									
Bulimia Modelling	0.15**			0.18**					
Supportive Friendships									
Conflicting Friendships									
Teammate Pressure	0.18**			0.15**			0.20**		

405 * $p < 0.01$, ** $p < 0.001$

406 *Note.* Teammate influences highlighted. Only significant predictors at $p < 0.01$ reported.

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411 **Table 5.** Hierarchical regression analysis predicting compulsive exercise scores from covariates and teammate influences for females ($n=727$)

Predictor	Avoidance			Mood Improvement			Weight Control		
	β	Adj R ²	F change	β	Adj R ²	F change	β	Adj R ²	F change
Step 1		0.12	17.48**		0.01	3.57		0.13	18.68**
Age									
BMI							0.11*		
Sport type	-0.12*								
Competitive level	0.12*								
Self-Esteem							-0.19**		
Anxiety	0.23**						0.17*		
Depression									
Step 2		0.19	11.55**		0.08	18.17**		0.23	14.87**
Age				0.10*					
BMI									
Sport type									
Competitive level									
Self-Esteem							-0.14*		
Anxiety	0.20**								
Depression									
Anti-dieting Advice									
Encouragement of Healthy Eating									
Discouragement of Healthy Eating	0.12*						0.14*		
Bulimia Modelling	0.14*			0.15**			0.16**		
Supportive Friendships				0.17**					
Conflicting Friendships									
Teammate Pressure							0.13*		

412 * $p<0.01$, ** $p<0.001$,413 *Note.* Teammate influences highlighted. Only significant predictors at $p<0.01$ reported.

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Males. The regression models were significant for all EDI subscales (Table 6), with covariates explaining 16% (EDI-Drive for Thinness), 13% (EDI-Bulimia) and 26% (EDI-Body Dissatisfaction) of the total variance. Teammate influences explained an additional 5% (EDI-Drive for Thinness), 4% (EDI-Bulimia) and 4% (EDI-Body Dissatisfaction) of the total variance. Teammate Pressure and Bulimia Modelling made the largest contributions to EDI-Drive for Thinness and EDI-Bulimia, respectively. Supportive Friendships and Teammate Pressure made the largest contributions to EDI-Body Dissatisfaction.

The regression models were also significant for all CET subscales (Table 7), with covariates explaining 21% (CET-Avoidance), 7% (CET-Mood Improvement) and 15% (CET-Weight Control) of the total variance. Teammate influences accounted for an additional 8% (CET-Avoidance), 5% (CET-Mood Improvement) and 5% (CET-Weight Control) of the variance. For CET-Avoidance, Bulimia Modelling made the largest contribution to the total variance followed by Teammate Pressure and Encouragement of Healthy Eating. For CET-Mood Improvement, Supportive Friendships made the largest contribution. For CET-Weight Control, Teammate Pressure made the largest contribution.

432 **Table 6.** Hierarchical regression analysis predicting disordered eating scores from covariates and teammate influences for males ($n=445$)

Predictor	Drive for Thinness			Bulimia			Body Dissatisfaction		
	β	Adj R ²	F change	β	Adj R ²	F change	β	Adj R ²	F change
Step 1									
BMI	0.20**						0.26**		
Sport type									
Competitive level									
Self-Esteem				-0.15*			-0.25**		
Anxiety	0.15*								
Depression							0.21**		
Step 2									
BMI	0.16**	0.21	9.0**		0.17	7.72**	0.25**	0.30	8.58**
Sport type									
Competitive level									
Self-Esteem							-0.23**		
Anxiety									
Depression				0.16*					
Anti-dieting Advice									
Encouragement of Healthy Eating									
Discouragement of Healthy Eating									
Bulimia Modelling				0.18**					
Supportive Friendships							-0.18**		
Conflicting Friendships									
Teammate Pressure	0.18**						0.15**		

433 * $p<0.01$, ** $p<0.001$

434 *Note.* Teammate influences highlighted. Only significant predictors at $p<0.01$ reported.

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437 **Table 7.** Hierarchical regression analysis predicting compulsive exercise scores from covariates and teammate influences for males ($n=445$)

Predictor	Avoidance			Mood Improvement			Weight Control		
	β	Adj R ²	F change	β	Adj R ²	F change	β	Adj R ²	F change
Step 1		0.21	21.47**		0.07	12.08**		0.15	14.09**
Age							0.15*		
BMI									
Sport type	-0.23**			-0.23**					
Competitive level							-0.13*		
Self-Esteem									
Anxiety	0.43**						0.31**		
Depression	-0.17*								
Step 2		0.29	15.33**		0.12	6.21**		0.20	9.60**
Age							0.14*		
BMI									
Sport type	-0.21**			-0.21**					
Competitive level							-0.16**		
Self-Esteem									
Anxiety	0.38**						0.27**		
Depression	-0.16*								
Anti-dieting Advice									
Encouragement of Healthy Eating	0.14*								
Discouragement of Healthy Eating									
Bulimia Modelling	0.16*								
Supportive Friendships				0.16*					
Conflicting Friendships									
Teammate Pressure	0.15*						0.13*		

438 * $p < 0.01$, ** $p < 0.001$ 439 *Note.* Teammate influences highlighted. Only significant predictors at $p < 0.01$ reported.

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Discussion

The primary aim of this study was to explore the relationships and predictive associations between a variety of teammate influences and eating and exercise attitudes and behaviours of athletes from a wide range of sports and competitive levels. A further aim was to identify the presence of any gender differences. Significant, small relationships were identified between many of the teammate influence mechanisms and indices of eating / exercise psychopathology. After accounting for indices of psychological wellbeing (self-esteem, anxiety and depression), having supportive teammate friendships was the best (i.e., statistically strongest) predictor of *lower* eating psychopathology (lower levels of body dissatisfaction) and higher levels of healthy exercise behaviours (i.e., exercising to improve mood), whereas modelling of teammates' disordered eating behaviours and perceived pressure from teammates to lose weight / change shape were the best predictors of *higher* disordered eating and compulsive exercise levels. Overall, influences from teammates explained more of the additional variance in disordered *exercise* than disordered *eating* attitudes and behaviours. Furthermore, teammate influences explained more variance in eating and exercise psychopathology for female athletes. These key findings confirm our hypotheses, provide support for Petrie and Greenleaf's (2012) sociocultural model of disordered eating, and extend prior literature which has yet to consider the relative importance of various teammate influence mechanisms on eating *and* exercise attitudes and behaviours.

Perceiving pressure from teammates to lose weight / change shape (e.g., add muscle), in addition to perceiving that teammates engaged in disordered eating attitudes and behaviours (e.g., restriction or bingeing, preoccupation with body dimensions and vomiting to control weight) were the strongest mechanisms of influence associated with elevated disordered eating and exercise behaviours. This aligns with previous literature which has

identified the negative role of perceived teammate pressure to lose weight/change shape (T. A. Petrie et al., 2007; T. A. Petrie, Greenleaf, Reel, & Carter, 2009b) and modelling of teammates' disordered eating (Engel et al., 2003) on athletes' own disordered eating attitudes and behaviors. However, our findings build on existing literature by demonstrating that perceived teammate pressure to lose weight/change shape and modelling of teammates' disordered eating appear to be *more important* than other negative teammate influence mechanisms (e.g., having teammate friendships characterised by conflict/distrust or discouragement/sabotage from teammates to eat healthily) in the explanation of elevated levels of disordered eating *and* exercise. Pervasive social norms and within team "subcultures" (Thompson & Sherman, 2011) of acceptance around disordered eating and exercise behaviours may explain the strong relationship between an athlete's self-reported behaviour and parallel perceptions of their teammate's behaviours. Athletes are also often acutely aware of their teammates' weight if mandatory team weigh-ins occur (Galli, Petrie, & Chatterton, 2017), teammate lifting is required (e.g., cheerleading, figure skating, rugby), or where the attire means that the body is clearly visible (e.g., volleyball, swimming). In these contexts, weight and body shape comparisons are easily facilitated (Voelker, Petrie, Reel, & Gould, 2018) and pressure from teammates may manifest through critical comments about weight / shape (e.g., Muscat & Long, 2008), subsequently contributing to the disordered eating *and* exercise attitudes / behaviours identified in the present study.

For females, eating and exercise psychopathology were more strongly associated with indices of negative teammate influences than for males. While this finding aligns with existing (descriptive) research which has found that females report receiving more negative teammate influences with regards to their eating behaviours than males (Hausenblas & Carron, 2000), the findings from the present study extend research by documenting *how* teammates are being influential (i.e., via teammate pressure to lose weight/change shape) and

the relative *strength* of teammate influence on female athletes' eating and exercise psychopathology. Disordered eating prevention efforts that take account of the specific dynamics of female peer groups (e.g., "girl talk" support groups, McVey, Lieberman, Voorberg, Wardrope, & Blackmore, 2003) may be a useful approach to reduce levels of disordered eating and exercise in this already at-risk population (Torstveit, Rosenvinge, & Sundgot-Borgen, 2008).

With regard to positive teammate influences, this study identified that supportive teammate relationships (characterised by warmth, compassion and an absence of conflict) was the only mechanism of influence significantly associated with *lower* levels of eating psychopathology (body dissatisfaction) and higher levels of healthy exercise behaviours (e.g., exercise to improve mood). This finding is in line with studies that have explored these relationships longitudinally (e.g., Shanmugam et al., 2014) and have found high quality teammate friendships to be protective against disordered eating attitudes (e.g., Scoffier, Maïano, & d'Arripe-Longueville, 2010). Importantly, the current study extends existing research by indicating that having supportive teammate friendships is more *strongly* related to healthier eating and exercise attitudes and behaviours than receiving anti-dieting/anti-weight control advice from teammates which (although not identified as a predictor in the present study) has been previously linked with lower eating psychopathology (Kroshus et al., 2014, 2015). This finding highlights an important target for future intervention programmes aiming to prevent unhealthy eating and exercise behaviours in athletes.

A finding novel to this study was the association between encouragement from teammates to eat healthily and avoid unhealthy foods and *increased* levels of compulsive exercise. This is contrary to a wide body of literature from the general population demonstrating associations between encouragement to eat and / or exercise healthily and subsequent healthy eating / exercise behaviours (Bauer, Nelson, Boutelle, & Neumark-

Sztainer, 2008; Larson et al., 2008). Given the cross-sectional nature of our study, it is not possible to unpack the temporal precedence. It is plausible to suggest that a focus on *healthy eating* behaviours within a team might serve to promote excessive weight pre-occupation and disordered avoidance of unhealthy foods (Dixey, 1996). Indeed, compensatory practices such as exercise are widely accepted as the appropriate behavioural response to the consumption of unhealthy food (Lenne et al., 2017). Given their often rigid diet and exercise habits (Bonci et al., 2008), athletes may have distorted notions of what it is to be healthy. For example, by having strict adherence to, and obsessive routines around, consuming particular macronutrients (e.g., lean protein) (Segura-Garcia et al., 2012). Input from teammates encouraging healthy eating may promote such obsessive and rigid practices and potential engagement in compulsive exercise, as demonstrated in this study. Further longitudinal work is needed to unpack this finding, but it could be important to reduce the focus on ‘healthy’ eating practices in teams in order to reduce disordered eating / exercise practices.

Uniquely, this study found that teammate influences accounted for additional variance in eating and exercise psychopathology, over and above constructs typically associated these variables (e.g., athletes’ self-esteem, anxiety, depression, age, BMI, sport type and competitive level). This supports previous research suggesting teammates can play a unique protective / facilitatory role in the development of disordered eating (e.g., Scott et al., 2019). Furthermore, this study also identified relationships between teammate influences and psychological well-being. In line with this, a wide body of literature has demonstrated the link between psychological well-being and eating psychopathology in athletes (Giel et al., 2016; T. A. Petrie, Greenleaf, Reel, & Carter, 2009a; Shanmugam et al., 2012). Additional research is now required to assess how these constructs interact longitudinally (e.g., via mediation analyses).

The identification of risk and protective factors, such as teammate influences and indices of psychological wellbeing, are essential in order to facilitate the identification of high-risk groups, appropriately tailor prevention and intervention programmes, and to keep sport policies concerning eating and exercise psychopathology in athletes well informed and relevant (Striegel-Moore & Bulik, 2007). This study is the first to comprehensively assess the role of multiple potential mechanisms of teammate influence on athletes' eating and exercise attitudes and behaviours. By sampling a large and representative population of athletes and accounting for known covariates of disordered eating and exercise (e.g., BMI, age, psychological wellbeing, sport type and competitive level), this study builds on the limitations of the extant literature. In doing so it has highlighted the sub-populations at increased risk where targeted intervention efforts may be effective – notably, female athletes.

There are, however, some limitations. The cross-sectional design did not allow for cause and effect to be determined, meaning that longitudinal and experimental studies are required to determine temporal relationships between teammate influences and disordered eating and exercise attitudes and behaviours. Future research should investigate whether susceptibility to teammate influences changes as a function of sport type and competitive level given research finding the athletes' sport to be a key moderator in the development of disordered eating and exercise attitudes / behaviours (e.g., Chapman & Woodman, 2016; Rosendahl et al., 2009; Schaal et al., 2011; Voelker et al., 2018). In addition, it is important that influences from the athlete's *coach* are not overlooked. For example, conflicting coach-athlete relationships and coach pressure have been linked to athletes' disordered eating (Coker-Cranney & Reel, 2015; Jones, Glimtmeier & McKenzie, 2005). Therefore, future research would benefit from assessing both teammate and coach influences in tandem to ascertain their relative strength when predicting disordered eating and exercise. Finally, around half (51%) of the athletes in the sample reported competing in individual sports (but

regularly trained with a group of athletes). Further research exclusively sampling athletes competing in *team-based* sports may indicate influences from teammates to have a greater impact on eating / exercise psychopathology.

Conclusion

This novel study has highlighted that teammates can have both a positive and negative influence on athlete eating attitudes and behaviours, even after indices of psychological wellbeing are controlled for, with gender differences apparent. In particular, supportive teammate friendships was the best predictor of *lower* eating psychopathology and higher levels of healthy exercise attitudes and behaviours. In contrast, negative mechanisms of influence had the opposite relationship; modelling of teammates' disordered eating behaviours and perceived pressure from teammates to lose weight / change shape were the best predictors of *elevated* disordered eating and exercise. These findings are important as they will help to inform the development of future targeted interventions to prevent disordered eating and exercise behaviours occurring in athletes. Further longitudinal and experimental research is needed to enable definitive conclusions to be drawn about the circumstances under which teammates can influence athlete eating / exercise psychopathology.

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