

Eating Disorders and Disordered Eating in Athletes

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Declaration

I, Hannah Stoyel, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Date: 5th of February 2021

Hannah Stoyel

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I have loved almost every moment of my PhD experience. Despite the challenges of starting a business and working full-time as a sport psychologist, I am proud of the work I have done in the past 2.5-3 years.

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Abstract

Background: This research focusses on disordered eating and eating disorders (DE/ED) in athletes. DE/ED negatively impact athletes' physical and mental health and performance. Hence, understanding their development is key. Petrie and Greenleaf's (2007) model is specific to athletes and served as a theoretical basis for this work. This model posits that initial predictors of disordered eating are sport pressure and societal pressure and describes several moderators and mediators.

Aims and Methods: The thesis aimed to improve understanding of the development of DE/ED in athletes and develop a new model to predict DE/ED in athletes. The first task was to systematically review the evidence for Petrie and Greenleaf's (2007) model. The next was to test the model's applicability in a large cross-sectional sample. A qualitative study was undertaken to better understand the experiences of the athletes in the sample. Finally, a longitudinal study was conducted to test the model over time, using structural equation modelling and cross-lag mediation.

Results: The systematic review yielded inconsistent findings, providing further support for the need to test Petrie and Greenleaf's theoretical model. Testing their model in a large athlete sample revealed that it does not adequately explain DE/ED in athletes and a new model was developed that better fit the sample. This new model was then used in a longitudinal study, where it showed that societal pressures, mediated by internalisation, predicted later bulimic symptomatology. The qualitative study highlighted the complex interaction between societal expectations, social comparisons, and sport pressures that contribute to the development of disordered eating.

Conclusions: These findings suggest that development and prevention of DE/ED in athletes may align with principles already established in research and practice for nonathlete populations. A key limitation was that the scales used were not reliable for athletes across time. Future research should include scales specifically designed for athletes.

Impact Statement

In this thesis, attention and insight are given to the risk factors for the development of disordered eating in athletes. The impact of this work lies in the convergence of different disciplines of psychology. Progress and impact are often impeded by fear of the unknown and the reliance on “how we have always done it.” The cross-collaboration between fields in this work meant that new ideas and more advanced and mixed methodologies were utilised that moved the disciplines forward.

The findings in this work revolve around two main points: one consists of issues with the existing methodology, and the other concerns the impact of society on athletes’ risk for developing disordered eating. This dual vantage point allows for the following acknowledgment: if we accept that society is problematically judgmental of athletes, perhaps researchers, who are part of that same society, have wrongly assumed that athletes feel pressure from their peers and within their sport, when this pressure is, in fact, a projection of society’s own judgmental nature. Understanding our own impact as researchers must be noticed and rectified. The findings of this work suggest some future steps for research and applied interventions in the prevention and treatment of disordered eating in athletes. The inclusion of social media across the work brings this work firmly into the 21st century.

Components of this work have been published in academic journals; two papers have been published on the studies reported in this thesis, with two more under review. The systematic review in chapter two has an Altmetric score of 18, putting it in the top 25% of all research output scored by this metric. The cross-sectional study in chapter three has been viewed over 1500 times. Parts of this thesis have also been presented at four academic conferences in eating disorders and applied sport, as well as being disseminated via blog posts, podcasts, and media interviews.

The impact of this work was supported by my qualifications and background; I am a postgraduate student studying a clinical topic, and also have applied qualifications and insight into working with athletes as a sport psychologist. My dual role within the academic and applied sphere allows for broad dissemination of this research, to a wide range of people on a wide range of platforms. The findings in this work have been translated not only to those in other academic disciplines of psychology, but also to coaches, athletes and other sport scientists through working in multi-disciplinary teams and presenting at sport science conferences. The most poignant example of impact is my work with Henley Royal Regatta. After months of collaboration using my research and expertise, the prestigious Henley Royal Regatta will no longer require weight information, nor will they publish weight information on the athletes competing.

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Chapter 1.

Eating disorders and disordered eating classification, diagnosis, and risk factors, and their relation to the sporting context and athletes.

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Eating Disorders

Eating disorders and disordered eating in athletes sit at the intersection between clinical psychology and sport psychology. To begin discussion on this topic, we must begin in the clinical realm, the area that has the benefit of heritage as well as established rigour. In clinical psychology, eating disorders and disordered eating are thought of on a continuum, with eating disorders representing a more extreme, clinically diagnosable form of eating psychopathology. The DSM-5 defines feeding and eating disorders as “characterised by a persistent disturbance of eating or eating-related behaviour that results in the altered consumption or absorption of food and that significantly impairs physical health or psychosocial functioning.” (DSM-5, 2012, p. 329). In the DSM-5, criteria for a range of eating disorders, such as Anorexia Nervosa, Bulimia Nervosa, Binge Eating Disorder, and Otherwise Specified Feeding and Eating Disorders, are defined (American Psychiatric Association, 2013). See Figure 1-1.

The DSM has been through five revisions to reach its current state, with each edition changing the inclusion and diagnostic criteria of various feeding and eating disorders. The DSM has changed over the decades in response to expert critique and research evidence such that it can become increasingly valid and reliable both for diagnoses and for related research (Wilfley et al., 2007). However, large numbers of individuals do not receive a formal diagnosis – and therefore treatment access – for an eating disorder. It can take years for someone to be diagnosed with a clinical eating disorder, and individuals may not receive treatment if they do not fit all the diagnostic criteria in the DSM (BEAT, 2017; Robinson et al., 2020). This lack of treatment exists despite individuals experiencing physical and mental health issues related to eating disorder symptomatology.

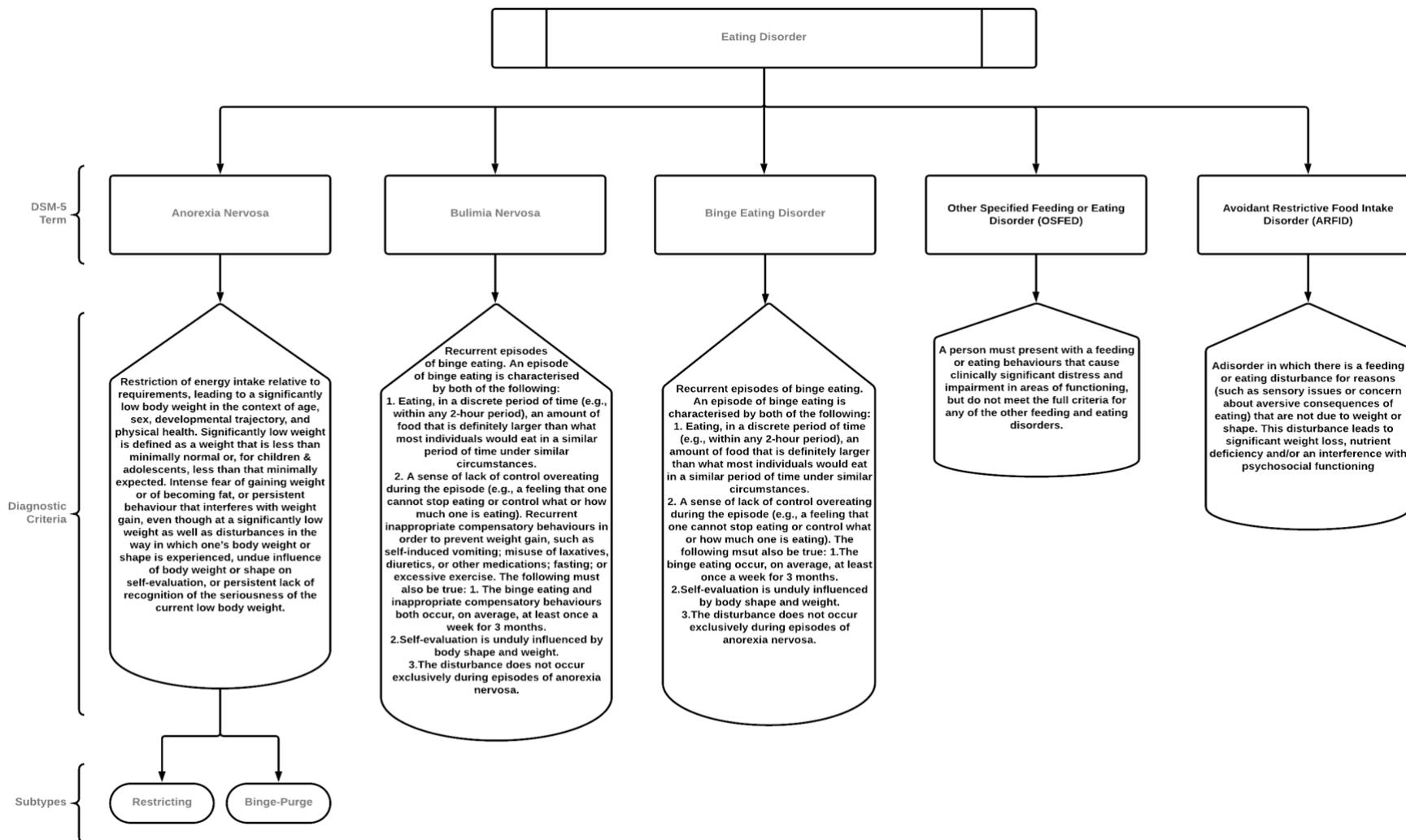


Figure 1-1. DSM-5 Eating Disorders and Diagnostic Criteria

Eating disorders in the general population

All eating disorders pose serious threats to the physical and mental health of those afflicted (Hudson, Hiripi, Pope, & Kessler, 2007; Klump, Bulik, Kaye, Treasure, & Tyson, 2009). Clinically diagnosable eating disorders are consistently under-treated, greatly affect physical health and quality of life, and have a high comorbidity with other mental illnesses such as anxiety and obsessive compulsive disorder (Hudson et al., 2007; Schaumberg et al., 2019). Women are more likely to experience an eating disorder in their lifetime than men, with adolescents being the most at-risk age group (Smink et al., 2014). The lifetime prevalence rate for women for experiencing Anorexia Nervosa is 1.7%; it is 0.8% for Bulimia Nervosa, 2.3% for Binge Eating Disorder and 0.6% for OSFED. For men, the lifetime prevalence rates are 0.1% for Anorexia Nervosa, 0.1% for Bulimia Nervosa, 0.7% for Binge Eating Disorder and 0.3% for OSFED (Smink et al., 2014).

Athletes and eating disorders

There is considerable debate over the prevalence rate of clinical eating disorders among athletes and whether that rate is higher than within the general population. Prevalence rates vary from 6% to 45% in female athletes and 0-19% in male athletes, which are generally (but not always) higher than rates within the general population (Sundgot-Borgen & Torstveit, 2004; Bratland-Sanda & Sundgot-Borgen, 2013). The confusion may stem from a number of potential moderators, such as sport type and gender, that are often not considered when attempting to make prevalence rate comparisons (Hausenblas & McNally, 2004). For example, many studies sample one or two specific sports, usually selecting those with athletes who are greater risk, which means that making claims about overall prevalence rates for athletes across all sports is not possible (Beals, 2004; Ferrand et al., 2007; Kampouri et al., 2019; Krentz & Warschburger, 2011b).

Another set of factors contributing to the lack of general consensus are measurement and terminology issues. Many studies that look at eating disorders in

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athletes are based on symptomatology rather than clinical diagnosis (perhaps because of the time and training required for clinical diagnosis), which prevents the assessment of prevalence in the same manner as with clinical or general populations (Hausenblas & McNally, 2004). These studies use classifications of symptoms such as ‘clinical’, ‘subclinical’, or ‘symptomatic’ by using scales such as the Questionnaire for Eating Disorder Diagnosis or the Eating Disorder Inventory-2, rather than the formal diagnostic tools that yield diagnostic titles from the DSM (e.g., Carter & Rudd, 2005). Other studies have looked at rates of specific symptoms – one study showed that 5.5% of female athletes and 2.2% of males reported purging behaviours on a weekly basis, and another estimated that 4.2% of athletes display eating disorder symptomology – but again, formal diagnostic techniques and titles were not used, making absolute claims about prevalence rates very difficult (Greenleaf et al., 2009; Johnson et al., 1999).

In order to accurately determine diagnosis of clinical eating disorders, a diagnostic interview such as the Eating Disorder Examination must accompany a questionnaire (Byrne & McLean, 2001; Sundgot-Borgen, 1994). It is also important to note that adult athlete eating disorder symptoms are under-reported when using a questionnaire alone (Martinsen & Sundgot-Borgen, 2013). The few studies that have used clinical diagnostic interviews to accompany self-report questionnaires have found a higher rate for eating disorders among athletes compared to controls (Martinsen & Sundgot-Borgen, 2013; Torstveit et al., 2008). Clinical interviews are not always feasible, however (again, often due to a lack of clinical research training), as was the case here. In these instances, using the gold standard questionnaires for diagnoses, such as the Eating Disorder Examination Questionnaire, which stems from clinical interviews, is best practice (Dahlgren et al., 2017; Fairburn, 2008; Fairburn & Beglin, 1994).

Despite equivocality and lack of rigorous research, athletes do suffer from eating disorders, and study of their relationship with food and related psychopathology is

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warranted. When athletes are impacted by eating disorders, it can have significant ramifications; they may need to be temporarily prevented from engaging with sport training, for instance. Research on athletes who stop training due to injury or concussion shows that this can lead to social isolation and identity loss (Heird & Steinfeldt, 2013). With exercise both a symptom and maintenance factor of eating disorders as well as integral part of being an athlete, preventing the development of this illness is especially key for this population (Goodwin et al., 2016).

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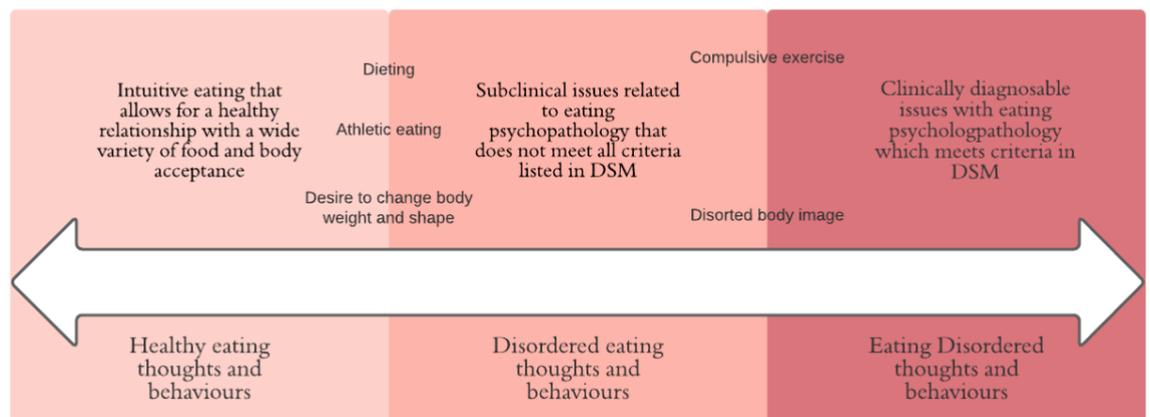


Figure 1-2 Healthy eating, disordered eating, eating disorder continuum

Disordered eating, compared to eating disorders, does not have an official definition; it is a concept often captured as subclinical issues related to eating psychopathology, such as restriction and bingeing, but to a lesser degree or frequency than found in clinical eating disorders. Often, it also includes subclinical issues with cognition related to overvalued ideas around body weight and shape (Krentz & Warschburger, 2011b; Tylka & Subich, 1999). It is also sometimes conceptualised as a continuum or ‘a spectrum of attitudes and behaviours like a preoccupation with body weight and shape, food restriction, and dieting as well as bingeing, vomiting, and the abuse of diuretics, laxatives and diet pills’ (Torstveit et al., 2008; see Figure 1-2). Subclinical issues include a variety of symptoms, with some symptoms classified into

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subclinical conditions such as orthorexia, which is an obsession with healthy eating, or muscle dysmorphia, in which someone has an unhealthy obsession with obtaining a large muscle mass (Donini et al., 2005; Pope et al., 2005). Due to a lack of official consensus on the definition of disordered eating coupled with a lack of specific diagnostic criteria or tools, prevalence estimates for engaging in some form of disordered eating behaviour range from 3.2% to 13.7% in adults in the general population to over 50% of adolescent females and about a third of adolescent males (Croll et al., 2002; Reba-Harrelson et al., 2009). Evidence shows that subclinical eating disorder symptomatology predicts an increased likelihood for eating disorder diagnosis two years later, making the inclusion of those with subclinical eating disorders or disordered eating in the sample for this PhD (rather than relying solely on the diagnostic criteria above) both important and relevant (Einsberg et al., 2011).

Athletes and Disordered Eating

There is also debate over the prevalence rates of disordered eating within the athlete population and how these rates compare to those of nonathletes. This equivocality is due in part to methodological issues that make comparing studies difficult, as well as a lack of a firm definition for disordered eating (Bratland-Sanda & Sundgot-Borgen, 2013; Reinking & Alexander, 2005). Prevalence rate estimates for disordered eating in athletes range from 0% to upwards of 60%, but many estimates hover around 15% to 25% (for both male and female athletes exhibiting some form of disordered eating), with rates increasing in recent decades (Beals, 2004; Greenleaf et al., 2009; Hawkins II & Clement, 1980; Petrie et al., 2008; Sundgot-Borgen & Torstveit, 2010). As with clinical eating disorders, there is still some debate over whether athletes have higher rates of disordered eating than nonathletes, but there is a higher degree of consensus that athletes do suffer more than nonathletes from disordered eating (Mancine et al., 2020). It is thought that this higher rate can perhaps be partially explained by the fact that they are more

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commonly exposed to factors related to disordered eating, such as higher rates of body scrutiny and moving away from home at a young age (Beals, 2004; Carter & Rudd, 2005; Greenleaf et al., 2009). Part of the equivocality about nonathlete versus athlete prevalence rates stems from studies using only one gender or only type of sport, which, as with clinical eating disorder research, creates issues with comparison and consensus (Sundgot-Borgen & Torstveit, 2004).

Female athletes, as with females in the general population, are more likely to suffer from disordered eating than male athletes (Bratland-Sanda & Sundgot-Borgen, 2013; Mancini et al., 2018). This has led to some bias in the research, with the majority of work focusing exclusively on female athletes, and the measurement tools for disordered eating being created only for females (Carter & Rudd, 2005).

The type of sport also plays a role in the prevalence of disordered eating. Within research into eating disorders, disordered eating, body image and the like, sports are often categorised by how integral weight and shape are to performance. Lean sports, such as gymnastics and marathon running, are those in which a lean body weight and shape benefit performance, and they are largely considered to have higher prevalence rates of disordered eating and eating disorders. Nonlean sports, such as football or lacrosse, are defined as those in which a lean weight or shape does not offer any advantage (Andersen & DiDomenico, 2012; Duffy-Paiement, 2010; Sundgot-Borgen & Torstveit, 2010). Those in lean sports have a higher prevalence rate of disordered eating, estimated around 48% as compared to around 20% in nonlean sports (Torstveit et al., 2008). Lean sports can be further categorised in variety of ways including as aesthetic or antigravitational; in aesthetic sports, a lean shape is determined to be visually appealing to a judge and is therefore rated higher, and antigravitational sports (such as long jump or high jump) are those in which a lean shape is favoured because it allows for preferred physical outcomes that arise from the to the ability to defy gravity with more ease (Krentz

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& Warschburger, 2011; Sundgot-Borgen, 1994; Thompson & Sherman, 2010). The highest prevalence of disordered eating in female athletes is seen in aesthetic sports, while the highest prevalence rates for male athletes are seen in antigravitation sports (Krentz & Warschburger, 2011a; Sundgot-Borgen, 1993; Sundgot-Borgen & Torstveit, 2004).

Relative Energy Deficiency in Sport (RED-S)

Disordered eating in athletes has significant ramifications; not only is the health of the athlete in danger, but so is the sporting performance. The relationship between caloric intake and exercise expenditure in sport is has been studied in other scientific disciplines beyond psychology. In the 1990s, the American College of Sports Medicine defined and documented the Female Athlete Triad as a collection of interrelated issues, specifically osteoporosis, disordered eating, and menstrual dysfunction, which create health and performance consequences for those athletes afflicted (Birch, 2005; Otis et al., 1997). In recent years, a syndrome called Relative Energy Deficiency in Sport (RED-S) has replaced the Female Athlete Triad, which was criticised for excluding men who may also be suffering from the impact of activity on their physical health. RED-S also includes other areas of the body that are affected as a health and performance consequence of RED-S (see Figure 1-2). Health consequences of low energy availability are far-reaching, impacting the central nervous system and the cardiovascular and endocrine systems, as well as having gastrointestinal and reproductive ramifications. RED-S also has pervasive performance consequences for athletes, including increased injury risk, decreased response to training, decreased coordination and more (see Figure 1-3) (Drinkwater et al., 2005; Mountjoy et al., 2018; Nattiv et al., 2007).

Notably, poor psychological wellbeing can act both as a precipitator for and a consequence of RED-S. Calorie deficiency due to poor nutritional understanding combined with intense training can result in psychological consequences such as depression (Mountjoy et al., 2018). Alternatively, disordered eating or an eating disorder

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can cause an athlete to restrict caloric intake to a point of health and performance detriment. No matter the underlying cause, extended bouts of low energy availability can impair health and performance. The key role psychology plays in RED-S, a disorder that stretches across the sport science disciplines and into the clinical realm, is another reason why understanding risk factors for the development of disordered in athletes is important.

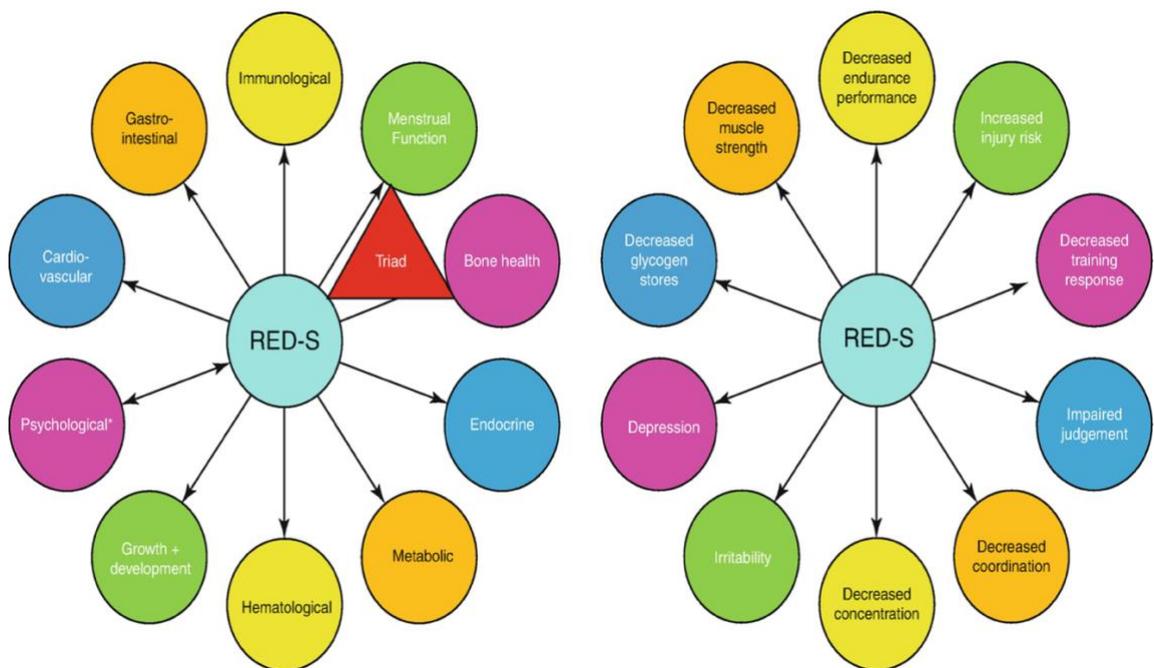


Figure 1-3 RED-S Health (left) and Performance (right) Consequences (Figure from Mountjoy et al., 2018)

Understanding the Risk Factors for Disordered Eating

Risk factors for disordered eating can be classified into two categories: those that are general and have the potential to affect anyone, and those that are specific to a particular sub-population (such as athletes) and pose unique risks to those in that sub-population (Bratland-Sanda & Sundgot-Borgen, 2013). Before exploring this topic further, critical appraisal of the terminology must be discussed. The vast majority of studies in this area lack the controlled and randomised experimental design needed to uncover true causal risk factors as opposed to noncausal risk factors. Noncausal risk factors are different than correlates, variable risk factors, and fixed and variable markers, despite many studies that call them all risk factors (Bratland-Sanda & Sundgot-Borgen,

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2013; Jacobi et al., 2004). See Table 1-1 for more details on terminology and respective study design.

Table 1-1 Risk Factor Typology and Identification Methods from Jacobi et al., 2004

Term	Definition	Study Design
Noncorrelate	No significant association between factor and outcome (onset)	Cross-sectional and longitudinal studies
Correlate	Statistically significant association between factor and outcome	Cross-sectional studies: epidemiological studies, case-control studies, family or family history studies
Risk Factor	Significant statistical and clinical association between factor and outcome; precedence	Longitudinal studies
Fixed Marker	Risk factor that cannot be changed or change spontaneously	Cross-sectional studies using data from medical records or birth registers, longitudinal studies (including twin and genetic studies)
Variable Risk Factors	Risk factor that can be changed or can change spontaneously	Longitudinal studies
Variable Marker	Variable risk factor; manipulation does not change the risk of outcome	Randomized clinical trial (preventive or therapeutic intervention study)
Causal Risk Factor	Variable risk factor; manipulation changes the risk of outcome	Randomized clinical trial (preventive or therapeutic intervention study)

General Risk factors and correlates

The potential risk factors for disordered eating that affect the general population (and are therefore not specific to athletes or those participating in sport) can be classified into three categories: biological, sociocultural, and psychological. For each of these three categories, there are factors that have been studied either with longitudinal design, retrospective cross-sectional design, or twin study design in such a way that allows for claims to be made about whether they are putative risk factors, true risk factors, or fixed markers; still, many elements that make someone more vulnerable to developing

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disordered eating are considered correlates, so the wording must be considered carefully (Jacobi et al., 2004; Striegel-Moore & Bulik, 2007). Looking at each category in turn, there are several elements of biology that put an individual at risk for developing disordered eating. One such factor is an individual's genetic predisposition to developing disordered eating or an eating disorder (Mitchison & Hay, 2014; Striegel-Moore & Bulik, 2007). Another is the age of an individual, a variable marker that puts adolescence and early adulthood as the most likely time to develop issues around food psychopathology (Pope et al., 2015; Hudson et al., 2007). Looking at one's sociocultural environment, elements such as gender, especially being female in western society, put an individual at greater risk for developing disordered eating, due in part to the internalisation of the thin ideal for the female body shape (Shaw et al., 2009; Stice et al., 2017). Psychologically, someone is more at risk if they have a history of affective disorders, have certain personality types like neuroticism or perfectionism, or have low self-esteem (Cervera et al., 2003; Jacobi, 2005).

Risk factors and correlates for athletes

Athletes are one of the sub-populations that have been argued to be more susceptible to disordered eating (Bratland-Sanda & Sundgot-Borgen, 2013; Byrne & McLean, 2002; Mitchison & Hay, 2014). The factors that put an athlete at greater risk can be divided into those that would place any individual at risk for disordered eating, which are briefly described in the previous section, and factors and correlates that are specific to being involved in competitive sport. It is important to highlight that disordered eating is a complex and multifaceted condition which arises from a combination of factors in a person's life and genetic predisposition (Striegel-Moore & Bulik, 2007).

Therefore, general risk factors cannot be ignored when studying athletes' susceptibility to disordered eating development, but rather should be studied in conjunction with sport-specific risk factors. The body of research that looks at sport-

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specific risk factors is voluminous, but the vast majority of these studies use cross sectional research designs that can only establish correlates of disordered eating in athletes (Bratland-Sanda & Sundgot-Borgen, 2013).

It can be the case that general risk factors and correlates compound with those in sport to create risk for athletes. For example, certain sociocultural environments are a general risk factor for the development of disordered eating, and the ones that athletes contend with are very intense and competitive (Sundgot-Borgen, 1994; Sundgot-Borgen & Torstveit, 2010). Personality factors such as perfectionism or engaging in restriction put both athletes and nonathletes at risk as a correlate of disordered eating, but athletes also have to contend with how perfectionistic tendencies can aid their sport success; being more perfectionistic can have benefits for perfecting performance (Bachner-Melman et al., 2006; Thompson & Sherman, 1999b). Engaging in restriction or dieting is a risk correlate for athletes and nonathletes alike, but for athletes that initial weight loss can improve performance, meaning that restriction is positively reinforced at first (Rosendahl et al., 2009). Age, specifically adolescence and early adulthood, is a variable marker that influences the development of disordered eating in the general population; it also coincides with peak age for athletic endeavours, creating perhaps the perfect storm for the development of disordered eating for a young athlete (Byrne & McLean, 2001; Pope et al., 2015). Therefore, understanding the context in which athletes operate is key to fully comprehending the risk factors of disordered eating that confront athletes.

Turning to sport itself, and its inherent requirements, the obvious must be stated: competitive sport by nature requires vigorous physical exertion. Exercise is thus part and parcel of the everyday life of an athlete, as is ingestion of the fuel needed to feed those efforts. Even the recreational runner knows extra food is needed to finish the charity 10k run. Furthermore, sporting success is inherently tied to body shape and weight, with body composition requirements tied to the physics of each sport (Sundgot-Borgen & Torstveit,

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2010). The lightest cyclist has the least mass to pull up the Alpe de Huez, while the largest rugby player wins the tackle. Again, to match these physical ideals, diet and food intake play a central role. Sport's link to physical exercise and by extension diet, as well as the tie to body shape and weight, creates a potential entanglement with disordered eating (e.g. Bratland-Sanda & Sundgot-Borgen, 2013; Cooper & Winter, 2017; Sundgot-Borgen & Torstveit, 2004; Sundgot-Borgen & Torstveit, 2010).

Something distinctive about both the eating disorder continuum and sport psychology is the intrinsic element of physical wellbeing. For instance, exercise is both a maintenance factor for eating disorders and is integral to sporting success (Drinkwater et al., 2005; Mond, et al., 2004; Sundgot-Borgen & Torstveit, 2010). When looking at competitive, especially elite sport, to ignore the physical requirements for gymnasts to flip through the air, for cyclists to conquer a steep gradient, for that rugby player to tackle an opponent, would be a disservice to the craft. When true success is tied to weight and shape and to exercise intensity, it can be hard to delineate where passion for sport ends and compulsive behaviours begin (Meyer, Taranis, Goodwin, & Haycraft, 2011; Plateau, Arcelus, & Meyer, 2017).

The sociocultural context in which athletes operate is a microcosm of success and failure perhaps unlike anything else: the pressure created by the competitive environment, funding opportunities (or lack thereof), the binary nature of wins and losses and the marginal gains that define them. Delving further contextually, the elite competitive sporting world is — perhaps unsurprisingly — comprised of competitive people, who are high achievers. This intense environment full of intense people means that those within it are acutely aware of what they need to do to succeed. With sport underpinned by a notion of “giving it your all” or “go big or go home” and with sport success perceived to be tied to body shape, physical exertion, and food intake, the potential for disordered eating to develop is clear (Drinkwater et al., 2005; Sundgot-Borgen & Torstveit, 2010). In fact,

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elite athletes' mentality is closely related to one that reinforces anorexia nervosa (Priester, 2018; Thompson & Sherman, 1999).

Other elements of competitive sport create an enmeshment with disordered eating and related factors; for example, the basic need to wear tight costumes for aerodynamics can lead to increased appearance scrutiny (Sundgot-Borgen, 1993; Sundgot-Borgen & Torstveit, 2004; Torstveit, Rosenvinge, & Sundgot-Borgen, 2008). Furthermore, performance in sport often takes place in arenas full of watchful eyes of coaches, sponsors, parents, and fans; sometimes these arenas exist online, a perhaps more claustrophobic setting where harsh comments and judgements can be unleashed anonymously (Kerr et al., 2006; Nattiv et al., 2007; Otis et al., 1997). Revealing uniforms coupled with the watchful eyes of others can lead to increased feelings of body shame and self-objectification and more pressure to fit a sociocultural norm, all of which are associated with an increased susceptibility for disordered eating (Byrne & McLean, 2001; Muscat & Long, 2008; Tiggemann & Kuring, 2004; Tylka & Hill, 2004)

Disordered eating and eating disorders can last for years and can affect not only the physical and mental health of those afflicted but also their families and carers (Robinson et al., 2020). Thus, understanding the factors that may put individuals at risk and thus how to prevent eating disorders and disordered eating is critical. The link to sporting success and body shape harkens back how and why disordered eating and eating disorders are such an important and relevant topic. Understanding this link, as well as the importance of prevention, is what guided the theoretical underpinning for this thesis. The context of sport is one that is ripe for disordered eating to take hold.

Underpinning Theoretical Framework

There are several models of the development of eating disorders, such as the 2003 transdiagnostic model by Fairburn and colleagues which outlines the cognitive behavioural theory of the onset and maintenance factors of several eating disorders.

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Another influential model is Stice's prognostic dual pathway model of bulimia (see Figure 1-4; Stice, 1994, 2002; Stice et al., 1996). As seen in the figure below, Stice's model has predictors of social pressures and internalisation of a thin body ideal that each affect body image dissatisfaction. This dissatisfaction, in turn, can lead to dieting and/or negative affect, which leads to bulimic symptoms (Ouwens et al., 2009; Stice et al., 2007). Importantly, Stice's model has been repeatedly tested longitudinally so that claims about risk factors can be made when looking at elements in the model (Stice et al., 1998; Stice & Whitenton, 2002).

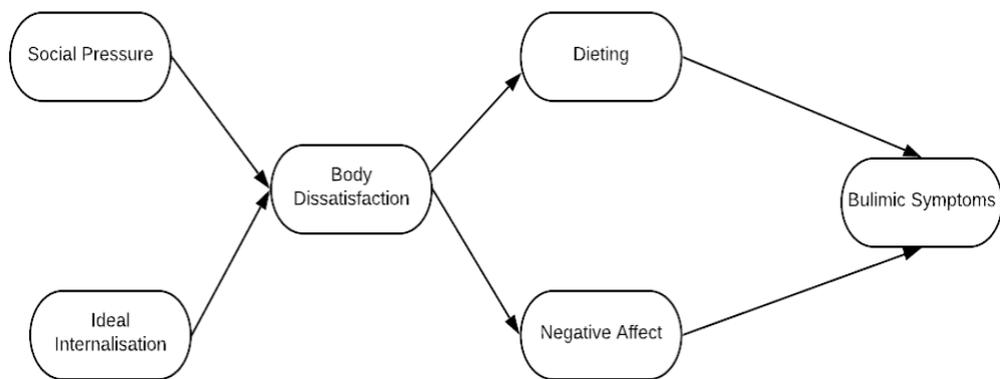


Figure 1-4. Stice (1994) dual pathway model of bulimia

As described above, due to the specific context of athletes, who have their own particular risk factors, it is likely that general models of aetiology will not be sufficient to explain cases in this group. Very few models are specifically designed for disordered eating in sport; most often, clinical models are applied to a sporting context (e.g. Shanmugan et al., 2011). One theoretical model, first published by Petrie and Greenleaf in 2007 (re-published in 2012), does outline a detailed prediction of disordered eating in athletes. Basing their work closely on Stice's (1994) model, Petrie and Greenleaf predict that pressures in the sport and societal world, combined with similar psychological and behavioural concepts to those included in Stice's model, lead to symptoms of disordered eating in athletes, including restrained eating and binge eating and bulimia. This model by Petrie and Greenleaf (Figure 1-5) forms the theoretical starting point for what was tested in thesis (Figure 1-6).

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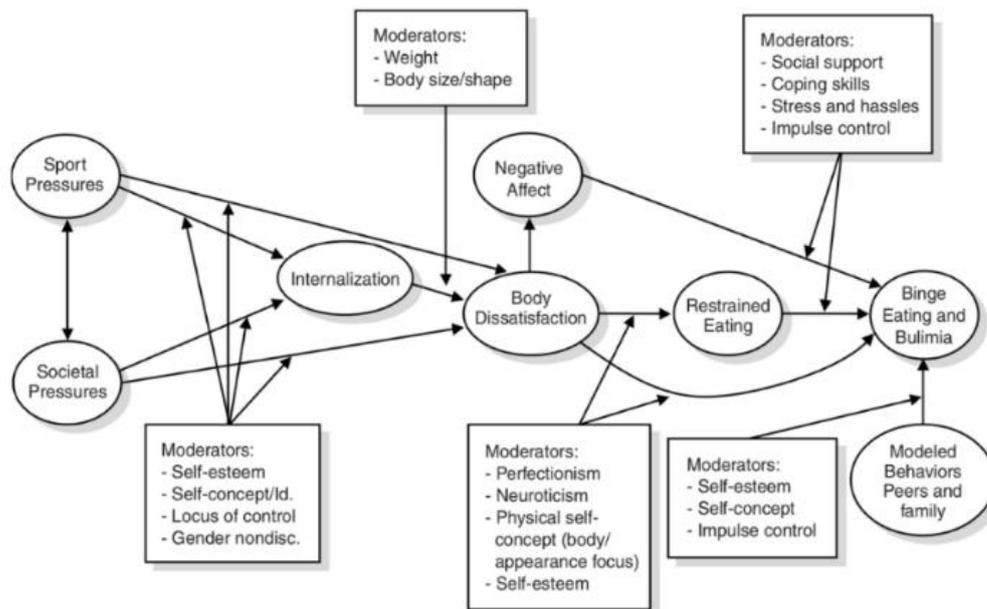


Figure 1-5. Full model developed by Petrie and Greenleaf (2007)

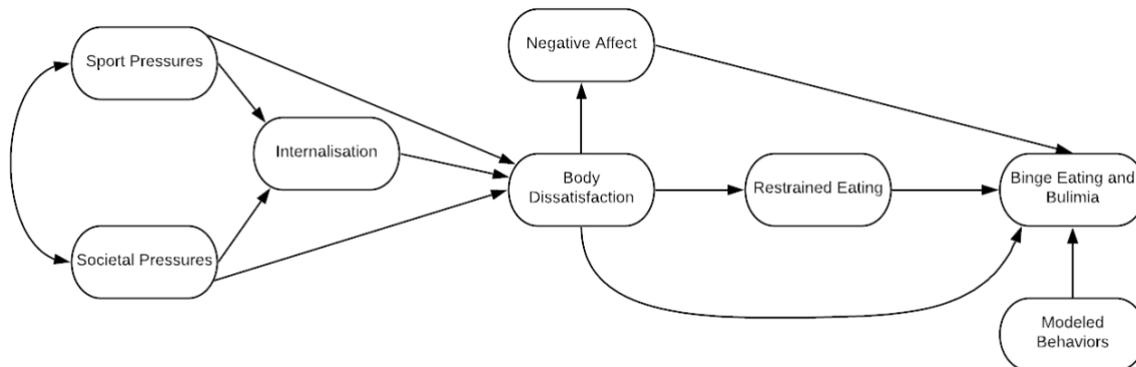


Figure 1-6 Theoretical model tested in thesis, based on the model by Petrie & Greenleaf.

In the full model by Petrie and Greenleaf (Figure 1-5), the initial predictors of disordered eating are sport pressure and societal pressure. Petrie and Greenleaf hypothesise that several moderators and mediators will predict the two components of disordered eating in the model: restrained eating, and binge eating and bulimia, with the former predicting the latter. The mediators that are claimed to predict these two components of disordered eating are internalisation, body dissatisfaction, negative affect, and modelled behaviours. The moderators include elements such as perfectionism and

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self-esteem. The moderators are not tested in this thesis, resulting in the model shown in Figure 1-6. It is important here to acknowledge the model by Petrie and Greenleaf due to its crucial role in this thesis; it serves as the basis for the model that was adapted for testing in this PhD. Chapter two examines the tested model in more depth, offering a systematic review of the model in Figure 1-6 and an in-depth look at the surrounding literature for each pathway in the model.

Scope of the Current Thesis

While a clinically diagnosable eating disorder constitutes a more serious diagnosis, studying disordered eating will potentially allow for prevention and treatment options for both disordered eating and eating disorders for the sporting community and beyond (Martinsen & Sundgot-Borgen, 2013). Research into the eating psychopathology of athletes has rarely included only clinically diagnosable eating disorders. However, the term “eating disorder” is often used in research that in practice looks at both eating disorders and disordered eating (e.g., Sundgot-Borgen & Torstveit, 2004). However, for this PhD, because diagnostic work was beyond the scope of this research and no diagnostic interviews were conducted, ‘disordered eating’ will be the term used throughout to encompass both subclinical and clinical eating difficulties. Even if a small percentage of the sample recruited reached clinical thresholds for self-report measures, to maintain the integrity of the terminology, ‘disordered eating’ will be used.

Rationale for current PhD research

This thesis expands the current understanding of the development of disordered eating in athletes by addressing the limitations of the current canon of research. As previous research had not fully reviewed evidence for Petrie and Greenleaf’s (2007) model, chapter two offers a systematic exploration of the underpinning evidence base. The cross-sectional study in chapter three addresses sampling criticisms from previous work. The findings of the systematic review reported in chapter two were used in

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designing the cross-sectional study in chapter three so that scales used would be considered the best available. Also, in chapter three, structural equation modelling (SEM) was employed. This methodology is infrequently used in psychological research, but is growing in popularity as it is a more rigorous method for testing than other regression techniques (de Sousa Fortes et al., 2015). SEM allows for simultaneous examination of multiple predictors and mediators on multiple outcome variables and allows for the fit of a model to be adapted or confirmed using fit indices, among other strengths (Shanmugam & Marsh, 2015). Chapter four incorporates a qualitative approach, making the current thesis multi-method and thereby leading to a deeper understanding of the topic at hand. Finally, chapter five's prospective design addresses the largest gap in the current research, the lack of longitudinal work.

Aims for this Thesis

The first aim for the current thesis was to critically examine and review the evidence and research underpinning an existing theoretical model for the development of disordered eating in athletes. The second aim was to test the applicability and utility of this underlying theoretical model in a large and diverse sample. The results of the first two aims resulted in the creation of a new model. The third aim was to increase understanding of how and why this new model and the original theoretical model differ, by employing qualitative investigation. Finally, to fill a gap in the literature, the final aim of this thesis was to test the new model longitudinally, to determine whether it was able to predict the development of eating disorders and disordered eating.

Overview of current thesis

An overview of this entire research project is as follows. Chapter two undertakes a systematic review of risk factors for the development of eating disorders and disordered eating in athletes. This chapter examines the evidence base for the underpinning model (this chapter published as Stoyel et al., 2020b).

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Guided by Petrie and Greenleaf's (2007) model and the prevailing evidence base underpinning the tenets of the model, chapter three outlines a cross-sectional study which tests the utility and applicability of the model in Figure 1-6. It also aims to address whether the model can account for how disordered eating may arise across gender, sport type and other demographic information (this chapter was published as Stoyel et al., 2020a). Participation in the cross-sectional study took place in February 2019, henceforth called Time 1 (T1). For this T1 cross-sectional study, a large and diverse sample of athletes was recruited. The T1 study showed that the original model by Petrie and Greenleaf did not accurately explain the development of disordered eating in the sample recruited. Thus, a new model – one that did have good and parsimonious fit – was created, termed for this thesis the T1 model.

The discrepancy between the well-cited and well-researched Petrie and Greenleaf model and the T1 model which fit the large sample of athletes was explored using an entirely different methodological approach. Specifically, the lack of fit that sport pressures had within the model needed interpretation and deeper consultation, with input from those entrenched in the world of sport. Thus, the fourth chapter of this thesis provides a qualitative exploration, using deductive thematic analysis that focusses on the sport, social and societal pressures thrust upon athletes and how they impact the development of disordered eating. This qualitative chapter uses a subset of participants from the quantitative part of this research, offering insight and depth to the quantitative work that would have otherwise gone undiscovered. This qualitative chapter has been published in *Frontiers in Psychology*.

Chapter five contains the final study of the thesis, which undertook a longitudinal approach to understanding the risk factors underpinning disordered eating in athletes. The fifth chapter focuses on specific issues of methodology and measurement. High methodological rigour was established in this study with all measures of stability or

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consistency considered across time. Temporal invariance, both in terms of the across-time reliabilities and the stationarity of how questions and response choices were being asked and interpreted by participants at each time point, were also assessed.

The final chapter was influenced by the findings highlighted in the systematic review, namely, that very little longitudinal work had taken place in the field. Using the model from chapter three, this study tested the utility and applicability of the tenets underpinning Petrie and Greenleaf's model over time. This study used the same participant pool from chapter three with data collected at two additional time points (T2 and T3), six months apart, such that the T1 model could be tested longitudinally. In this chapter, the SEM from chapter three was expanded to a Cross-Lag Mediation Model (CLMM) made up of T1 predictors of societal pressures and body dissatisfaction, T2 mediators of internalisation and body dissatisfaction, and T3 bulimic symptomology.

Finally, of note, chapters two, three, and four have all been published, with chapter five currently under review. The published versions of these chapters differ slightly from those presented in this text in that they have been edited for readability, reduce repetition in introductory sections, and to ensure flow within the thesis. However, the main findings and key messages in each of the chapters remain the same from those presented here and those published versions. The final page of this thesis states where these published papers can be found.

Chapter 2.

Systematic review of risk factors for disordered eating in athletes: A critique of an etiological model

Key Points:

- Systematic review of the literature to examine evidence that supports or critiques the pathways outlined in Petrie and Greenleaf's model
- Lack of longitudinal research means that true risk factors for disordered eating in athletes cannot be established from the existing literature
- Differing sample make-ups and measurement tools make comparison of findings between studies problematic

Introduction

The chapter that follows is a systematic review of the underpinning model put forth by Petrie and Greenleaf (2007). This chapter is a version of a manuscript previously published in the *Europeans Eating Disorder Review* (2020) with the same title as Stoyel et al., 2020b.

As noted in chapter one, athletes experience pressures unique to the demands of their sport due to the physical and emotional effort required for high levels of competition (Petrie & Greenleaf, 2007, 2012). Like the general population, athletes experience societal pressures to fit a society-determined body ideal (Striegel-Moore & Bulik, 2007). However, for athletes, this societal pressure can be compounded or placed at odds with the pressures of sport, creating a situation potentially ripe for the development of disordered eating (Anderson, et al., 2012; Cooper & Winter, 2017; Greenleaf et al., 2009). While a number of studies have explored the development of eating pathology in athletes, inconsistency amongst the findings and methodologies has made it difficult to pinpoint causal elements in the development of disordered eating (DE) and eating disorders (ED).

The theoretical model developed by Petrie and Greenleaf (2007, 2012) collates the research conducted on the causal factors of DE and pressures unique to competitive athletes (see Figure 2-1). As Petrie and Greenleaf acknowledge, there is a need to test these mediators with a sporting sample, as the model was created using theory and data from both a general nonsporting sample and previous work on athletes, with mainly female participants included in both groups (Petrie & Greenleaf, 2007). The rationale for choosing this specific model for critique is its comprehensive nature, which gives it the best potential of any theoretical model to become an applied model. Additionally, while a number of models exist to explain the development of ED and DE in the general population, and several have applied the model to samples of athletes, this model is the only one specifically designed to include sport pressure as an integral component, in

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contrast to general clinical models adapted to an athlete population (e.g., Shanmugam et al., 2011). In conducting a review of this particular model, it is hoped that theoretical discrepancies in current research can be exposed, a first step to creating an applied intervention and treatment plan for those athletes suffering from DE and ED. A vast array of studies addresses the subject matter at hand, and this review aims to create a comprehensive overview of how all the relevant findings fit into a solid theoretical foundation.

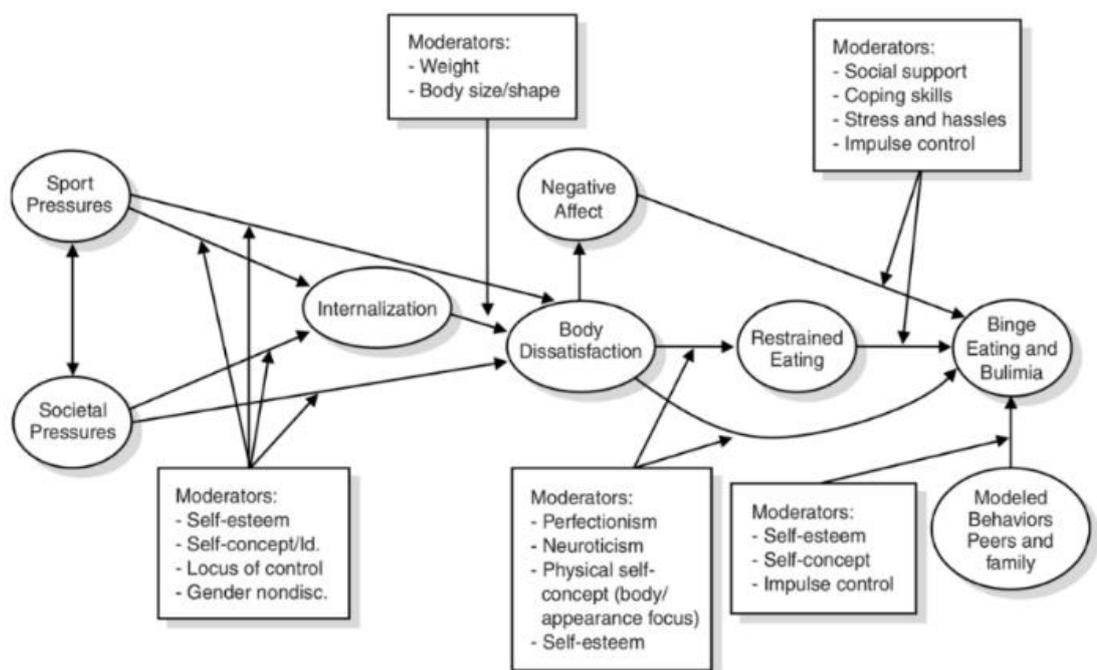


Figure 2-1 Original Theoretical Etiological Model from Petrie and Greenleaf, 2007, 2012

The model includes eight mediators that Petrie and Greenleaf (2012) describe as “risk factors”; this review also uses these terms interchangeably. The mediators in the model are (1) Sport Specific Pressures, (2) Societal Pressures, (3) Internalisation, (4) Body Dissatisfaction, (5) Negative Affect, (6) Restrained Eating, (7) Modelled Behaviours Peers and Family, and (8) Binge Eating and Bulimia. While the model also includes moderators, the current review focusses solely on these mediators and on research that specifically investigates them in relation to high-level athletes.

Therefore, the objectives of the current systematic review are to:

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- 1) Provide an overview of the existing literature related to the factors in the theoretical model.
- 2) Assess whether the data from existing literature on DE in athletes support the theory specified in the Petrie and Greenleaf model.
- 3) Evaluate the quality of different study designs, methods, and measures used to test the mediators from the model and indicate any areas for improvements.
- 4) Highlight which parts of the model have been adequately tested in research and which areas lack sufficient testing and should be prioritised in future research.

Methods

This systematic review adhered to PRIMSA guidance. It began with a key terms search via Ovid-Medline, PsycINFO, JSTOR, and EBSCOhost. The search terms were *disordered eating* or *eating disorder*, *athlete* or *sport*, and *risk*. The initial search which took place from 5th of October to 5th of November 2018 returned 689 results. The inclusion criteria specified that articles must use quantitative methodology, be peer reviewed, and have been published after 2000. The year 2000 was chosen in order to keep the search relatively modern. As the Petrie and Greenleaf model was published in 2007, the majority of studies included were published after that year. However, it was decided to include papers from between 2000 and 2007 as well. This was to find literature that offered insight that would be relevant to this review, even though it preceded the model; on that basis an additional ten papers were included that were published prior to 2007. To be included, studies needed to have one of the mediators from the model as an independent measure and a dependent measure of DE or ED (see Table 2-1 and 2-2).

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Table 2-1. Measurement Tools Utilised

Mediator	Measures
Sport Pressure	Type of Sport: lean vs nonlean; individual vs sport; Being an athlete vs nonathlete control; Level of competition, Coaches' influence
Societal and Social Pressure	Media usage and exposure; Pressure to be Thin and Social Support Climate in Social Setting Scale; Appearance Related Social Pressure Adapted for Sport; Social Physical Anxiety; Weight Pressures in Sport Scale; Sociocultural Attitudes Toward Appearance Scale (SATAQ); Appearance Orientation subscale from the Multidimensional Body Self Relations Questionnaire; Beliefs About Attractiveness Scale-Revised (BAA-R); Weight and Shape concern subscales of EDE-Q; Self-rated single question of attractiveness
Internalisation	EDI-2 subscale; ATHLETE; Drive for Muscularity; EDE-Q subscales
Body Dissatisfaction	EDI-2; Contour Drawing Rating Scale; Difference between current and ideal weight; Choosing Silhouettes; Body Shape Questionnaire; Frankfurt Body Concept Scales; Sport Condition Questionnaire, Figure Rating Scale; Body Parts Satisfaction Scale
Negative Affect	Difficulties in Emotion Regulation Scale; Depression Inventory; Patient Health Questionnaire; Children's Depression Inventory; Mood States; Positive and Negative Affect States; Symptom Checklist-90
Modelled Behaviours	None
Restrained Eating & Binge Eating and Bulimia	EDE-Q subscales; EAT-26 subscales

Note. There is overlap with many studies looking at more than one risk factor.

Abbreviations: EDE-Q, Eating Disorder Examination Questionnaire; EDI, Eating Disorder Inventory

Table 2-2. Overview of Included Articles

Author (date)	Method	Design	Relevant Mediator Measure(s)	ED/DE Outcome Measure	Participant Information: N, Gender, Sport	Relevant Primary Outcome	Quality Tool Rating
Anshel (2004)	Cross-Sectional	Quasi-Experimental	EDI-2 subscales; Food Intake Attitude Survey (developed for this study)	EDI-2	N = 58 female; ballet dancers M age = 17.8; N = 51 non-dancers M age = 17.1	Pressure from others increased weight control behaviours; Drive for Thinness: Dancers > Non-dancers; Body Dissatisfaction: Dancers < Non-dancers; Bulimia Subscale: Dancers = Non-dancers; EDI-2 Global Score: Dancers = Non-dancers	Strong
Bachner-melman et al. (2006)	Cross-Sectional	Quasi-Experimental	Brief Symptom Inventory; EDI-2 subscales; Sociocultural Attitudes Towards Appearance; Self-rated single question of attractiveness	EAT-26; EDI-2	N = 458; female; n = 111 aesthetic athletes; n = 31 women with AN; n = 68 nonaesthetic athletes; n = 248 nonathletes controls; ages 13-35 years	Body Dissatisfaction: Nonathlete controls = aesthetic athletes = non-aesthetic athletes. Drive for Thinness: Aesthetic athletes > Other groups; SATAQ and Self-Rated Attractiveness: Aesthetic athletes = non-aesthetic athletes = nonathletes controls	Strong
Bissel (2004)	Cross-Sectional	Quasi-Experimental	Exposure to thin ideals on TV and magazines in sport and nonsport media; EDI-2 subscales	EAT-26; EDI-2	N = 78; D1 nonlean female athletes; multi-sport; M age = 19	Nonlean athletes exposed thin societal pressures media had lower body image → related to increased disordered eating behaviour	Strong
Byrne & McLean (2002)	Cross-Sectional	Quasi-Experimental	EDI-2 BD and DT subscales 2; the Bulimia Test-Revised; Restraint subscale of the Three Factor Eating Questionnaire; asked to rate from 0-10 feeling of sociocultural pressure to be thin/lean	Interviewed using Composite International Diagnostic Interview	N = 263 co-ed elite athletes (58% female); n = 263 nonathlete controls; aged 15-36 years	Athletes have higher eating pathology than nonathletes, specifically restraint; Doing lean sports vs nonlean sports → higher eating pathology directly or via mediator; Female athletes feel more pressure to fit a lean ideal vs. male athletes	Strong

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de Bruin, Bakker & Oudejan (2009)	Cross-Sectional	Quasi-Experimental	Task & Ego Orientation in Sport; Perceived Motivational Climate in Sport; Dieting & weight control frequency; Weight-related coach & peer-pressure	BULIT-R; EDI-2	N = 94 female aesthetic performers; n = 59 gymnasts; n = 35 dancers; M age = 15.1	Aesthetic performers at a greater risk for disordered eating; high ego orientation and perceptions of the performance climate contributed to increased disordered eating for athletes	Strong
Ferrand et al. (2007)	Cross-Sectional	Correlational	Dutch Eating Behaviour Questionnaire-Restraint Scale; Self-report of eating behaviour, weight control techniques, and desired weight	Dutch Eating Behaviour Questionnaire	N = 33 elite female synchronized swimmers; M age = 17.1	Results focused on factors not relevant for this review	Strong
Francisco et al. (2012)	Cross-Sectional	Quasi-Experimental	Pressure to be Thin and Social Support; Body Dissatisfaction with Contour Drawing Rating Scale	EDE-Q	N = 249 female and male ballet dancers and gymnasts; M age = 15.4	Social support or level of competition did not play a role in disordered eating development; Pressure from coaches was related to higher EDE-Q scores; Ps felt pressure to be thin, sport-related and general body dissatisfaction → elevated levels of disordered eating	Strong
Galli et al. (2014)	Cross-Sectional	Quasi-Experimental	Appearance Orientation Scale	Q-EDD	N = 203 Male D1 NCAA athletes; M age = 20.3	Appearance Orientation scale results was not found to be significantly related to eating disorder psychopathology	Strong
Gapin & Kearns (2013)	Cross-Sectional	Quasi-Experimental	EDI-2 Subscales	Q-EDD	N = 133 male and female rowers in lightweight and open categories; M age = 19.8	Lightweight category athletes showed higher drive for thinness; male athletes had higher rates of disordered eating, but female athletes had higher body dissatisfaction	Strong
Giel et al. (2016)	Cross-Sectional	Quasi-Experimental	Frankfurt Body Concept; Patient Health Questionnaire-4 (depression and anxiety)	Structured Inventory for Anorexic and Bulimic Disorders	German co-ed elite athletes N = 1138; age range from 23-25 years	Weight class sports Ps had higher eating disorder pathology vs. non-aesthetic sport Ps; Female athletes lower on body acceptance than males; Anxiety associated with higher eating disorder pathology	Strong

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Gomes et al. (2011)	Cross-Sectional	Correlational	EDE-Q subscales; Sport Condition Questionnaire; Sport Anxiety Scale; TEOSQ; Cognitive Evaluation of Sport-Threat Perceptions; Self-Presentation Exercise Questionnaire	EDE-Q	N = 290 co-ed Portuguese elite athletes; M age = 17.8	No sport variables, level of athlete, team or individual or pressure from coaches' comments contributed to disordered eating; eating disorder psychopathology predicted by lower scores in satisfaction of body shape	Strong
Haase (2009)	Cross-Sectional	Quasi-Experimental	Social physique anxiety Eating Attitudes Test subscales (EAT-26)	EAT-26	N = 137; female athletes in team sports vs individual sports; M age = 19.5	Social pressure → increased DE; Increased social physique anxiety → increased disordered eating when moderated by sport type; and female individual sport participants, who exhibit more social physique anxiety, also show increased dieting and bulimic behaviours	Strong
Herbrich et al. (2011)	Cross-Sectional	Quasi-Experimental	EDI-2 subscales; The Multidimensional Self-Concept Scale	Structured Inventory for Anorexic & Bulimic Eating Disorders; EDI-2	n = 52 pre-professional ballet dancers vs n = 52 AN patients vs n = 44 nonathlete controls; M age = 16.4	Dancers higher on body dissatisfaction subscale, larger difference between current and ideal weight, higher drive for thinness than controls; Dancers and controls healthier than patients on all scales	Strong
Hopkinson & Lock (2004)	Cross-Sectional	Quasi-Experimental	EAT-26 subscales; Level of athletic competition	EDI-2; EDE-Q	N = 257 male and female athletes; varsity and recreational level at Stanford (D1); ages between 18-22 years	Female athletes higher on restraint scale and overall eating disorder pathology than male athletes; Elite athletes > disordered eating than recreational level athletes; Sport type not relevant; Weight and shape concern related to increased disordered eating for both levels	Strong
Kerr et al. (2006)	Cross-Sectional	Correlational	Surveys were designed by the principal author for the purposes of the study.	Surveys designed specific for this study.	N = 95 female active gymnasts; M age = 14.4	Impact of coaches and teammates increased disordered eating symptoms; gymnasts low on body dissatisfaction compared to norm	Moderate
Kong & Harris (2015)	Cross-Sectional	Quasi-Experimental	EAT-26 subscale; Figure Rating Scale: current, ideal,	EAT-26	N = 320 elite, recreational,	Lean sports and elite level increased eating pathology directly or via or	Strong

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			sport; General body dissatisfaction and sporting body dissatisfaction		female athletes in lean and nonlean sports; ages 17-30 years	mediator (body dissatisfaction or pressure to be thin) compared to nonlean sport participants and recreational athletes; Lean sport Ps higher body dissatisfaction than nonlean athletes and nonathletes, Elite level preferred the leanest body shape as ideal	
Krentz & Warschburger (2011)	Cross-Sectional	Quasi-Experimental	EAT-26; Body dissatisfaction EDI-BD; Contour Drawing Rating Scale (sports-related body dissatisfaction); ATHLETE drive for thinness and performance; Social pressure from sports environment (Appearance-Related Social Pressure adapted to sport)	EAT-26	n = 96 elite athletes from aesthetic sports and n = 96 matched controls; both girls and boys; ages 11 to 18 years	Lean sport participation contribute to eating pathology; Social pressure affected disordered eating mediated by wanting to be leaner for sport performance; Aesthetic athletes and nonathletes measured the same for general body dissatisfaction, but that body dissatisfaction still associated with disordered eating; Sports-related body dissatisfaction did not predict disordered eating	Strong
Krentz & Warschburger (2013)	Longitudinal	Correlational	Contour Drawing Rating Scale; desire to be leaner to improve performance (adapted from ATHLETE); Appearance-Related Social Pressure adapted to sport)	EAT-26	N = 65 aesthetic sport athletes; male and female; ages 11 to 18 years	Aesthetic athletes at higher risk for disordered eating when thought sport performance could improve by changing weight and shape; Body dissatisfaction was not relevant for disordered eating development	Moderate
Milligan & Pritchard (2006)	Cross-Sectional	Quasi-Experimental	Body Shape Questionnaire	EAT-26	N = 176 D1 male and female athletes; lean and nonlean; M age = 19.8	Lean sports contributed to eating pathology for males; Nonlean female athletes at greater risk for disordered eating patterns; Athletes' disordered eating pos. related to body dissatisfaction for both genders	Strong
Neves et al. (2017)	Longitudinal	Correlational	Body Shape Questionnaire; Media internalisation; the Sociocultural Attitudes Towards Appearance	EAT-26	N = 20 Brazilian elite gymnasts aged 10–16 years; female; ages 10-18 years	Aesthetic sport Ps higher on the SATAQ; Disordered eating levels fluctuated depending point in season; Disordered eating predicted body dissatisfaction levels; Neg. mood	Weak

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			Questionnaire-3 (SATAQ-3); Brunel Mood Scale			state associated with lower body dissatisfaction and thus disordered eating	
Nordin-Bates et al. (2016)	Longitudinal	Quasi-Experimental	Perceived Motivational Climate in Sport Questionnaire 2	EAT-26	N = 597, male and female teenage dancers; ; M age = 14.7	High ego orientation and perceptions of the performance climate contributed to disordered eating; Older dancer showed more disordered eating patterns	Strong
Petrie et al. (2014)	Cross-Sectional	Correlational	Positive and Negative Affective States scale; Body Parts Satisfaction Scale Revised; Dietary Intent Scale; Drive for Muscularity Scale; Social desirability; Marlowe-Crowne Social Desirability	6-item Bulimia Test-Revised	N = 203 Male D1 NCAA athletes; ; M age = 20.3	Dietary restraint and drive for muscularity significantly impact bulimia symptomatology	Strong
Petrie et al. (2009a)	Cross-Sectional	Quasi-Experimental	Psychological Well-Being; Life Orientation Test-Revised; Reasons for Exercise Inventory; Appearance Orientation subscale from Multidimensional Body Self Relations Questionnaire	Q-EDD	N = 204 D1 female athletes; ; M age = 20.2	Appearance orientation and using exercise as a means to increase attractiveness partially, and significantly, explained level of disordered eating symptomatology across multiple sports	Strong
Petrie et al. (2009b)	Cross-Sectional	Quasi-Experimental	Weight Pressures; Mood scale; Beliefs About Attractiveness Scale-Revised; Body Parts Satisfaction Scale-Revised; Appearance Evaluation subscale from Multidimensional Body-Self Relations Questionnaire	Q-EDD	N = 442 female athletes DI; ; M age = 19.7	Pressure from others affected the eating disorder symptomatology; Lower body dissatisfaction related to increased eating disorder symptomatology; Shame and guilt higher in those with eating disorders	Strong
Pettersen, et al. (2016)	Cross-Sectional	Quasi-Experimental	EDI-2 subscales; The sociodemographic variables	EDI-2	Norwegian female junior cross-country skiers and biathletes (n = 262)	Level of competition not predictive of disordered eating scores nor was type of sport; Attendance of an elite high school impacted disordered eating development via drive for	Strong

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						thinness, which may be related to social expectations and pressure	
Reinking & Alexander (2005)	Cross-Sectional	Quasi-Experimental	EDI-2 and its subscales	EDI-2	N = 146 and n = 84 female NCAA D1 athletes (divided into lean and nonlean) and nonathletes n = 62; M age athletes = 19.7	Athletes = nonathletes for eating pathology; Lean sport participation related to development of an eating disorder vs. nonlean sport; Lean sport athletes > nonathletes on body; Athletes had lower body dissatisfaction than the norm	Moderate
Rosendahl et al. (2009)	Cross-Sectional	Quasi-Experimental	Body image and body ideal were measured with male and female silhouettes representing different weight categories	EAT-26	N = 576 elite German high school athletes in grades 5-12 and n = 291 non athletes from regular high schools, co-ed sample	Lean sport participants and elite athletes more vulnerable for disordered eating than nonlean sport and non-elite athletes, but only for females; Athletes had higher body dissatisfaction, linked to disordered eating, if had been dieting	Moderate
Rousselet et al. (2017)	Cross-Sectional	Quasi-Experimental	EDI-2 subscales; Athlete's dietary habits using 24 h recall interview, and food frequency; Psychological assessment Variables were collected using the Interview Grid for Multidimensional Assessment of Athletes	EDI-2; interview and somatic assessment	N = 340 French high-level athletes (lean vs nonlean); minimum age of 12	Athletes with disordered eating had higher scores on the body dissatisfaction subscale and had larger discrepancies between current and ideal weight; Athletes who skipped meals or restrained caloric intake were more likely to show disordered eating symptomatology	Strong
Rouveix et al. (2007)	Cross-Sectional	Quasi-Experimental	Athletic involvement, training regimen, weight history, eating-related behaviours; eating patterns; Weight satisfaction, and state whether they wished to lose or gain weight; EAT-26 subscales; Profile of Mood States	EAT-26	N = 24 Judo athletes (male and female) and n = 31 non athlete controls; M athlete age = 16.9	Female athletes higher on Global EAT scores vs male athletes. Female athletes showed higher eating pathology than controls and scored higher bulimia athletes = nonathletes for mood states	Strong

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Scoffier et al. (2010)	Cross-Sectional		Sport Friendship Quality Scale Coach Relationship Quality; French version of the Marsh (1990) Self-Description Questionnaire (SDQ-II) subscales	EAT-26	N = 227 elite adolescent female athletes engaged in various aesthetic sports; M age = 15.8	Coaches and teammates, through comments or general pressure was related to more disordered eating symptoms; Parent-athlete relationships do affect on disordered eating psychopathology	Strong
Tan et al. (2016)	Cross-Sectional	Quasi-Experimental	EDE-Q subscales; Beck Depression Inventory	EAT-26; EDE-Q	N = 51 male and female gymnasts; age range 10-25 years	Depression related to heightened disordered eating; Weight and shape concern directly related to increased disordered eating; International gymnasts higher on restraint than national level counterparts	Strong
Thiemann et al. (2015)	Cross-Sectional	Quasi-Experimental	EDE-Q Subscales; SEDI-2 subscales; Clinical Interview for DSM-IV Axis I Disorders; Patient Health Questionnaire (screening for mental disorders); Sociocultural Attitudes Towards Appearance Scale (SATAQ-3); ATHLETE	EDE-Q; EDI-2	N = 108 German female professional athletes aged 12 to 34 years and N = 108 age-matched female nonathletes	Lean sports compared to nonlean sports at greater risk for eating disorder directly and via increased body dissatisfaction or pressure to be thin; Aesthetic sport athletes higher eating disorder symptomatology than nonathlete controls; Aesthetic athletes had a higher drive for thinness; Athletes = controls in dissatisfaction ratings, but body dissatisfaction still predictor of disordered eating	Strong
Torres-McGehee et al. (2011)	Cross-Sectional	Quasi-Experimental	Body disturbance with sex-specific BMI silhouettes	EAT-26	N = 138 (mean age = 19.88 years). English riding (n = 91) & Western riding (n = 47)	Equestrian riders at risk for developing disordered eating due to the sport-specific pressures; Body dissatisfaction not different between types of equestrian athlete	Moderate
Torstveit, et al. (2008)	Cross-Sectional	Quasi-Experimental	Questions regarding menstrual, body weight, training, injury, and dietary history, physical activity patterns, nutritional habits, use of pathogenic weight control	EDI-2; EDE Interview	N = 938 female athletes (ages 13-39); N = 900 controls (n = 900)	Aesthetic sports contributed to eating pathology; Dietary behaviours was related to disordered eating	Strong

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			methods and self-reported EDs; EDI-2 Subscales; EDE Interview				
Van Durme, et al. (2012)	Cross-Sectional	Quasi-Experimental	Sport Competition Anxiety Test; Competitive State Anxiety Inventory-2; Dutch Eating Behaviour Questionnaire; EDI-2 subscales; Children's Depression Inventory	Children's Eating Disorder Examination Questionnaire; EDI-2	N = 68 adolescent aesthetic athletes; age range 11-21 years	Aesthetic sport athletes higher eating disorder symptomatology than nonathlete controls; Female aesthetic athletes more eating pathology than controls, difference was not in male athletes; Weight and shape concern, drive for thinness, bulimic behaviours, and dieting elevated and related to increased disordered eating behaviours for the female athletes; Nonathlete = aesthetic athletes = non-aesthetic athletes for body dissatisfaction; Higher competition state anxiety related to more disordered eating pathology	Weak
Voelker, et al. (2014)	Cross-Sectional	Quasi-Experimental	Weight Pressures in Sport Scale-Females; General and sport-related body dissatisfaction--The Contour Drawing Rating Scale	EAT-26; EDE-Q	N = 272 female figure skaters ages 12-25	Level of competition (sub-elite vs elite) not predictive of disordered eating scores, but those scored higher in competition also scored higher on restraint subscale; Weight and appearance linked to disordered eating in females; Both types of body dissatisfaction positively correlated with disordered eating	Strong
Wollenberg, et al. (2015)	Cross-Sectional	Quasi-Experimental	EAT-26 subscales; Difficulties in Emotion Regulation Scale	EAT-26	540 female NCAA D1 college students (n = 389 nonathletes; n = 151 athletes)	Female athletes not at greater risk for developing eating pathology compared to nonathletes; Non-athletes scored higher on the subscale and therefore on the overall EAT score; Athletes had better emotion regulation and a lower rate of disordered	Strong

Other reviews and meta-analyses were not included. To ensure that the research included in this review was fully focussed on how the theoretical mediators affected athletes, and not simply frequent exercisers, the inclusion and exclusion criteria were set such that participant samples must include “high-level” or “elite” athletes or a sample of athletes who represented their country internationally at a junior or senior level. For the vast majority of research, reviewed these types of samples were stipulated. Where that wording choice or distinction was not made by the authors of the reviewed studies, at least one sample of the athletes needed to train for greater than 10 hours per week to be included in this review. This 10-hour threshold as this was considered the marker from which zealous exercisers and athletes could be discerned based on the applied sport psychology expertise of the author of this thesis. Determinations of what constitutes an athlete is often inconsistent, so this thesis followed recommendations by Byrne and McLean (2002) and Kong and Harris (2015). If any criteria were unclear, the authors of the papers were contacted to supply the missing information.

As the United States is a hub for elite sport, with a large percentage taking place in the collegiate system for collegiate athletes, only those in Division I (D1), the most elite athletic division in the National Collegiate Athletics Association (NCAA), were included to ensure a high level of sporting achievement and to control for the wide range of levels found in Division II and Division III universities. Studies from other countries did not have a separate inclusion terminology as their terminology fit into that outlined above. All results were imported into Mendeley where results of the search were sorted first by title, then by abstracts, and finally by a full text review of the remaining results. Once the inclusion and exclusion criteria were applied, 37 papers were included in this review (see Figure 2-2). The Quality Tool for Quantitative Studies developed by the Effective Public Health Practice Project was then used to rate the quality of the remaining research in terms of bias, design, confounders, collection methods, and analysis

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appropriateness, and the majority of articles were found to be of high quality (Effective Public Health Practice Project, 1998). See Table 2-2 for quality tool ratings as well as for information related each included study.

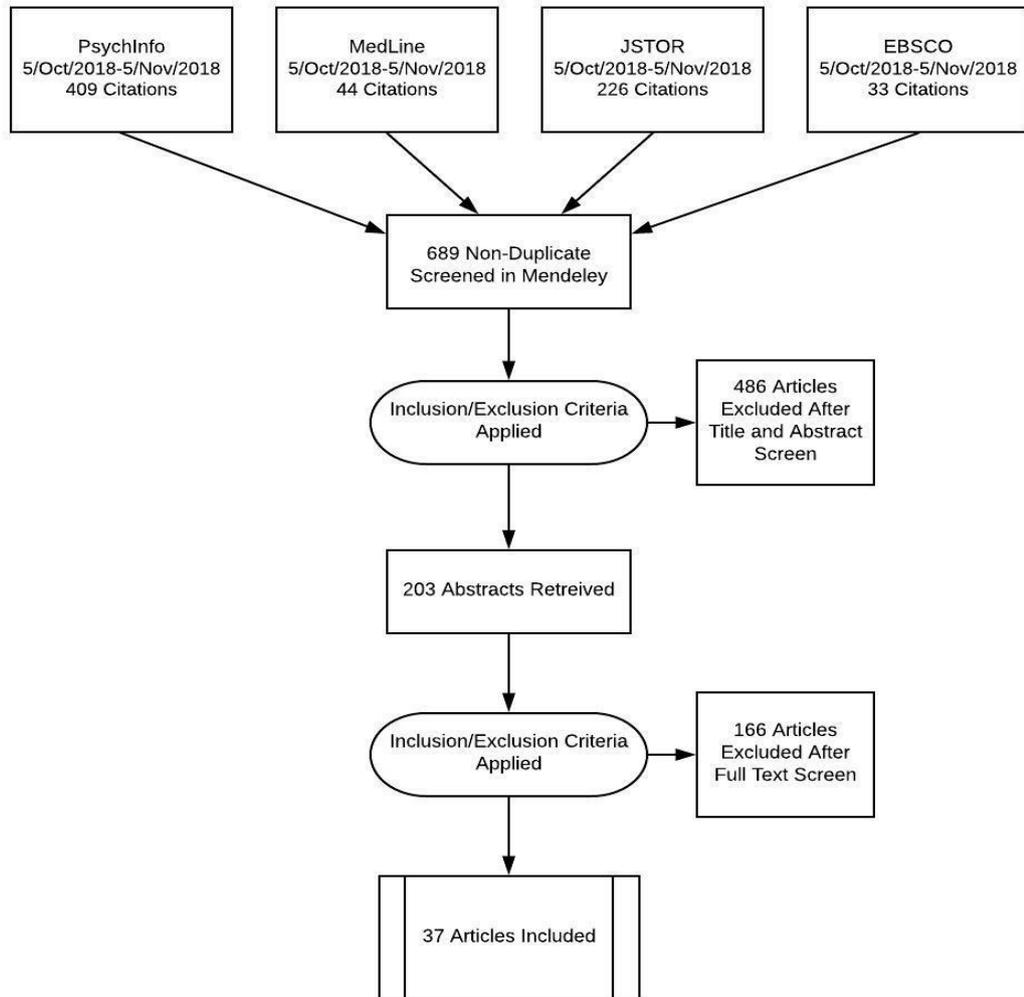


Figure 2-2 Prisma diagram showing process for choosing included articles

Results

Sport Pressures

Petrie and Greenleaf's (2007) model includes three factors that are hypothesised to affect the prevalence rates of disordered athletes in athletes: being an athlete versus a nonathlete, type of sport (lean vs. nonlean sports; individual vs. team sports), and competition level. Therefore, for this review, the mediator of sport pressure was considered to include these three factors, along with the additional factors outlined below.

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The first sport pressure highlighted by the included articles was the mere participation in sport. Byrne and McLean (2002) found athletes to have higher eating pathology than nonathletes, a finding replicated by Krentz and Warschburger (2013), Rosendahl et al. (2009), and Thiemann et al. (2015). Van Durme and colleagues found the same result with female aesthetic athletes, who demonstrated more eating pathology than controls, but no difference was found in males (Van Durme et al., 2012). However, two studies, Wollenberg et al., (2015) and Reinking and Alexander (2005) failed to find that their sample of female athletes were at greater risk for eating pathology than a nonathlete sample. Similarly, using mixed-gender samples, Rosendahl et al. (2009) found no increased ED risk in elite German high-school athletes, and neither did Rouveix et al. in their study of judo athletes compared to nonathlete controls (Rouveix et al., 2007). In sum, out of nine relevant articles, five found that athletes were at a higher risk, but four others found no difference in DE symptomatology between athletes and nonathletes.

Lean sports are defined as those that rely on a thin physique to be successful, such as horse racing or gymnastics, while nonlean sports are defined as those which do not rely on a thin physique for success, such as rugby. Nine studies found that participating in lean sports compared to nonlean sports contributed to eating pathology, either directly or via another mediator, such as increased body dissatisfaction or pressure to be thin (Byrne & McLean, 2002; Francisco et al., 2012; Kong & Harris, 2015; Krentz & Warschburger, 2011; Milligan & Pritchard, 2006; Reinking & Alexander, 2005; Roussetlet, et al., 2017; Thiemann et al., 2015; Torstveit, et al., 2008). These results suggest that lean sport participants are at greater risk for DE. However, Milligan and Pritchard (2006) found that participating in lean sports was associated with increased DE patterns for male athletes but not for female athletes. In contrast, Rosendahl et al. (2009) found that female elite sport participants were at a greater risk than non-elite female athletes but that this was not the case for their male counterparts. Giel et al. (2016), who focussed on young German

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athletes in a mixed gender sample, found that participants of weight-class sports, that is, those that classify competition status based on weight, presented a higher ED pathology than those in other sports.

Another cluster of studies examined level of sport participation, for example, national versus international level, as a sport pressure. Three studies (Pettersen et al., 2016; Voelker, Gould & Reel, 2014; Francisco et al., 2012) found that level of competition was not predictive of DE scores. However, one study of high-level male and female gymnasts did find that competing at an international level compared to a national level was associated with higher levels of DE (Tan et al., 2016). This echoed work by Kong and Harris (2015), who found that DE symptoms were greater amongst elite athletes than amongst those at a recreational level. However, Hopkinson and Lock (2004) found that elite athletes displayed lower levels of DE than recreational level athletes and that the type of sport did not make a difference.

A small number of studies looked into other miscellaneous risk factors that can be categorised under sport pressures. Haase (2009) found that increased social physique anxiety is associated with increased DE when moderated by sport type, and that female individual sport participants who exhibit more social physique anxiety also show increased dieting and bulimic behaviours. In 2017, Neves et al. showed that DE levels fluctuated depending on the point in the season, for instance, competing at championships versus during the offseason, with higher levels of DE found at the pre-competition stage. The impact of coaches and teammates, either through their comments or through athlete-perceived general pressure to look a certain way or to perform well, was associated with DE symptoms in three studies (Kong & Harris, 2015; Kerr et al., 2006; Petrie et al., 2009b; Scoffier et al., 2010). Two further studies found that a high ego orientation and a performance climate – rather than a mastery climate – was associated with higher ED behaviours for athletes (de Bruin et al., 2009; Nordin-Bates, et al., 2016). However,

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Gomes et al. (2011) found that none of the sport variables, level of athlete, team or individual, or pressure from coaches' comments were associated with DE.

In summary, there is a lack of consistency in the evidence regarding the relationship between sport pressures and DE. The three main sport pressures examined, namely, participation, type, and level, only show relation to DE when gender or sport type or another caveat was accounted for, making it difficult to advance any firm overarching claims about the nature of the relationship between sport pressures and DE.

Societal Pressures and Internalisation of an Ideal

For women and girls, the pressure to be thin, and for men, the pressure to be muscular, is far reaching and pervasive (Petrie & Greenleaf, 2007, 2012). These pressures stem from both the media and from people within an athlete's family and social circle (Andersen & DiDomenico, 1992; Grogan, 2016). Pressures from coaches or team-mates are categorised as sport pressures and discussed in the section above, but the distinction of social factors that exist within or outside sport can be blurry.

Societal pressures have been found to be most detrimental in terms of their relationship to DE symptomatology if internalised, as they then affect the athlete's own body satisfaction (Fredrickson & Roberts, 1997; Stice & Shaw, 2002). Thus, internalisation of the thin ideal occurs when any negative discrepancies between one's own body and the body that is perceived as ideal by societal standards are incorporated into the psyche (Petrie & Greenleaf, 2007; Thompson & Stice, 2001). In the general population, there is evidence that internalisation of the thin ideal acts as a mediator between societal pressures and body dissatisfaction (Lester & Petrie, 1995; Stice & Agras, 1998). When determining which of the included studies incorporated societal pressures or internalisation, studies that measured perceptions of appearance, the pressure to be thin, or the drive for thinness, or those that used scales that have a specific social aspect

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or mentions of internalisation, were included. Table 1 shows which measurement scales were used in each study.

Examining an athlete's day-to-day social and societal interactions, Anshel (2004), Krentz and Warschburger (2011), Petrie et al., (2009b), Petterson et al., (2016), and Haase (2009) all found that elements of the social sphere, such as not wanting to give a negative impression, wanting to match stereotypical societal expectations, attending elite schools, and experiencing general social pressure in the environment, were associated with more DE. Scoffier et al. (2010) showed that a healthy parent-child relationship can act as a protective factor against disordered eating behaviour. The role of gender was assessed in Byrne and McLean's study in 2002, which demonstrated that female athletes felt more pressure than males to fit a lean ideal, but that males in lean sports were still at risk of an ED compared to nonathlete controls. However, Francisco et al. (2012) highlighted that both male and female ballet dancers and gymnasts feel pressure to be thin and that coach pressure was a factor in disordered eating development, but that overall social support was not. Bissell (2004) was the only included study to examine media influence, finding that when nonlean athletes were exposed to media that portrayed societal pressures for thinness, it was associated with increased DE.

Four studies measured social perceptions of appearance. Three studies used the Sociocultural Attitudes Toward Appearance Scale (SATAQ; Calogero et al., 2004). Bachner-Melman et al. (2006) found that there were no significant differences in scores amongst aesthetic athletes, non-aesthetic athletes, and nonathlete controls in terms of the measure, nor did they differ in terms of a self-rated attractiveness question. Neves et al. (2017) conducted a longitudinal study with young gymnasts and did not find that the scores on the SATAQ contributed significantly to DE pathology in their sample. However, Thiemann et al. (2015) found that athletes in aesthetic sports scored higher on the SATAQ in terms of both pressure and the internalisation of that pressure. Voelker and

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colleagues (2014) used the Weight Pressures in Sport Scale and showed that self-consciousness regarding weight and appearance was linked to disordered eating in female figure skaters.

Petrie et al. (2009a,b) found that appearance orientation and using exercise as a means to increase attractiveness partially and significantly explained the level of disordered eating symptomatology across multiple sports for female athletes. Conversely, for male D1 NCAA collegiate athletes, appearance orientation was not significantly related to ED psychopathology (Galli et al., 2014).

Several studies found that lean athletes, a population already established to have higher prevalence rates for DE and EDs, had a higher drive for thinness than nonathletes or norm populations (Bachner-Melman et al., 2006; Byrne & McLean, 2002; Herbrich et al., 2011; Gapin & Kearns, 2013; Roussetlet et al., 2017; Thiemann et al., 2015; Torstveit et al., 2008; Van Durme et al., 2012). Anshel (2004) also found that ballet dancers reported a higher drive for thinness, which was related to elevated weight control behaviours compared to nonathletes, but found that their overall Eating Disorder Inventory-2 (EDI-2) scores did not differ significantly. Petrie et al. (2014) examined the drive for muscularity, an internalisation of an ideal more applicable to men, in a sample of male D1 athletes. This study found that this internalised drive for muscularity was significantly correlated with bulimic symptomatology. Krentz and Warschburger (2013) analysed the desire to be leaner so as to improve performance and found that this desire correlated with DE in elite aesthetic sport athletes.

Finally, three papers used the Eating Disorder examination questionnaire (EDE-Q) subscales, which measure shape concern and weight concern to determine social pressure and internalisation scores. All three found that the scores on the subscales were associated with increased DE behaviours in their respective samples (Hopkinson & Lock, 2004; Tan et al., 2016; Van Durme et al., 2012).

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In summary, many studies showed that social pressures and internalisation were related to DE pathology for athletes; however, as with sport pressures, there were some differences based on gender. With most studies focussing on lean or aesthetic sports, sport type must be accounted for before any robust claims can be made.

Body Dissatisfaction

As described in the original work by Petrie and Greenleaf, body dissatisfaction occurs when one perceives a negative disparity between one's own body and an internalised ideal, often a thin ideal (Hargreaves & Tiggemann, 2003; Stice & Shaw, 2002). Body dissatisfaction is understood to be key to the development of disordered eating, as seen in the Petrie and Greenleaf model and in other research in nonathlete populations (Jacobi et al., 2004). Of note, it may be the case that athletes are satisfied that their body matches a societal ideal, but not a sport-specific ideal, or vice versa (Kong & Harris, 2015).

Ten studies in this area used the body dissatisfaction subscale of the EDI-2. Despite the widespread use of this measure, the samples differed in each case, so comparisons are difficult. Looking at the relationship between body dissatisfaction and disordered eating in athlete samples compared to nonathlete samples, one study found that athletes and nonathletes did not differ in body dissatisfaction ratings, but that body dissatisfaction was still a significant predictor of disordered eating (Thiemann et al., 2015). Similarly, Bachner-Melman et al. (2006), Van Durme et al. (2012), and Byrne and McLean (2002) found that nonathletes, aesthetic athletes, and non-aesthetic athletes did not differ significantly in terms of body dissatisfaction. Yet another study found that dancers had lower body dissatisfaction compared to non-dancers but that both groups had similar global EDI scores, suggesting similar levels of ED symptoms (Anshel, 2004).

Gender also plays a role, with Reinking and Alexander (2005) showing that female lean-sport athletes scored higher on the EDI-2 subscale than nonlean female sport

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athletes. They also discovered that, in general, athletes had lower body dissatisfaction than published norms. Furthermore, a study that compared male and female athletes found that while males had higher rates of DE, it was the female athletes who had higher body dissatisfaction (Gapin & Kearns, 2013).

Still utilising the EDI-2, Bissel (2004) found that nonlean athletes reported increased levels of body dissatisfaction and ED behaviours when exposed to societal pressures for thinness in the media compared to those who looked at media which did not specifically promote the thin ideal. Finally, Rousselet et al. (2017) and Herbrich et al. (2011) both found that those high-level athletes and pre-professional dancers who had disordered eating symptomatology showed higher scores on the body dissatisfaction subscale and displayed larger discrepancies between current and ideal weight; however, the athlete groups had better overall body satisfaction and positive attitudes about themselves than nonathlete patients with clinically diagnosed anorexia nervosa.

Another seven studies measured body dissatisfaction using drawing scales or silhouettes, some of which allow for the separation between general body dissatisfaction and sport-related body dissatisfaction (Thompson & Gray, 1995). The work of Francisco et al. (2012) found that sport-related body dissatisfaction specific to aesthetic sports as well as general body dissatisfaction was directly linked to elevated levels of disordered eating in dancers and gymnasts and that overall, males were more satisfied with their bodies. Krentz and Warschburger (2011) echoed the results of Bachner-Melman et al. (2006), Van Durme et al. (2012), and Byrne and McLean (2002), finding no differences between aesthetic athletes and nonathletes in terms of general body dissatisfaction. They also found that higher body dissatisfaction was associated with disordered eating, which was more pronounced in the athlete group. Torres-McGehee et al. (2011) did not find that body dissatisfaction differed amongst different types of equestrian athletes or that body dissatisfaction was related to disordered eating. Additionally, Krentz and Warschburger

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(2013) found that sports-related body dissatisfaction did not predict disordered eating symptoms in the aesthetic athletes tested. However, Voelker, Gould, and Reel (2014) established that both types of body dissatisfaction correlated with disordered eating when studying female figure skaters, which is consistent with the theory proposed by the etiological model. Finally, Rosendahl et al. (2009) found that athletes showed greater dissatisfaction with their bodies if they had been dieting, which was linked to DE for those participants (Stice & Shaw, 2002).

An additional eight studies measured body dissatisfaction and its relationship to DE with varying tools (see Table 2). Giel et al. (2016) showed that female athletes scored lower on body-acceptance measures. Gomes, Martins, and Silva (2011) determined that ED psychopathology was predicted by lower satisfaction related to body shape. Kong and Harris's (2015) results showed that athletes in lean sports had higher body dissatisfaction than nonlean athletes and nonathletes, with those at an elite level choosing the leanest body shape as ideal. Kerr, Berman, and Souza (2016) showed that current gymnasts rated themselves as heavier than they wanted to be on scales that the researchers designed specifically for the study. Milligan and Pritchard (2006) used the Body Shape Questionnaire (BSQ; Cooper et al., 1987) and found that male and female athletes' disordered eating was related to body dissatisfaction levels. Furthermore, research conducted by Petrie in both 2009b and 2014 found in both studies that body dissatisfaction in terms of muscularity for males was positively correlated to ED symptoms in high-level collegiate athletes across different sports; however, this result was no longer significant in the 2014 study once physical size and social desirability were controlled for. These findings contrast with the longitudinal study by Neves et al. (2017), which determined that disordered eating predicted higher levels of body dissatisfaction on the BSQ, indicating that perhaps the directionality indicated in the etiological model should be reconsidered.

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In summary, an array of studies has looked into the relationship between body dissatisfaction and eating pathology with results being largely inconsistent between studies. With gender, level, and sport type all not controlled for, it is difficult to critically compare findings, despite several of the studies using the same or similar tools.

Negative Affect

Petrie and Greenleaf (2012) discuss negative affect in conjunction with dietary restraint, with both acting as mediators between body dissatisfaction and bulimic behaviours. However, research has shown negative affect to be a valid independent predictor of EDs in athletes due to its relationship with compulsive exercise (Fairburn et al., 2003; Goodwin et al., 2016; Plateau et al., 2017). Petrie and Greenleaf (2007, 2012) discuss how negative affect can also trigger binge eating, thus invoking it as a risk factor for the development of disordered eating, yet they do not give any details of how negative affect should be measured. Therefore, this review has included any studies that examined mood, affect, or emotions, as well as those which measured depression and anxiety.

Six of the ten included articles found that negative emotions and mood, or heightened depression and anxiety measures, were positively correlated with ED/DE pathology in athletes. Wollenberg and colleagues (2015) found that athletes who had a lower rate of disordered eating were better at regulating their emotions. Tan et al. (2016), Van Durme et al. (2012), and Giel et al. (2016) all found that heightened depression or anxiety symptoms, either state or trait, were related to heightened DE symptoms. Finally, mood state was found to partially contribute to levels of body dissatisfaction, which was in turn related to eating pathology (Neves et al., 2017).

In one of the few studies to look specifically at affect, Petrie et al. (2014) used a 23-item version of the Positive and Negative Affect Schedule (PANAS; Crawford & Henry, 2004) and found that, once they had controlled for physical size and social desirability, there was no significant association between affect and disordered eating.

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Similarly, Rouveix and associates (2017) did not find differences in mood states between athletes and nonathletes and found no differences in DE pathology between the groups. Finally, Petrie et al. (2009b) using a five-item mood scale (from Stice & Shaw, 1994) found that shame and guilt were higher in those with EDs; however, the other emotions such as anxiety, shame, confidence, and sadness did not differ between groups.

Modelled Behaviours Peers and Family

None of the included articles investigated modelled behaviours. In the original chapter, modelled behaviours are defined as partaking in disordered eating behaviours because it is sanctioned as acceptable or encouraged by the larger group, or developing this type of pathology due to exposure to it in the group, and internalising it as normal or expected (Petrie & Greenleaf, 2007).

Restrained Eating and Binge Eating and Bulimia

The final two mediators suggested by Petrie and Greenleaf invite criticism. They are deemed to be mediators acting as risk factors when, in fact, certain levels of restrained eating, binge eating, and bulimia are part of disordered eating and clinical EDs. Hence, it is not appropriate to use ED symptoms as a risk factor for DE/ED itself.

Restrained eating is hypothesised to be linked to binge eating and bulimia due to the intense hunger it generates, leading to binges, and the guilt which follows those binges, resulting in purging behaviour (Stice, 2002; Stice & Agras, 1998). However, the original model does not distinguish between restraint and restriction of food intake: restriction is defined as the behaviour of restricting intake to lose weight or to prevent weight gain, while restrained eating encompasses both actual and attempted restriction (Anokhina & Serpell, 2012; Laessle et al., 1989). Several studies examined dietary restraint as a separate mediator by using the restraint subscale of the EDE-Q, although notably this subscale contains a mixture of items measuring restriction and restraint.

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Tan and colleagues (2016) found that international gymnasts scored higher on the restraint subscale than their national-level counterparts. Hopkinson and Lock (2004) found that female athletes scored higher on the restraint scale than male athletes. Voelker et al. (2014) found that athletes with better competition results scored highest on the restraint subscale.

Using a variety of scales (see Table 1 and 2), Petrie et al. (2014), Rousselet et al. (2017), and Torstviet et al. (2008) found that dietary behaviours were related to bulimic symptomatology and disordered eating in their respective studies. Byrne and McLean (2002) indicated that both male and female athletes differed significantly compared to male and female nonathletes, with athletes scoring higher on dietary restraint.

The Eating Attitudes Test (EAT-26) also consists of relevant ED-related subscales: Dieting, Bulimia and Food Preoccupation, and Oral Control (Garner, Olmsted, Bohr & Garfinkel, 1982). Rouveix et al. (2007) found that female judo players had significantly higher overall EAT scores as well as higher scores on the bulimia subscale of the EAT than female nonathlete controls. They also had higher overall EAT scores than their male counterparts. While Wollenberg et al. (2015) found that nonathletes scored higher on the bulimia subscale and on the overall EAT score, in 2015, Kong and Harris highlighted that athletes in lean sports had an increased rate of self-induced vomiting and laxative use compared to nonlean sport participants.

Using the Children's EDE-Q (Decaluwé & Braet, 1999), Van Durme et al. (2012) found that, compared to a norm group, female adolescent athletes showed more dieting behaviour, and using the EDI-2, they showed that these athletes also engage in more bulimic behaviours than adolescent nonathletes. However, Anshel (2004) did not find any significant difference on the bulimia subscale of the EDI-2 when conducting research on dancers and nonathlete controls.

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In summary, restraint and binge eating and bulimia behaviours were linked to disordered eating in athletes, but significant gender and sport type differences exist. Furthermore, inconsistency in whether athletes exhibit these behaviours at higher rates than nonathletes still remains.

Discussion

The theoretical model by Petrie and Greenleaf (2007, 2012) is an admirable attempt to collate the factors that may be linked to disordered eating in athletes. The aim of the current review was to assess research which examined parts of the model to determine to what extent the theory presented in the model has been verified in the existing data. However, several methodological issues complicated this effort.

The lack of longitudinal studies incorporating the relevant mediators in athlete populations makes it impossible to determine whether the potential mediators described by Petrie and Greenleaf are risk factors or causal risk factors rather than simply correlates of DE/ED. Only three of the 37 papers reviewed were of longitudinal design. The findings with respect to all the potential mediators are inconsistent and equivocal, and the range of measures used makes it difficult to draw overarching conclusions.

Furthermore, the definition of a mediator in this model may need to be revisited. By definition, a mediator is “a variable that reduces the size and/or direction of the relationship between a predictor variable and an outcome variable and is associated statistically with both” (Field, 2009). However, in the depicted model, it is not clear which are the predictor variables and which are the outcome variables. All the factors in the model are termed mediators or moderators, which is statistically unfitting, as this means that no independent or dependent variables are identified. For example, it is not clear whether social and sport pressures are the predictor variables and whether “restrained eating” and “binge eating and bulimia” are mediators or outcomes. If they are mediators, then no outcome – such as the development of DE – appears in the model.

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The research investigated showed methodological inconsistency in terms of research design, sample criteria, and measures used. A wide range of questionnaires, terminology differences, and shifting sample inclusion criteria has led to inconsistent findings that not only stall research but also limit progress in applied care and treatment for the athletes affected by DE and EDs (Hausenblas & McNally, 2004). The included studies all had differing samples in terms of gender, age, and type of athlete. Some included controls, while others did not (see Table 2-2). The measurement tools for both predictor and outcome variables varied, as did the measures, with some studies favouring the EDI-2, others the EAT-26, others the EDE-Q, and still others the QEDD, and with some formally assessing for EDs and others examining DE as the primary outcome (see Table 2-1). The lack of cohesive methodology means that drawing overall conclusions about what research has determined to be risk factors of DE in athletes is problematic.

Another widespread methodological issue that arose was that a number of studies used subscales of larger measures, such as the body dissatisfaction subscale of the EDI-2, then claimed that high scores of the subscales meant a significant relationship with ED symptomatology which was measured by the global score of that same scale. This review reported these measures as they were reported in the included studies, but it is important to note that this method has questionable validity. When a subscale rating of a scale increases, the global score, of course, also increases, and this is not evidence of any meaningful relationship.

The current review had several limitations. First, very few studies that examine athletes and DE or EDs cite any underpinning theory, such as the one examined here, as the groundwork for the research. This lack of academic rigor means that it was often up to the authors' discretion to determine whether the studies did in fact measure the intended mediators. Furthermore, the current review did not have the scope to include the many moderators depicted in the model. The inclusion of the moderators is something that

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future reviews and applied research should undertake in order to continue to move the field forward. Additionally, while the search methodology was seen as the practical way forward for this review, other search terms and methods could also be considered viable. Finally, as with any review, the risk of bias exists; however, attempts were made to limit bias by following a strict systematic protocol and employing a quality tool.

Looking ahead, longitudinal research should be the main priority of the research field if true risk factors of disordered eating in athletes are to be uncovered and will therefore dictate the next steps in this thesis. In forthcoming work, care must be taken to consider what part of the season the athletes are in when tested, and how many years the athlete has been engaged in their sport, as these factors may influence the impact of sport and societal pressure experienced by an athlete. Adding depth via qualitative methods on the predictors of sport pressures and societal pressures is also warranted – especially when considering sport pressures, as this is the only element of the model that is unique to athletes, and it is currently poorly investigated. The qualitative investigation undertaken in this thesis, which looks at sport pressures in depth, can be found in chapter four. Furthermore, care must be taken to ensure consideration of both male and female athletes. While the studies reviewed here included both male and female participants, the original model was created mainly using studies with female participants. However, as male athletes are also susceptible to disordered eating, the study outlined in chapter three was careful to determine model fit for both males and females (de Sousa Fortes et al, 2015; Galli et al., 2014). Finally, consistent measures must be used to allow a coherent story to emerge. This author recommends using the best validated and most commonly used measures in the general population, which are reported in this chapter, to begin to create a consistent evidence bank and ultimately to develop a gold standard to use in athletes. The EDI, the PANAS, the SATAQ, and the EDE-Q are the recommended measures to use, due to their relatively wide use and established validity. These are the measurement

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tools that were used for the quantitative work in this thesis, which can be found in chapters three and five. These suggestions for future research will allow for a clearer, more cohesive evidence base with which to evaluate theoretical model, thus allowing the theory to be lifted from page to practice.

Chapter 3.

Psychological risk indicators of disordered eating in athletes

Key Points:

- Petrie and Greenleaf's model was tested cross-sectionally using structural equation modelling in a large sample of male and female athletes across a range of sports
- Petrie and Greenleaf's model failed to achieve a good fit, meaning it did not accurately explain the rise of disordered eating in this athlete sample
- A new model that did achieve a good fit was created, termed the T1 model, and was tested across various sub-samples

Introduction

In chapter two, a systematic review of relevant literature relating to the 2007 theoretical aetiological model by Petrie and Greenleaf was completed (see Figure 3-1). Results of this review were inconsistent and equivocal, necessitating the collection of new data to test the model and to address several issues that arose in previous work related to this model. The results of this effort are detailed in this chapter. This chapter is a version of a previously published paper, Stoyel et al (2020a).

As reviewed in detail in chapter two, Petrie and Greenleaf's published a theoretical etiological model in 2007 (and later re-released in a second version in 2012) that outlines potential risk factors for the development of disordered eating in athletes as a series of mediators and moderators (see Figure 3-1). The factors that are included in the model are (1) sport pressures, (2) societal pressures, (3) internalisation, (4) body dissatisfaction, (5) negative affect, (6) restrained eating, (7) modelled behaviours by peers and family, and (8) binge eating and bulimia. The model also includes five groupings of moderators that affect the intensity and directionality between factors.

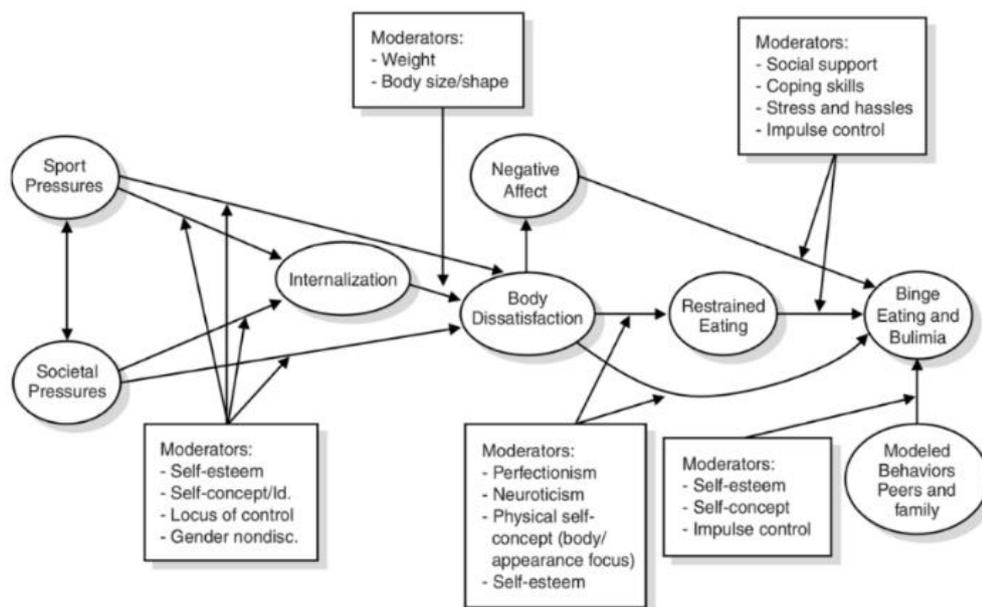


Figure 3-1 Original theoretical etiological model from Petrie and Greenleaf, 2007, 2012.

Sport pressures

In the original chapter by Petrie and Greenleaf that accompanies the theoretical etiological model, the higher prevalence of disordered eating in athletes was determined to result from three elements: being an athlete versus a non-athlete, competition level, and type of sport (lean/nonlean) (Petrie & Greenleaf, 2007). These competition level and type of sport are used in the current study to operationalise sport pressure alongside three additional relevant elements: the number of years of sport participation, number of hours of training per week, and whether an athlete is currently competing or in his or her off-season. These are applied to help to determine whether participating for longer in sport and actively competing create additional pressure that may relate to the development of disordered eating behaviour.

Previous research findings have been largely consistent in indicating that for lean sports, those in which performance or success is influenced by a lean body shape, disordered eating has a higher prevalence rate for male and female athletes (e.g., Kong & Harris, 2015; Krentz & Warschburger, 2011; Milligan & Pritchard, 2006; Reinking & Alexander, 2005; Rousselet et al., 2017; Thiemann et al., 2015; Torstveit, Rosenvinge, & Sundgot-Borgen, 2008). The impact of the level at which the athlete competes is not as clear-cut: while some research has posited that elite athletes have higher levels of disordered eating than recreational ones, other research has found the opposite (Hopkinson & Lock, 2004; Kong & Harris, 2015; Sundgot-Borgen & Torstveit, 2004).

The current study also includes the number of hours spent training per week as a sport pressure, something which has rarely been included in previous research, as much of the previous work has been conducted using NCAA athletes (whose hours of training are capped at 20 per week) (“NCAA Athletes Work Long Hours, Survey Says,” 2009). Previous work has called for level and training regime to be investigated (de Sousa Fortes, Ferreira, de Oliveira, Cyrino, & Almeida, 2015); in addition, the original work by Petrie

and Greenleaf stated that increased exercise and training is inversely connected with body dissatisfaction, making it a relevant factor to be included (Hausenblas & Downs, 2001). Increased hours could be assumed to mean an increased amount of pressure on the athlete, with the caveat that not all sports require more than 20 hours of training per week. Furthermore, there is a positive correlation between level and hours per week, with more hours generally required for high-level sports; hence, these two variables tend to be related.

The present study also aims to determine whether an athlete's status as currently competing or currently in 'off-season' plays a role as a sport pressure. Each sport has a time of year or season designated for competition. For example, rugby players compete in the winter, while major cycling events are held during the summer. Although athletes continue to train during the off-season, it has been suggested that measuring disordered eating without accounting for whether those athletes are currently feeling the pressures of competition may result in equivocal findings (Petrie, Greenleaf, Carter, & Reel, 2007; Sundgot-Borgen & Torstveit, 2010).

Societal pressures

Societal pressures affect athletes, and much like the rest of the population in the Western world, female athletes feel pressure to fit a thin ideal, and male athletes feel pressure to fit a muscular one (Murnen et al., 2003). However, for athletes, these ideals can compound the sport pressures already exacted upon them – or, an opposing tension can arise (Anderson, Petrie, & Neumann, 2012; Cooper & Winter, 2017; Greenleaf, Petrie, Carter, & Reel, 2009). For example, for a female powerlifter, gaining mass may be advantageous for her sport but not for meeting societal ideals. Societal pressures can stem from family, teammates, the media, and more recently, from social media and the internet (Andersen & DiDomenico, 1992; de Sousa Fortes et al., 2015; de Vries, Peter, de Graaf, & Nikken, 2016; Grogan, 2016). Discerning the degree to which these pressures

are internalised—the extent to which the pressures are incorporated into one’s values and beliefs—is key to understanding the impact of sport and societal pressures on athletes. It is often only when these pressures are internalised that athletes’ body satisfaction is damaged and disordered eating behaviours become likely to develop (Knauss, Paxton, & Alsaker, 2007; Stice & Shaw, 2002).

The current study updates the model to fit the demands of the 21st century by including social media pressure as one of the societal pressures faced by athletes. The majority of popular social media involves photographs, and research has shown that viewing photographs of others in general and on social media decreases self-evaluations and is linked to the increased prevalence of eating disorder symptoms, including excessive exercise and lowered body image (Hobza, Walker, Yakushko, & Peugh, 2007; Monro & Huon, 2005; Ransom, La Guardia, Woody, & Boyd, 2010; Santarossa & Woodruff, 2019; Stice, Schupak-Neuberg, Shaw, & Stein, 1994; Tiggemann, 2003). Social media creates a community in which harmful behaviours associated with disordered eating and eating disorders can be reinforced or seen as commonplace (Ransom et al., 2010). In fact, those people considered to be part of the online health community—a source of ‘fitspiration’—scored higher on disordered eating questionnaires and presented more symptoms of compulsive exercise than those whose online presence was focused on travel (Holland & Tiggemann, 2017). Research indicates that repeated exposure to photographs of women who possess the athletic-ideal body type increases body dissatisfaction, and as athletes are likely to follow other athletes on social media, the implications of social media use warrant attention (Homan, Kristin, Erin McHugh, Daniel Wells, Corrinne Watson, 2012).

Internalisation and body dissatisfaction

Internalisation, in this context, is the incorporation of an external, often unattainable body shape ideal into how one measures his or her own self-worth (Petrie &

Greenleaf, 2007). When sport and societal pressures give rise to an ideal body standard that is then internalised, and when an athlete perceives his or her own body to not correspond to this ideal, body dissatisfaction and other disordered eating behaviours can occur (Hargreaves & Tiggemann, 2003; Lester & Petrie, 1995; Stice & Shaw, 2002). Body dissatisfaction has been found to be directly related to the formation and maintenance of eating disorders and disordered eating (Jacobi et al., 2004). In addition, evidence has suggested that in athletes specifically, body dissatisfaction is strongly related to the development of disordered eating (Byrne & McLean, 2002; Krentz & Warschburger, 2011). However, discrepancies regarding which type(s) of athletes experience the most body dissatisfaction and whether athletes experience more dissatisfaction than the general population remains the subject of debate (Bachner-Melman, Zohar, Ebstein, Elizur, & Constantini, 2006; Gapin & Kearns, 2013; Thiemann et al., 2015; Van Durme, Goossens, & Braet, 2012).

Negative affect

While negative affect is presented in the original model as a link between body dissatisfaction and bulimic behaviours based on research in the general population, only a few studies have examined negative affect in athletes in relation to disordered eating (Petrie & Greenleaf, 2012; 2007). Research has found that negative affect in athletes, especially constructs such as fear and guilt, influenced bulimic behaviour when tested in conjunction with increased body dissatisfaction and dietary intent (Anderson, Petrie, & Neumann, 2011; Greenleaf, Petrie, Reel, & Carter, 2010; Petrie, Galli, Greenleaf, Reel, & Carter, 2014). Negative affect has also been linked with disordered eating in athletes via increased levels of compulsive exercise (Goodwin, Haycraft, & Meyer, 2016; Plateau, Arcelus, Leung, & Meyer, 2017). As athletes have a readily available outlet of sport and exercise, over-exercise may be a tempting avenue through which athletes alleviate negative affect (Meyer, Taranis, Goodwin, & Haycraft, 2011).

Modelled behaviours

Modelled behaviours are adopted behaviours that have been reinforced as the group norm. Those pertaining to eating psychopathology have been shown to increase disordered eating symptomatology (Arthur-Cameselle & Quatromoni, 2011; Crandall, 1988). Modelled behaviour by peers and family is a mediator that much of the literature has overlooked, and research has yet to operationalise or validate a measurement tool for this potential risk factor. Therefore, the present research begins to close this gap in the literature by including questions relating to modelled behaviours of disordered eating among athletes.

Restrained eating, and binge eating and bulimia

Restrained eating refers to the attempted and successful behaviour of limiting food intake in terms of quantity and type (Anokhina & Serpell, 2012). Binge eating and bulimia refer to the symptoms of overeating and compensatory behaviours (Fairburn, Marcus, & Wilson, 1993). These two mediators are conceptually considered part of disordered eating but are examined separately as dictated by the theoretical model. In the model, restrained eating is thought to mediate the relationship between negative affect and binge eating and bulimia (Petrie & Greenleaf, 2012, 2007). Restrained eating, as well as bulimia and bingeing, have been linked to negative affect resulting from stressful situations (Stice, 2001).

Previous structural testing of the model

Previous studies have tested several elements of the model (e.g. Petrie, Greenleaf, Reel, & Carter, 2009a). However, only a few have used structural equation modelling, which allows for the simultaneous analysis of relationships that is required to test the model fully. First, Anderson, Petrie, and Neumann (2011) tested the eight factors depicted in the model in female collegiate gymnasts, swimmers, and divers. They found that modelled behaviours did not fit the model and that several pathways required adjustment.

Next, de Sousa Fortes and colleagues (2015) considered the model in a sample of male Brazilian athletes. de Sousa Fortes et al. originally predicted that the sport pressures of training regimes, competitive level, body fat percentage, and sociocultural pressures would lead to body dissatisfaction, which in turn might promote disordered eating in male athletes. However, they found that only sociocultural factors and body dissatisfaction predicted disordered eating. These two studies and the prevalence factors taken from the original chapter from 2007 were all used to guide the operationalisation in the present study in order to match the findings of the literature review and encourage measurement consistency (Sundgot-Borgen & Torstveit, 2010; Stoyel, Slee, Meyer & Serpell, 2020).

Demographic information

The current study also aims to test this model between genders and ages. Previous studies have tested the elements of the model in single-gender samples (Anderson et al., 2011; Brannan, Petrie, Greenleaf, Reel, & Carter, 2009; de Sousa Fortes, Ferreira, de Oliveira, et al., 2015; Petrie, Greenleaf, Reel, & Carter, 2009b). The literature on disordered eating has shown higher prevalence rates of disordered eating and eating disorders in female athletes, but a mixed gender sample is needed to re-test this finding (Sundgot-Borgen & Torstveit, 2004). Due to convenience sampling, the ages of the athletes in previously conducted studies have often been aligned with traditional US university age (cf. Galli, Petrie, Greenleaf, Reel, & Carter, 2014; Greenleaf et al., 2009). This study instead includes a broader range of ages to ascertain how age may influence disordered eating development. Understanding these demographic factors will help guide how this research is used in applied care. Participants were divided into two age groups, 18-26 (the young athletes) and 27+ (the older athletes). This age grouping was chosen because the younger age bracket is considered both a time when athletes are most likely to be competing at their highest level in sport and when individuals are more vulnerable to the development of disordered eating (Pope, Gao, Bolter & Pritchard, 2015).

For all of the reasons outlined in previous chapters, it is difficult to identify the underlying causal factors for disordered eating in the athlete population. However, the theoretical etiological model provides an ideal starting point. Accordingly, this study has three aims. The first is to use structural equation modelling (SEM) to determine the utility of the model by testing all eight mediators in a diverse sample that includes both men and women and a wide range of sports and levels of participation. The second aim is to develop and test a revised model that includes social media. The third and final aim is to test the newly revised model and determine whether it is equivalent across groups such as gender, sport type, and age.

Methods

Procedure

The study received ethical approval from the Clinical Educational and Health Psychology Department at University College London (reference for this approval: CEHP/2018/573). This was the same ethical approval used throughout the entire project. Participants were recruited using online social media campaigns as well as by word of mouth. Those who identified themselves as athletes and performed at least ten hours of training per week and compete in their current sport were invited to participate. This inclusion criteria were used to determine that those completing the questionnaire were athletes rather than zealous exercisers. The athlete identity question was the central criteria for inclusion with competing also acting as an important determinate of inclusion. As a final back-up, a minimum number of hours was set based on the expertise of the author of this thesis. The questionnaire consisted of 241 questions and took just over 30 minutes to complete. It was administered using *Opinio* (Manual, 2008) and following informed consent, participants could start the questionnaire and return to it at a later point within a seven-day window. The questionnaire was open from January 27, 2019 to

February 24, 2019. Participants who completed the questionnaire were given a £5 Amazon voucher as compensation for their time.

Participants

The inclusion criteria for this study were that participants had to be over 18, consider themselves to be an athlete, and spend over ten hours a week participating in their sport and compete, thus meaning that sport was a significant part of their daily experience. After providing their informed consent, 1,208 participants started the online questionnaire, of whom 1,084 completed it. Only completed questionnaires were kept for analysis. Seventeen participants were excluded because they did not fit the inclusion criteria and another three were deleted as they were based outside of the UK, and this study did not have ethical approval to recruit internationally. Thirty-five more were removed due to suspicion from the researcher that the answers were duplicates completed to obtain the £5 gift voucher. A final two were removed because, when asked, the participants did not identify as athletes. Therefore, the final sample consisted of 1,017 (N = 1017) athletes, of whom 56% were male and 44% were female. A wide range of sports was represented, with swimming, tennis, basketball, volleyball, dancing, marathon running, hurdles, and athletic sprinting events making up 76% of the sports represented. Slightly over half (58.3%) of the participants were classified as competing in lean sports, with 41.7% classified as nonlean sport participants. Several other demographic variables were captured and are presented in Table 3-1.

Table 3-1. Additional Demographic Information

Demographic		Percent of Total
Age	18-26	85.7%
	27+	14.3%
When in Season	Currently Competing	75.2%
	Not Currently Competing	24.8%
Years participated in their sport	1-3 Years	6.4%
	4-8 Years	52.7%
	9-15 Years	40.1%
	16+ Years	0.8%
Hours/week	10-15 hours/week	17.9%
	16-25 hours/week	60.4%
	26-40 hours/week	20.9%
	40+ hours/week	0.8%
Level	Non-elite	82.5%
	Elite	17.5%
BMI (range)	14.1-32.4	

Measures

The materials used to operationalise the relevant variables were a combination of existing validated questionnaires and other new measures created for the purpose of this study. These measures were chosen based on recommendations from the systematic review in chapter two. Therefore, the measures chosen were ones that are most widely used in previous research in clinical psychology and demonstrate high validity and reliability in that realm. Where many common scales had been used, those that had previous use in work with athletes were chosen. It is important to note that the reliability and validity of these measures has largely been established in non-athlete samples.

Demographics. Participants' age, gender, sport type information, years spent competing, the teams for which they had competed, and self-reported height and weight were collected.

Sport Pressure. Sport pressure was operationalised as a latent variable that encapsulated several aspects of being an athlete that had previously been related to possible increased disordered eating cognitions and behaviours. This exogenous variable

included if the participant partook in a lean or nonlean sport, the level at which the participants competed, the hours per week that they spent training, their years of participation in that sport, and their current competition status as competing or in off-season. The categorisation of lean and nonlean sports was decided by the author, based on previous classifications of sports in the existing literature or based on the author's applied experience. The hours trained per week were categorised into 10-15, 16-25, 26-40, and 40+ hours. The levels of sport participation were grouped into 'non-elite', which comprised athletes competing at a county or regional level, and 'elite', which consisted of those participating at a national or international standard. Athletes could choose from the following categories of the years for which they had taken part in their sports: 1-3 years, 4-8 years, 9-15 years, and 16+ years. Finally, athletes could indicate whether they were currently competing or in their off-season. In the case that N/A was chosen for the answer (n=41), it was assumed that those athletes were consistently competing throughout the year and thus were categorised with those who indicated that they were currently competing.

Societal Pressure. Societal pressure, the second exogenous variable in the original etiological model, was measured using the nine-item Information and seven-item Pressures subscales from the Sociocultural Attitudes Towards Appearance Questionnaire-3 (SATAQ-3) (Heinberg, Thompson, & Stormer, 1995). The subscales were summed for a total societal pressures score. An example of a statement from the pressure subscale is 'I've felt pressure from TV or magazines to lose weight'; an example from the information subscale is 'Pictures in magazines are an important source of information about fashion and "being attractive."' Cronbach's alphas have been found to be high for these subscales as well as for the entire SATAQ scale: Information ($\alpha = .94$), Pressures ($\alpha = .94$), and global score ($\alpha = .94$) (Thompson, Van Den Berg, Roehrig, Guarda, & Heinberg, 2004). Statements related to social media usage were also

incorporated using similar questions to those that were asked in the SATAQ about TV or magazines. The words ‘TV’ and ‘magazines’ were simply replaced with ‘social media’ – for example, ‘I’ve felt pressure from social media to be thin.’ This brief part of the questionnaire consisted of five items, was created for this study, and has not been formally validated; however, reliability calculations for the current study showed an alpha of .75.

Internalisation. Internalisation was also measured using subscales of the SATAQ-3, specifically the five-item Internalisation-Athlete ($\alpha = .89$) and the nine-item Internalisation-General ($\alpha = .92$) (Thompson et al., 2004). As above, these two subscales were summed for ease of analysis. An example item from the Internalisation-General is ‘I compare my body to the bodies of people who are on TV’. An example from the athlete scale is ‘I wish I looked as athletic as sports stars.’

Body Dissatisfaction. The nine-item body dissatisfaction subscale (EDI-BD) of the Eating Disorder Inventory (EDI-2) was utilised to measure body dissatisfaction ($\alpha = .88$) (Garner, Olmstead, & Polivy, 1983; Thiel & Paul, 2006). An example of a statement from this subscale is ‘I think that my stomach is too big.’ Notably, this scale shows lower alpha coefficients for men compared to women (Spillane, Boerner, Anderson, & Smith, 2004).

Negative Affect. Negative affect was measured using the 10-item subscale ($\alpha = .85$; 95% CI = .84-.87) from the Positive and Negative Affect Schedule (PANAS), in which participants had to rate the extent to which they felt various emotions, such as ‘guilty’, ‘scared’, and ‘nervous’ from ‘*Very slightly or not at all*’ to ‘*Extremely*’ (Crawford & Henry, 2004; Watson et al., 1988).

Restrained Eating. Restrained eating was operationalised using the Restraint Subscale of the Eating Disorder Examination Questionnaire (EDE-Q-R) (Fairburn & Beglin, 2008; Mond, Hay, Rodgers, Owen, & Beumont, 2004). This subscale has been found to have high internal consistency ($\alpha = .83$) and a high test-retest reliability in other

mixed-gender samples ($r = .81$) (Rose, Vaewsorn, Rosselli-Navarra, Wilson, & Weissman, 2013). An example question from this subscale is ‘Have you **tried** to exclude from your diet any foods that you like in order to influence your shape or weight (whether or not you have succeeded)?’ It is important to note that one question from this subscale was omitted due to human error, hence, as recommended by the authors of the scale, mean calculations were used with items included. It is also key to note that controversy over the content validity of this scale exists, with research indicating that it more accurately measures restriction rather than restraint (Anokhina & Serpell, 2012; Laessle, Tuschl, Kotthaus, & Prike, 1989).

Modelled Behaviours. No previous research has included a validated measure for modelled behaviours of peers and family, so the current study used seven questions to attempt to capture this concept. Example statements included ‘My friends diet or use weight control behaviours’ and ‘My teammates diet or use weight control behaviours.’ Reliability analysis for the current study found the alpha to be .61. These questions were designed based on the qualitative results that had previously discussed the harmful role that modelled behaviours of teammates can have in the development of eating disorders (Arthur-Cameselle & Quatromoni, 2011).

Binge Eating and Bulimia. Binge eating and bulimia were measured using the bulimia subscale of the 64-item EDI-2 (EDI-B) (Garner et al., 1983). This subscale is scored from ‘Never’ to ‘Always’ on a six-item Likert scale. An example statement is ‘I have gone on eating binges where I have felt that I could not stop.’ This subscale also has a high internal consistency ($\alpha = .87$) for a large sample of healthy controls (Clausen, et al., 2011).

Results

Analysis was conducted using SPSS version 25 and the SPSS add-on AMOS. Excel Macros was then utilised to compare the Chi-square results when comparing model

results for invariance testing. When analysing the data for normality, it was determined that all variables had distributions within the acceptable range for skewness and kurtosis (Ryu, 2011).

Data Analysis

SEM was conducted using AMOS. Several indicators of model fit were utilised during the analysis: χ^2 significance, the Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Normed Fit Index (NFI), and Root Mean Square Error Approximation (RMSEA). In general, a nonsignificant χ^2 value shows that the data fits the model well; however, with large samples it is unlikely to obtain a p -value $<.05$ (Cheung & Rensvold, 2002). For CFI, GFI, and NFI a value $>.90$ is considered to indicate acceptable fit, and for RMSEA a value $<.08$ is needed for acceptable fit (Marsh, 2007).

Descriptive Statistics

Table 3-2 outlines the descriptive statistics and intercorrelations (Pearson and point biserial correlations) for all the variables involved. While some of the correlations did show significant relationships between variables, the correlations were all weak, suggesting that variables were measuring relatively independent underlying constructs.

Testing the Theoretical Etiological Model

Testing the theoretical etiological model involved creating a hybrid model, with a combination of observed and latent variables, in AMOS (Figure 3-2). Only the Sport Pressures was a true latent variable as the others were composite scores due to a lack of computing power that would have been needed to run the entire model with all latent variables. In this model, the two exogenous variables were Sport Pressures and Societal Pressures with Binge eating and Bulimia acting as the outcome variable. The remaining variables were mediators and therefore endogenous in that single-headed arrows led to them. Results revealed that this model did not fit the data well: $\chi^2 (70, 1017) = 1043.07$; $p < .0001$. CFI = .55; GFI = .88; NFI = .53; RMSEA = .12 (90% CI = .111--.123).

Regression weights are indicated with Betas to show the strength of the relationship between factors.

Table 3-2. Table of Correlations and Means and Standard Deviations

	Lean/ Non Lean	Hrs/ Wk	Elite/ Non elite	Competin g/Offseas on	Years done sport	SATAQ- Pressures	SATAQ- Informatio n	Social Media Pressures	Internali sation - General	Internalisa tion- Athlete	EDI- BD	Modelled Behaviour	EDE-Q Restraint Sore	EDI-B
Lean/Non Lean	1.00	0.18	0.05	0.07*	0.10	-0.02	0.06	0.00	0.03	0.03	-0.01	0.07	0.05	0.01
Hours/Week		1.00	0.26	-0.32	0.30	0.00	0.00	0.01	0.05	-0.07*	0.02	-0.15	-0.21	0.11
Elite/Nonelite			1.00	-0.01	0.16	0.02	0.08	-0.03	0.09	0.03	-0.05	-0.01	-0.09	0.10
Competing/Of fseason				1.00	-0.19	-0.02	0.04	-0.05	-0.05	-0.01	-0.03	0.28	0.28	-0.03
Years done sport					1.00	-0.11	-0.05	-0.06	0.03	-0.12	0.07*	-0.08*	-0.06	0.01
SATAQ- Pressures						1.00	0.37	0.53	0.48	0.45	-0.01	-0.02	-0.02	0.40
SATAQ- Information							1.00	0.31	0.34	0.19	-0.07*	0.01	0.01	0.21
Social Media Pressures								1.00	0.4	0.42	-0.01	-0.01	0.01	0.28
Internalisation -General									1.00	0.31	0.00	-0.01	-0.03	0.23
Internalisation -Athlete										1.00	-0.02	0.00	-0.03	0.30
EDI-BD											1.00	-0.03	0.02	0.05
Modelled Behaviour												1.00	0.56	-0.02
EDE-Q Restraint													1.00	-0.02
EDI-B														1.00
M						22.33	28.04	17.67	28.18	16.15	6.26	15.03	3.03	4.33
SD						3.33	3.07	3.19	3.14	2.35	2.72	3.27	0.94	3.57

Note. Bold show significant relationships. Bold with no asterisk means $p < .001$; * $p < .05$;

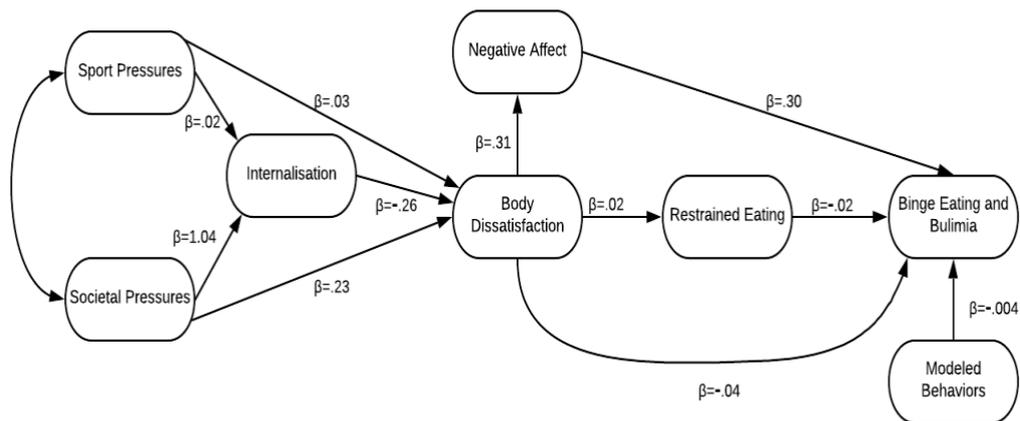


Figure 3-2 . Original theoretical etiological model in athletes.

To enhance the model, social media was added as an observed variable as part of societal pressures. This did improve the fit of the model, but not to an acceptable standard. $\chi^2 (70, 1017) = 646.09; p < .0001$. CFI = .74; GFI = .92; NFI = .72; RMSEA = .09 (90% CI = .084--.096). The original etiological model with social media was rerun and all nonsignificant pathways were deleted, followed by other changes made as indicated by the modification indices. To find a good fit, the original model was adjusted using an approach that was data-driven but with any final changes checked against existing theoretical knowledge. This resulted in the following revised model with excellent parsimonious goodness of fit (Figure 3-3). This was the model used for invariance testing. $\chi^2 (19, 1017) = 77.58; p < .0001$. CFI = .96; GFI = .98; NFI = .95; RMSEA = .055 (90% CI = .043--.068).

Standardised regression weights, or direct effects, are shown for this newly revised model in Figure 3-3. In this context, it is appropriate for the standardised regression coefficients to be above one; correlations can also be used to understand relationships (Table 3-2) (Deegan Jr, 1978; Kline, 2015). Indirect effect analysis along with bootstrapping 200 samples at a 90% confidence interval revealed that Societal Pressures ($\beta = .45, p = .002$) and Body Dissatisfaction ($\beta = .08, p = .01$) both had significant indirect effects on Bulimia. However, the inclusion of indirect pathways decreased model fit and so were not included in the revised model.

Testing for invariance across groups

The revised model (Figure 3-3) had the best fit of all the models tested. Therefore, tests of invariance across several groups, including gender, age, competition level, if currently competing, and years participated in sport, using this revised model are outlined below. As sport pressure had been removed from the model due to lack of fit, the model was tested for differences across these pressures as well. When testing for invariance, two methods were employed. First, AMOS multigroup analysis was utilised to examine the Comparative Fit Index (CFI) to see if the constrained models differed from the unconstrained model by an amount equal to or larger than .01, which can be taken as indication that the model differs across groups (Cheung & Rensvold, 2002; Milfont & Fischer, 2010). Secondly, a Chi-square difference test using an Excel Macros was then employed to provide additional insight on whether the models being compared were or were not invariant. While still showing good fit for the vast majority of groups, the model showed that variance was present depending on gender, age, level of athlete, whether the athlete was currently competing, and how long that athlete had participated in sport. The model was invariant for lean and nonlean sport types.

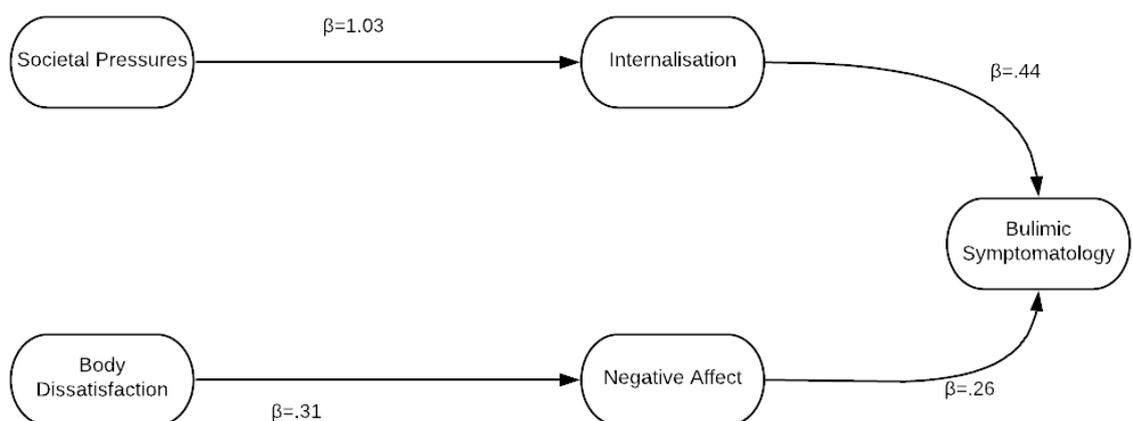


Figure 3-3 Revised model with best fit for athletes, used for all invariance testing.

Multigroup invariance testing revealed differences between genders (see Table 3-3). The model fit better for men $\chi^2 (19,567) = 54.46; p < .0001; CFI = .96; GFI = .98; NFI = .95; RMSEA = .06$ (90% CI = .040--.076) than for women $\chi^2 (19, 450) = 46.70, p < .0001; CFI = .95; GFI = .98; NFI = .93; RMSEA = .06$ (90% CI = .037--.078). Excel macros used in conjunction with AMOS revealed that gender differences were explained by differences in the pathway between body dissatisfaction and negative affect at a 99% confidence interval (CI).

Table 3-3 Gender model fit indices across various model constraints.

Model	χ^2	DF	CFI	GFI	NFI	RMSEA	CI for RMSEA
Unconstrained	101.17	38.00	0.96	0.98	0.94	0.04	0.03 0.05
Measurement weights	107.60	42.00	0.96	0.98	0.94	0.04	0.03 0.05
Structural weights	130.87	45.00	0.95	0.97	0.92	0.04	0.04 0.05
Structural covariances	131.04	46.00	0.95	0.97	0.92	0.04	0.03 0.05
Structural residuals	132.60	49.00	0.95	0.97	0.92	0.04	0.03 0.05
Measurement residuals	149.09	55.00	0.94	0.97	0.91	0.04	0.03 0.05

Invariance testing between those athletes under age 26 (young) and those age 27+ (older athletes) also showed a significantly different fit (see Table 3-4). The model fit better for younger athletes $\chi^2 (19,872) = 79.81, p < .0001; CFI = .96, GFI = .98, NFI = .94, RMSEA = .061$ (90% CI = .047--.075) than mature ones $\chi^2 (19, 145) = 36.98, p = 0.008; CFI = .93, GFI = .94, NFI = .87, RMSEA = .081$ (90% CI = .041--.120). Further testing revealed that age moderated the pathways between internalisation and bulimia and negative affect and bulimia at a 99% CI, thus explaining the different fit for the two age groups.

Table 3-4 Age model fit indices across various model constraints

Model	χ^2	DF	CFI	GFI	NFI	RMSEA	CI for RMSEA	
Unconstrained	116.90	38.00	0.95	0.97	0.93	0.05	0.04	0.06
Measurement weights	138.23	42.00	0.94	0.97	0.92	0.05	0.04	0.06
Structural weights	160.93	45.00	0.93	0.96	0.90	0.05	0.04	0.06
Structural covariances	163.52	46.00	0.93	0.96	0.90	0.05	0.04	0.06
Structural residuals	167.98	49.00	0.93	0.96	0.90	0.05	0.04	0.06
Measurement residuals	178.35	55.00	0.92	0.96	0.89	0.05	0.04	0.06

The model better explained disordered eating for nonelite athletes $\chi^2(19, 839) = 78.56, p < .0001$; CFI = .95, GFI = .98, NFI = .94, RMSEA = .061. (90% CI = .047-.076) than for elite athletes $\chi^2(19, 178) = 57.68, p < .0001$; CFI = .88, GFI = .93, NFI = .84, RMSEA = .107 (90% CI = .076--.139) with elite athletes being the only group in which the CFI dipped below the level required for adequate fit. See Table 3-5 for invariant test results. Excel macros analysis showed that for these groups, the difference could be explained by the path from societal pressures to internalisation at a 90% CI and from internalisation to bulimia at a 95% CI.

Table 3-5. Elite vs Nonelite model fit indices across various model constraints

Model	χ^2	DF	CFI	GFI	NFI	RMSEA	CI for RMSEA	
Unconstrained	136.39	38.00	0.94	0.97	0.92	0.05	0.04	0.06
Measurement weights	155.30	42.00	0.93	0.96	0.91	0.05	0.04	0.06
Structural weights	156.40	45.00	0.93	0.96	0.91	0.05	0.04	0.06
Structural covariances	160.28	46.00	0.93	0.96	0.91	0.05	0.04	0.06
Structural residuals	164.56	49.00	0.93	0.96	0.90	0.05	0.04	0.06
Measurement residuals	208.58	55.00	0.91	0.96	0.88	0.05	0.05	0.06

Those currently competing and those in off-season were variant in a multi-group analysis test (see Table 3-6) but only showed a very slight difference in fit for the GFI, and showed no difference in fit for the CFI. Those currently competing showed a fit of $\chi^2(19,252) = 41.40, p = .002$; CFI = .95, GFI = .96, NFI = .91, RMSEA = .069 (90% CI = .040--.097) and those in offseason showed a fit of $\chi^2(19,765) = 73.02, p < .0001$; CFI = .95, GFI = .98, NFI = .94, RMSEA = .061 (90% CI = .047--.076). Excel macros showed that the difference in fit can be explained by currently competing or being

in offseason moderating the pathways from internalisation to bulimia and negative affect to bulimia at a 95% CI, and body dissatisfaction to negative affect at a 99% CI.

Table 3-6. *Currently competing v. Out of season model fit indices across model constraints*

Model	χ^2	DF	CFI	GFI	NFI	RMSEA	CI for RMSEA
Unconstrained	114.45	38.00	0.95	0.97	0.93	0.04	0.04 0.05
Measurement weights	121.96	42.00	0.95	0.97	0.93	0.03	0.04 0.05
Structural weights	139.60	45.00	0.94	0.97	0.92	0.04	0.04 0.05
Structural covariances	141.60	46.00	0.94	0.97	0.92	0.04	0.04 0.05
Structural residuals	145.96	49.00	0.94	0.97	0.91	0.04	0.04 0.05
Measurement residuals	164.63	55.00	0.93	0.96	0.90	0.04	0.04 0.05

Finally, the model fit increasingly well the longer an athlete had participated in his/her sport (see Table 3-7). Those in sport for one to three years showed a fit of $\chi^2 (19, 65) = 33.47, p = .02; CFI = .84, GFI = .89, NFI = .72, RMSEA = .109$. (90% CI = .042--.169); those in sport for four to eight years showed a fit of $\chi^2 (19, 536) = 106.22, p < .0001; CFI = .91, GFI = .96, NFI = .89, RMSEA = .093$ (90% CI = .076-.110); and those in sport for nine or more years showed a fit of $\chi^2 (19, 416) = 76.75, p < .0001; CFI = .92, GFI = .96, NFI = .90, RMSEA = .086$ (90% CI = .066--.106). (An insufficient number of athletes had done their sport for over 16 years and so the 16+ category was combined with the 9-15 years category for analysis). Excel macros revealed that years participated in sport influenced the pathways from internalisation to bulimia at a 99% CI, negative affect to bulimia at a 95% CI, and body dissatisfaction to negative affect at a 90% CI.

Table 3-7. *Years spent participating in sport model fit indices across model constraints*

Model	χ^2	DF	CFI	NFI	GFI	RMSEA	CI for RMSEA
Unconstrained	216.70	57.00	0.91	0.88	0.95	0.05	0.05 0.06
Measurement weights	357.69	65.00	0.84	0.81	0.92	0.07	0.06 0.07
Structural weights	403.79	71.00	0.81	0.78	0.91	0.07	0.06 0.08
Structural covariances	410.21	73.00	0.81	0.78	0.91	0.07	0.06 0.07
Structural residuals	461.76	79.00	0.78	0.75	0.90	0.07	0.06 0.08
Measurement residuals	520.47	91.00	0.76	0.72	0.89	0.07	0.06 0.07

Discussion

The purpose of this research was to assess the applicability of the theoretical etiological model proposed by Petrie and Greenleaf in 2007 and 2012 in a large, multi-sport, mixed-gender sample. It also aimed to expand upon previous research that tested this model by adding social media in order to create a parsimonious model with high goodness of fit. It was hoped that evaluating the original model using a larger sample of mixed gender athletes that was unconstrained by the convenience sampling of US universities would mean a revised, better fitting model. This study specifically considered relationships between the eight mediators described in the model: sport pressure, societal pressure, internalisation, body dissatisfaction, negative affect, modelled behaviours, restrained eating, and binge eating and bulimia, as well as the addition of social media as a societal pressure. The revised model's utility was also assessed across groups in multigroup invariance testing.

The analysis showed poor fit for the original theoretical etiological model, although this fit improved slightly with the inclusion of social media. The relevance of social media as a source of societal pressure has been shown in a range of recent research indicating how intimately sociocultural experiences are tied to the online world (Pegoraro, 2010). The next step was to remove non-significant pathways, which resulted in the creation of a revised model that had good fit on the CFI, GFI, and other relevant indices.

This newly revised model showed that societal pressures, mediated by internalisation, are associated with binge eating and bulimia, while body dissatisfaction leads to bulimia and binge eating, mediated by negative affect. It is important to note that restrained eating was eliminated from the model and, therefore, this model predicts binge eating and bulimia as only one facet of disordered eating in athletes.

As this study is cross-sectional, causal claims cannot be made. However, these results demonstrate that the development of binge eating and bulimia is not associated with the sport pressures experienced by athletes, as theoretically suggested. These findings add to the growing body of research that suggests that sport pressures may not directly influence the development of disordered eating (de Sousa Fortes et al., 2015; Shanmugam et al., 2011)

Invariance testing across several groups showed that the newly created model differed across several groups, and the results showed in which pathways these differences arose, something that must be taken into account when considering the prevention and treatment of disordered eating in athletes. With sport pressures removed from the model, invariance testing was also conducted across the factors that were originally described as measuring sport pressure.

While the newly revised model showed very good fit for both males and females, tests of gender differences revealed that the model fit better for male than for female athletes, which is surprising, as the original model was designed based on literature that included mainly females. However, research has found increasing evidence that significant numbers of male athletes suffer from disordered eating (Baum, 2006; Petrie et al., 2008). The model also fit better for young athletes, specifically those younger than age 27, which is noteworthy, as the vast majority of research on athletes originates from convenience sampling in US universities, where the ages are often limited to 18–22 years. The model also fit better for athletes at a non-elite level (i.e., those at a regional or county level), which indicates that these athletes, who are serious yet aspiring, may not have adequate support in coping with the pressure that they experience, whereas elite athletes have access to such support. The model fit better for athletes who completed the questionnaire while in their off-season, something that is rarely taken into account when surveying athletes. This finding may indicate that when training intensifies around

competition time, it provides an outlet for athletes that allows them to fully fuel their bodies without internalising societal pressures or experiencing negative feelings around food. This finding is in line with previous work that has found athletes score higher on DE measures in the pre-competition time of the season than when currently competing (Neves et al., 2017). Finally, invariance testing showed that the longer an athlete had participated in a sport, the better the model fit for that athlete, indicating an increasing pressure on athletes who had participated in a sport for over nine years. Notably, the model was invariant across lean and nonlean sport types. However, several aspects of sport pressure did create variance in the model, demonstrating that while sport pressure does not fit within the model, various sport pressures may still be tangentially relevant to the development of disordered eating in athletes.

Limitations

This study is limited by its cross-sectional nature; however, future longitudinal phases of this project are described in chapter five. The measurement scales used in the current study were the ones most commonly found in eating disorder and disordered eating literature as suggested from the findings in the systematic review in chapter two; however, none were specifically designed for athletes. Additionally, in the absence of other acceptable measures, the scales for social media usage and modelled behaviours were purpose-built for this study and thus were not formally validated in previous research; therefore, they had lower Cronbach's alpha coefficients than would normally be acceptable. However, the sample, the range of different sports, and the fact that this study did not rely on a convenience sample of US university athletes from a similar age range make it a unique study in this area of research.

Future Directions

As previously discussed, future research should use a longitudinal design to determine whether the relevant factors are able to predict future disordered eating in an

athlete sample, an approach that is undertaken in chapter five. A qualitative investigation to further understand the differences between the original etiological model and the revised model has also been conducted and can be found in the next chapter.

Conclusion

This study provided a large amount of empirical data to further test the original theoretical model with a more diverse sample than previously used. This led to the creation of a newly revised model that can begin to explain the presentation of disordered symptomatology in a wide range of male and female athletes.

Chapter 4.

A qualitative investigation into the sport and social pressures on elite athletes' disordered eating

Key Points:

- Qualitative investigation into the sport and societal pressures experienced by athletes in relation to disordered eating thoughts and behaviours
- Following the cross sectional study, this study aims to explore why the T1 model and Petrie and Greenleaf's model differed, especially in relation to sport pressure
- The findings begin to suggest that sport pressures no longer fit in the model because it is the societal and social pressures within the sporting context, rather than sport itself, that appear to be associated with the development of disordered eating thoughts and behaviours.

Introduction

This qualitative investigation was undertaken in response to the future directions ideas from chapters two and three, and in order to add more in-depth understanding to the quantitative results of chapter three. The aim was to understand why the T1 model differed from Petrie and Greenleaf's (2007) model using an alternative methodological approach. What follows is a version of the manuscript has been accepted into *Frontiers in Psychology* (Stoyel, Delderfield, Shanmuganathan-Felton, Stoyel & Serpell, 2021).

As has been discussed in previous chapters, there is consensus that athletes are at higher risk of developing subclinical disordered eating, and perhaps also clinical eating disorders, than the general population, particularly female athletes and athletes in sports that have weight class components or rely on a lean physique to achieve success (Joy et al., 2016; Petrie & Greenleaf, 2007; Sundgot-Borgen & Torstveit, 2004). Athletes not only experience sport-related pressures but are also subject to broader societal pressures around weight, body image and eating. These societal pressures can either compound sport pressures or oppose them, creating a climate ripe for the development of disordered eating (Cooper & Winter, 2017; Petrie et al., 2009b; Petrie & Greenleaf, 2007; Pope et al., 2015; Sundgot-Borgen & Torstveit, 2004). Similarly, sport literature has pointed to a number of pressures specific to particular sports that are often exacerbated by societal burdens as reasons why athletes suffer from clinical and subclinical eating disorders (Anderson et al., 2012; Cooper & Winter, 2017; Petrie et al., 2009a; Rudd & Carter, 2006).

Returning again to the model proposed by Petrie and Greenleaf (2007), this chapter focuses on the predictors of the model: societal and sport pressures (for a review of the full model, see Figure 3-1 in the previous chapter). The research around sport pressure shows that there are several specific aspects of sport that are associated with increased rates of disordered eating, including whether the sport emphasises a lean

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physique for success (termed a 'lean' sport) in addition to the level of competition (Petrie & Greenleaf, 2007). Lean sports, by nature, create pressure to be thin to maximise both performance and appearance for judges and others (Chapman & Woodman, 2016; Krentz & Warschburger, 2011; Patel et al., 2003; Smolak et al., 2000).

Competitive level also has been demonstrated to be related to disordered eating risk, with research revealing that higher levels of competition increase the need for a competitive advantage, which may create a pressure that can force athletes to resort to disordered eating behaviours in an attempt to increase performance, or as a coping mechanism (Kirk et al., 2001; Swoap & Murphy, 1995). Overall, weight loss has been seen by athletes to be a performance enhancer for competitive moments, and with this message being encouraged by society in general, the pressure to limit body fat or weight may stem from wanting both to perform well and to fulfil societal expectations (Rosen & Others, 1986; Sundgot-Borgen, 1994). Other sport pressures linked to disordered eating may include overt or covert comments and actions from coaches or teammates on how appearance and physique may impact performance (Kerr et al., 2006; Kong & Harris, 2015; Petrie et al., 2009a; Scoffier et al., 2010). Teammates may exhibit harmful modelling behaviour that normalises disordered eating and related behaviours within the sporting context (Greenleaf et al., 2010; Scott et al., 2019; Scott et al., 2021). Furthermore, coaches weighing athletes publicly can also contribute to feelings of pressure to lose weight for sport performance (Galli et al., 2017). Upcoming competition may also play a role in creating additional sport pressure (Neves et al., 2017). Figure-hugging sport uniforms required for aerodynamics and therefore sport performance may also create pressures on athletes, as they can intensify feelings of body shame and therefore encourage disordered eating behaviours (Cooper & Winter, 2017; Sundgot-Borgen & Torstveit, 2004; Tylka & Hill, 2004). These sport pressures are experienced

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uniquely by each athlete in their own sporting context, against a background of broader societal pressures.

Before proceeding, it is important to define what is meant by “society” in this context. For this investigation, society is defined as the non-athlete population, those who are aware of competitive sport through friendship, family, or fandom. There is societal pressure, independent of sport, on each gender. Broadly, in Western culture, women experience societal pressure to be thin, while men experience pressure to fit a muscular ideal (Reel et al., 2013). These societal ideals, presented in the environment, traditional media and social media, have been linked to the development of eating disorders (Hutchinson & Rapee, 2007; Keery et al., 2004; Santarossa & Woodruff, 2017). Yet every sport also demands a specific body type ideal for success (Voelker et al., 2014). The desirable body type for success in many sports might contradict societal ideals. General pressures from Western media, including social media, interact with body-type ideals or body-type stereotypes, which are also socially-transmitted but are specific to each sport; for example, the abdominal muscles are highly valued in swimming, while a lean physique is valued in long distance runners (Sundgot-Borgen & Torstveit, 2010). These interactions can create a heightened risk of body dissatisfaction and therefore disordered eating (Bissell, 2004; Cooper & Winter, 2017; Milligan & Pritchard, 2006; Thompson et al., 1999). This body dissatisfaction has been found to be closely linked to the development of disordered eating, both in the general population and amongst athletes (Ferreira et al., 2013; Kong & Harris, 2015; Menzel et al., 2010).

As this qualitative study is part of a larger longitudinal, quantitative, multi-method project that investigates the risk factors of disordered eating in athletes, it is important to understand where this chapter sits within the wider PhD. The project began by examining Petrie and Greenleaf’s 2007 model with an attempt to apply this model to a sample of male and female athletes across a wide range of sports and sport levels via quantitative

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research in chapter three. The results indicated that a revised model better explained disordered eating development in athletes (Stoyel et al., 2020a) (see Figure 4-1). The sport pressures predictor was not a relevant risk factor for eating disorders in the new, applied model, but the role of social media was found to be a significant societal pressure (Stoyel et al., 2020a). The elimination of sport pressures as a predictor of disordered eating symptoms was unanticipated, and contrasts with anecdotal experience from sport psychologists. However, other research has begun to replicate this finding (de Sousa Fortes et al., 2015; Shanmugam et al., 2011). Given this finding, the purpose of this qualitative chapter was to offer experiential insight into the role of sport, societal, and social pressures on athletes in relation to the development of disordered eating and related concepts.

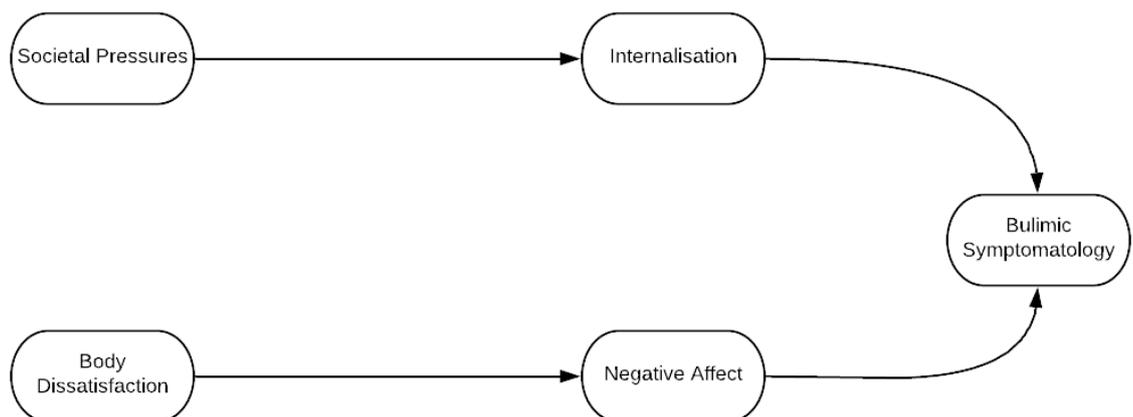


Figure 4-1. T1 model

Methods

Participants

Nine athletes were recruited, all of whom were volunteers from the quantitative portion of this thesis. All participants from chapter three were invited via email to take part in an additional interview, at which point six participants responded. A further three participants came forward after a second recruitment email. Informed consent for the interviews was given as part of the consent process for the quantitative elements of this research project. The names seen here are pseudonyms for these participants, with

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pseudonyms all gender appropriate. Interviews were conducted from March 2019 to June 2020. A varied sample in terms of gender and sport type was sought, but with a focus on those engaged in lean or endurance sports, as these show higher prevalence rates of disordered eating (Sundgot-Borgen & Torstveit, 2004). All nine participants were at an elite level, competing at a national or international standard. Four were male. Body Mass Index (BMI) ranged from 18.21 to 27.27; however, it is important to note that the muscle mass ratio of these athletic participants make the BMI a less reliable measure of health for this study. As part of the quantitative study, all participants had previously filled out the Eating Disorder Examination Questionnaire, a tool that is commonly used in clinical work as part of a diagnostic procedure for eating disorders. In Table 4-1, the on EDE-Q scores taken at the nearest available time point are presented. Alicia and Emily each reported a history of a formally diagnosed eating disorder, and Henry described a self-diagnosed eating disorder but did not score above the clinical threshold of 4.0 on the EDE-Q (Lavender et al., 2010). Georgia and Isabelle also alluded to histories of disordered eating.

Table 4-1. Participant Information

Participant	Gender	Sport	EDE-Q
Alicia	F	Orienteering	1.18
Ben	M	Swimming	0.49
Callum	M	Triathlon	0.85
Dan	M	Ultra-Running	0.49
Emily	F	Lacrosse/Rowing	3.42
Francesca	F	Swimming	1.00
Georgia	F	Mid-Distance Running	3.99
Henry	M	Running	1.73
Isabelle	F	Lacrosse/Track/Triathlon	1.61

Design

This study was of qualitative design and employed deductive thematic analysis. As outlined by Braun and Clarke (2012) and Braun, Clarke & Weate (2016) this method allows for existing knowledge of theories to provide the backdrop for the questions and analysis of interviewees' responses. Thematic analysis calls for a relatively homogenous sample from which a subjective interpretation of the human experience is uncovered (Guest et al., 2012; Smith & Osborn, 2015). The underlying ontology and epistemology were such that each participant's truth was a construction of their independent reality, and that the role of the research was to discover those experiences of independent realities unique to each participant, and to understand common themes that explored existing theory (Sparkes & Smith, 2013). The semi-structured flow and open-ended questions were designed and implemented such that the methodology had congruence with the underlying epistemology of the research and author of this thesis (Mayan, 2016). The author who conducted the interviews is a registered sport psychologist with the Health Care Professions Council, and skills from that professional experience were utilised to build rapport and guide as expert questioning and probing. These skills also had influence on the construction of the reality on which this study was based.

Procedure

The interviews, which lasted on average 47 minutes (ranging from 31 minutes to 74 minutes), began with questions designed to build rapport; the interview script then focused on questions related to sport pressure as related to body type and food intake. An example question from this section was "Is there anything unique to being an athlete that you think makes you view food differently than a non-athlete?" The interview guide then asked questions about perceived pressures related to being a member of society, social media, and day-to-day diet, both as a person and as an athlete. An example of a question

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from this section was, “Do you feel like you live up to societal expectations of you as a human being? You as athlete?” Of note, in the interviews conducted in mid-2020 (interviews with Georgia, Henry and Isabelle), an open-ended question was added to ask about participants’ experience of Covid-19 as it related to food intake, training regime, and view of food.

After the nine interviews, the author felt that data saturation was sufficiently achieved for the theory in question. Data saturation can be difficult and to determine and controversial as a stand-alone standard; therefore, self-reflection was utilised to strengthen the decision that sufficient data had been collected to capture the phenomena in question (Francis et al., 2010). Furthermore, the staggered data collection (the first six several months before the final three participant interviews) meant that the first set of interviews were analysed and the remaining three could act as confirmation that the content of the participant responses showed sufficient data saturation. Eight of the nine participants were interviewed virtually, either via Skype or Zoom and the ninth was interviewed face-to-face (Janghorban et al., 2014). As the author of this project is familiar with the theory surrounding disordered eating in athletes, self-reflection through journaling and supervision was employed in an attempt to expose and question the researcher’s pre-existing assumptions and to increase the authenticity and credibility of the research (Morrow, 2005; Tracy, 2010).

Analysis

Data analysis was aided by using NVivo 12. Thematic analysis can be inductive or deductive, with the current study employing a deductive approach. To enhance rigor, the guidelines established by Braun and colleagues (2016) were utilised throughout analysis: after verbatim transcription, all transcripts were checked by the participants to ensure the accuracy of transcription (Lincoln & Guba, 2000; Shenton, 2004; Tracy, 2010). The author also analysed the data in line with the six steps from Braun and Clark (2012)

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in the following fashion. To attain complete familiarisation with the data, multiple readings of the transcript were performed. The subsequent step involved coding the repeating and prominent ideas that appeared in the transcripts. These initial codes were then sorted into themes and subthemes that mapped onto the underlying theory. When designing and reflecting upon the themes, the mutually exclusive and collectively exhaustive (MECE) principle was employed to add additional rigor to the research (Chillarege et al., 1992; Lee & Chen, 2018). Before the themes were discussed among the research group, additional validation of the themes took place, in which a second researcher also coded all of the data with no influence from other researchers to ensure alternative explanations or interpretations were not missing (Smith, 2003). The author and second researcher together then reviewed, defined and named the themes. Finally, all researchers involved utilised self-reflections to enhance the trustworthiness of the analysis before producing the report (Morrow, 2005; Tracy, 2010).

As deductive analysis was utilised for the current project, the themes found in the interview transcripts were guided by the underlying theory from the theoretical model. The focus of this model, and therefore this research, was on sport pressures and societal pressures experienced by athletes and how these pressures related to disordered eating (Petrie & Greenleaf, 2007). When designing the questions to elicit the themes, the concepts of sport and societal pressures within the model were utilised to guide the interviews. However, the subsequent analysis embraced the organic nature of this qualitative research.

Results

The qualitative study revealed two overarching themes: conflating physical appearance and sporting ability and living as an athlete (Table 4-2). The first theme was found to have two corresponding subthemes: the first of these subthemes was social comparison in terms of body type between teammates, competitors, and idols within the

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sporting context, and the second subtheme was how the societal notion of ‘the athlete body’ put pressure on the athletes to look a certain way. The second theme, living as an athlete, also had two subthemes, which were the lifestyle necessary for success as an athlete, and managing sport pressures while living within wider society. These latter two subthemes were classified respectively as discipline and sacrifice and finding a balance.

Table 4-2. Themes and subthemes

Themes	Subthemes
Conflating physical appearance & sporting ability	Social comparison in a sporting world Societal notions of ‘the athlete body’
Living as an athlete	Discipline and sacrifice Finding a balance

Conflating physical appearance and sporting ability as a sport pressure

Understanding sport pressure in regard to physical appearance requires acceptance of the notion that body composition is inherently linked to sporting ability and therefore success. All the participants felt pressure from their sport to attain a particular aesthetic or body type for performance benefit. The following quotation from Callum, a triathlete, illustrated this: “*If you’re lighter you tend to move quicker in the sport... The biggest benefit is to be as lean as you can really.*” The physical requirements for sport were seen by participants in terms of physics and practical requirements for success:

If you did a mathematical equation, if you have two people who have the same acceleration but one is lighter, then the one who is lighter will win...people talk about the math and think if I lost five pounds then I could run that much faster per lap. (Dan)

Participants felt they could see a performance benefit to being lighter and leaner for competition, but not without the need for strength. The following quote from Isabelle

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illustrated this idea: *“my sports all have required strength and speed ... lacrosse particularly has so many other elements to it other than how light... you don't want to be that light as you get knocked over.”* Regardless of what the ideal body shape was, there was pressure to attain it.

This ideal body shape, dictated by sport pressures, meant that participants often quickly conflated their appearance with what they could do in terms of sporting success. Henry discussed the expectation that comes with having the desired body shape for sporting success, saying, *“If you're light and you're thin, you're expected to be fast.”* This quote highlighted that there is a disconnect between physical appearance and sporting ability, and that the two should not be seen as directly related. Nonetheless, Henry admitted that the two concepts are often confused and that the perceived ideal clouds judgment:

You often hear people say, oh, he looks quick or she looks quick. And I think you make that judgement based on how much body fat they're displaying and how muscular they look. I know for a fact that there's lots of guys there who look really lean and really fit and they look like they've just stepped off the Olympic podium, but I can beat them in a race, but then there's other guys who are bigger than me, heavier, they don't necessarily look like a particularly quick runner, yet they kick my ass in a lot of these races. So, I think our vision often gets clouded as to how we perceive a runner.

The participants gave voice to the pressure that sport creates to match one's physique with the one that science says will allow for maximum success on race day. For these athletes, the pressure to perform came with pressure to match the aesthetic most conventionally associated with success in their sport, with little room for the view that other body shapes may still allow for top sporting achievement.

Social comparison in a sporting world

Athletes are also susceptible to societal pressures that are often conveyed via an athlete's immediate and peripheral social sphere. These pressures heighten the conflation of physical appearance and sporting ability, as athletes compare their physique to others whose successes they are trying to emulate. As athletes are naturally competitive, comparing their own physical appearance to an athletic ideal and to other athletes is at the forefront during competitions. The interviews elicited the idea that comparison of physical appearance appeared to act as a stand-in for comparison of sporting ability. Participants described using body type to measure up opponents and boost pre-performance confidence. Ben provided an example: *“When you go in for a race and you're standing behind the blocks, you look to other people to see what their build is as well and that influences how you feel.”* Furthermore, maintaining an elite level of athletic performance seemed to intensify this competitive *“culture of comparing between people”* (Isabelle), as there was an added pressure from others in sport to not only look like a stereotypical athlete, but an elite one at that:

There's probably a bit of pressure in that once you've performed to a certain level, it's almost like you're expected to be at that level and getting better and that actually that level comes with an appearance or a body image and that's how everyone sees you. (Georgia)

These comparisons to other athletes and an idolised ideal were magnified by the need for many sporting costumes to be figure hugging and aerodynamic; as Isabelle said, *“You spend a lot of time in a swimming costume, so everyone's checking each other out.”* The participants' experience indicated that the defined acceptable parameters for the physical appearance of an athlete became narrower as the competitive level increased, therefore also amplifying the confusion and conflation between physical appearance and sporting success. Furthermore, the costumes worn to enhance performance also enhanced

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scrutiny from other athletes and left those performing vulnerable to the watchful eyes of society and the social sphere.

The participants in this study also discussed how further comparison, and the conflation between what the body looks like and what it can do, was worsened when it came to viewing the accomplishments of role models. There was a sense that even athletes over-simplify sporting success in terms of the role that body shape, and by extension diet, plays in the achievements of those to which they aspire. The following two excerpts highlighted this idea with Georgia saying, *“These people obviously are the elites, are the best ones, so surely that's what we should all be like. So, it's almost like the role model type picture.”* This was further reinforced by Henry: *“There's this sense that they need to be thin and they need to be muscular and look like Jessica Ennis [Hill] or look like Mo Farah if they want to achieve that level of athleticism and success.”*

This culture of comparing body shape within the competitive world of sport was exacerbated by social media, particularly as the participant athletes spoke about populating online platforms primarily with accounts connected to sport. However, as with real life, athletes posted in costumes and poses that meant what the body looked like quickly became a stand-in for what the body could do, and so emulating body shape was an understandable and perhaps inevitable next step. This idea was shown in quotes by two participants: *“On social media people do actually post quite a lot of pictures in their swimming costumes and all that stuff, and that is a factor in body image.”* (Francesca).

Georgia explained further:

Like having almost like an idol that I want to be able to run like them and therefore I need to look like them, even without any text behind it, without any meaning behind the picture other than this is where I'm running, I think it automatically comes across. (Georgia)

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Intention to imitate physical appearance in order to imitate performance extended to copying training and dietary behaviours, as revealed in the selection of quotes presented first by Alicia who said, *“Everyone else keeps theirs on the same platform, so I know what other people are doing and I have over the years a lot of people who I compare myself to.”* As well as by Dan who spoke discussed the imitation in the following way: *“You are comparing yourself because you can see what other people are doing ... everything is very visible, what people are doing and how they look or what they’re eating.”*

With a lack of formal nutritional guidance expressed by the majority of the athletes, it meant that to increase feelings of confidence in their chances for sporting success, athletes turned to what they could measure, what they could see: physical appearance. Comparison of physical appearance to teammates, competitors, and role models was all exacerbated by social media and revealing costumes.

Societal notions of ‘the athlete body’

Previous research has revealed that a lean ideal is prevalent among the general population; in addition, it has become apparent that this ideal gets applied specifically to how society believes athletes’ bodies should look (Sundgot-Borgen & Torstveit, 2010). The societal notion of an athletic ideal exists despite a lack of knowledge regarding what body type is needed for success in sport and how this may vary from one sport to another. Participants described how this societal ideal put pressure on athletes that was much greater than the pressure from other athletes, who understand the intricacies of body type and sporting success. According to Alicia, *“It’s mostly from more kind of outside and I think the people who are the other athletes who train, [teammates] wouldn’t be that judgmental.”* Emily agreed: *“I think the negative stuff does come more often from the non-athlete side of it for sure.”* Emily, as a rower, elaborated further:

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We're all very tall athletes, we're quite strong, have big shoulders, big legs, muscle and stuff like that, and often I think from the outside world or as a female particularly it's not the kind of social norm to be like a big strong woman really, but that's obviously what's required of your sport to perform at that level and so I think a lot of the time I do find myself thinking 'oh this is not great, that I look like this' because that's not how girls look even though that's what's made me great at my sport and stuff.

The analysis of these interviews showed that the compounded effect of the sport and societal pressures to match this athletic ideal is inescapable. Even when the athletes were aware that looking slim and toned might not actually benefit their sporting performance, there remained societal pressure to fit an ideal. These expectations and ideals come from society's "*misperceptions and judgement and stereotypes (Dan).*" Henry added that society seems to have a lack of understanding of what it takes to achieve sporting success: "*the general public misinterpret how much runners have to look after their diet and have to look after their general health and put training into achieve these times.*"

This pressure by society clouded the feeling of body positivity that stemmed from being proud that the body could achieve athletic feats, as described here by Alicia:

I do feel I should look like a runner all the time. When I go to the gym, I should look in the mirror at the gym and have this ideal running shape which isn't necessarily being light, it's kind of like being strong and having this muscle tone.... sometimes I feel like I'm not lean enough, sometimes I feel I don't have enough muscle.... I have to remind myself it doesn't matter if you look a certain way, it's whether you can move quickly; that's the important thing and not if you look like you can run quickly.

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Emily echoed Alicia's sentiment, indicating that her past eating disorder derived from the pressure that society puts on athletes to match the image it has conjured: "*You think okay so I'm an athlete and there's a picture of an athlete; I need to look like that....When my eating disorder started ...[it] probably came from society's image of an athlete.*"

The participants saw social media as a place in which these social pressures were amplified, which allowed for and even facilitated judgement of how they looked, based on a faulty societal definition of an athlete. Alicia and Dan both emphasised this in their interviews:

If you post on Instagram you feel like it has to have an image and then you feel a lot of pressure for it to be an ideal [image] and you spend an awful lot of time worrying about [it]. (Alicia)

I've met girls more than guys that will photoshop things and alter a photo of themselves or take something down straightaway if it gets a comment and I have seen some of the nasty comments people put on there...Particularly with social media, there's a lot of people now viewing people so there is judgment from all sides ... comments like 'this person doesn't look like an athlete'. (Dan)

Henry highlighted how photos in general, which are often showcased on social media, create pressure about body shape:

In some races where I'd had my photograph taken, particularly ones where you're sweating a lot and your running vest sticks to your body, I'd sometimes see that little outline of that little bit of chub I've got around the belly and I felt I worried that if people saw that, they'd think god he's put weight on or how is he leading the race, he doesn't look like an athlete. (Henry)

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As seen from the excerpts, these experiences demonstrated that living up to society's image of an athlete was intensified by the use of social media. The means by which social media operates also played a role. Social media is a space defined by both anonymity and ease of communication, where almost anyone can connect directly to the personal devices in an athlete's pocket. For participants, this dynamic meant that society's pressures were amplified.

From social media you do get a lot of pressure because anyone can contact you and anyone can say whatever they want, so if they want to comment on how you look or anything like that, then they can. (Emily)

Social media was a necessity for many of the athletes interviewed, as it influenced sponsorship opportunities; this was captured simply by Isabelle: *I'm not sponsored at the moment, I'm trying to get sponsored again, so that's why I would put stuff on social media (Isabelle)*. Sponsorship, accessible mainly from social media, was key for allowing these athletes to continue training at their current level in a world in which many minor sports do not offer contracts and salaries that exceed living and training expenses. However, these sponsorships were the epitome of a conflation between what one looks like and what one can do athletically:

I think there is big pressure on the way you look in sport and I know from before when it's been about getting sponsorship and things like that and you feel like the people who are awarded things are not always awarded on skill or that actually you are an inspiring athlete, it's usually quite aesthetic the way that opportunities get opened to you. (Alicia)

Social media heightened societal pressures by inviting comments about the athletes' appearance based on what society equates with athletic success. These comments, which would otherwise have been left unheard by the athletes, were instead brought to the forefront of their daily scrolls through their social media feeds.

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Living as an athlete

Analysis of the interviews highlighted that to be a successful athlete, there was certain lifestyle – which includes food and behaviour – that was expected within the sporting realm, the social sphere, and general society. There were certain behaviours that are simply a necessity when it comes to sporting success; specifically, discipline and sacrifice are required for sport participation. However, these behaviours may negatively affect social life, and were judged negatively by society when they fail to match that societal ideal. The narrative around discipline and sacrifice in sport was often extended to food choice, making diet and the function of food an inescapable part of the conflation between what the body can do and what it looks like.

For the athletes interviewed, food and its function as fuel, as well as the ability to manipulate food intake to access desired body shape, were connected to sporting success. This view stood in contrast to society's view of food as fun and its place at the centre of many social events. Therefore, the discipline or sacrifice each athlete's sport required often meant not partaking in social life, expected festivities, and what society dictated as normal, but still feeling a pressure to do so. The complex interaction between sport, the social sphere, and society manifested in the conflicting expectations around athletes' eating patterns. Society expected athletes to eat in a way that demonstrates their dedication to the athlete lifestyle, while still partaking in social events where food is the central focal point. The participants spoke about internalising these conflicting pressures, which were linked to disordered eating, and about needing to find a balance between them.

Discipline and sacrifice

Recognising food's function as fuel was an integral element of the athletes' disciplined lifestyle. All nine participants spoke about the importance of eating enough food to satisfy training output and sport performance. For example:

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I very much see food as fuel and it's also definitely part of performing, it's like it's just another element, it's like doing strengthening and doing your aerobic training, it's just like that it's like doing your nutrition as well. So, I see it as a sort of component of my sport, it's not just something I do to survive. (Emily)

It's food for fuel...I'm just thinking how much energy is this going to give me, have I eaten enough for training...I cook things that will actually give me energy, not because it's tasty. (Francesca)

Viewing food as fuel also meant making a conscious effort to eat at the right times, fitting meals around training so that the fuel was utilised properly. Dan discussed the need for food to be “digestible” and well-timed so that “*when it comes to training, so not feeling sick when I'm actually in training and everything.*” This sentiment was echoed by Isabelle: “*when I'm training, I want to make sure that I've eaten enough and far enough in advance of training and that I've got food there to eat afterwards.*”

This careful focus on food to fuel training also meant that food intake was manipulated to change body composition in line with an ideal that would help with sporting success.

In addition, because the athletes had internalised the confusion/conflation about how they looked and how they performed, they sometimes prioritised eating to look a certain way over what might have been optimal for their performance/what their body was telling them.

High level sport is more, it's like marginal gains isn't it; it maybe matters more what you eat...I think as an athlete I'm always thinking of how it's going to affect my performance. (Francesca)

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There's been times where I get back from a long run and I think I just want to eat and eat and eat but then I think oh God, no I'm just adding weight and is my weight going to start going up, is that going to then affect my performance....I've got an odd relationship with food and I think it extends really from this sort of performance related side of things. (Henry)

The participants described how this manipulation of food intake had to be done with great care and concentration. Food had to serve its function as a crucial food source, but it also had to act as a body shape manipulator, both of which were perceived to aid training and performance. This is explained by Henry, when he said, *“there's almost this obsession with becoming as light as possible but not to the point where your body is no longer able to perform at its maximum ability.”* This notion was supported also by Georgia:

There's a combination of thinking of food as fuelling, and thinking about actually getting leaner effectively, so it was sort of working the balance out between those... I'm very aware that that body image, body shape has changed so my mind is going okay, well, I want to get back to how I was and therefore that leads to under fuelling and then you're not getting the performance and the things that you need because you're trying to run on empty.

To be successful, an athlete's lifestyle must involve prominent behaviours encapsulated as discipline and sacrifice. Discipline is considered a necessary and intrinsic part of elite sport. As Emily emphasised: *“To get to this sort of level you do have to have a lot of discipline and a lot of ... you have to be really strict with yourself.”* However, this discipline is linked to food and body image, and can be dangerous if taken to the extreme. For instance, when over-discipline is applied to diet, it can lead to disordered eating or even an eating disorder:

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I ended up being treated for an eating disorder because I had just decided that basically like food was a bad thing, and then having that super focused, super determined mindset, that's one of the reasons why I'm good at sport, but it's also one of the reasons why I was able to spiral quite quickly into an eating disorder.

(Emily)

The athletes interviewed considered the sport pressure of being disciplined and making sacrifices to be part of the game, but athletes also spoke about how this often meant missing out on fun or social occasions. Alicia said, *“You're spending your whole life trying to make things simple and make things so that you can train and recover but that also cuts out a lot of fun things.”* Francesca explained how this sacrifice and discipline extended to university life: *“I'm at university but I don't go out a lot ... I've trained so hard to get to the fitness level I just don't want to ruin it.”*

As with the physical demands of sport, there was an inherent pressure on the athletes to lead a life that allowed time for training and optimal fuelling. These sport pressures demanded a lifestyle that was disciplined and included elements of sacrifice.

Finding a balance

It is important here to reiterate the definition of society. In this study, society is defined as the non-athlete population, those who are aware of the existence of competitive sport and are perhaps also personally connected to it via friends, family, or fandom. Expectations from society are often in opposition to the pressures around using food as fuel to maximise training and performance. The athletes acknowledged that the amount of food required for sporting success was far larger than for non-athletes. However, this need for extra energy sometimes drew unhelpful comments from those in the non-athlete realm:

I think if someone was to come to a GB rowing camp with us and see the amount of food that we eat like five full meals a day, they would probably be quite

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surprised and probably would comment like 'wow you guys eat so much food'.

You could probably interpret that and think oh like maybe "I shouldn't eat so much food." (Emily)

Isabelle supported this notion:

Society people often just think, why are you eating so much, and they just can't.

That used to really bother me because I just randomly have like bowls of cereal throughout the day. And my parents, my dad would be like oh my goodness, what are you doing, you're going to get so fat. (Isabelle)

Athletes in general are also asked to be fun and present members of a social sphere, which often involves eating meals with friends and family. Two opposing messages were internalised: the need to fuel the body for athletic endeavours, and social pressures and expectations. Athletes, therefore, had to balance these contrasting messages, and this balance was seen as an important part of being an athlete:

I know what my goals are and what I need to do, so if I was in training really hard and I have some friends I want to go and hang out with and just blow off some steam and have a few drinks and it is someone's birthday and it seems fun and it is not going to be late and it is not like it's a massive deal, that would be fun... I think it's good to overall be a far more balanced individual, particularly for the long term; short term you can get away with it. (Dan)

However, with food central to so many social engagements, the requirements for food to function as fuel and as a means to enhance performance was ever present:

There's probably some conflict in that in one brain you're always thinking about, okay, well, what training session have I got tomorrow or when's my next race and how can I plan my social schedule around those and whether it be, you've got a group of friends that want to go out for dinner and actually you're thinking, well, I've got to do this session tomorrow and I know that going for X cuisine doesn't

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sit well with me and actually I want to do that session tomorrow and therefore the balance of do I/don't I? (Georgia)

Due to issues of balancing sport requirements, the athletes' social spheres often shrank to include only others in sport such as teammates and coaches. These social connections within the sporting sphere were then used to determine what diet would maximise performance. Participants described the pressure that arose from their teammates modelling certain dietary behaviours:

If your teammates are saying that they're doing this, they're eating this, or eating that, then you might feel pressure to do that as well... [thinking that] 'if she's taking it, then I need to take it too to be as good as her' (Emily).

They also discussed the influence of coaches: *"Your coach has got these ambitions for you and he wants you to perform well, and does this relate to the way you look...and the way you view food?" (Francesca).* Pressure to copy teammates or follow a coach's suggestions regarding food and adjustment of body composition, was amplified by a reported lack of formal nutrition education and support.

The athletes spoke about attempts to find a balanced behaviour pattern that incorporated elements of rest, recovery, and fun, and included a more relaxed attitude toward food in order to be part of a wider social sphere. However, finding a balance between the behaviours required for athletic success and those which fulfilled societal norms was made more difficult because the athletes perceived that society had a double standard regarding discipline and sacrifice discussed in the previous subtheme. The disciplined schedule of an elite differs greatly from the norm for non-athletes and society at large, which sometimes led to feelings of isolation. *"I think the thing I say most about being an athlete is it can be pretty isolating...I'm often here or there which means I can't really get a proper job."* (Alicia)

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Missing out on social occasions due to sport requirements was a required sacrifice. However, as Ben described, society puts added pressure on athletes to maintain what it deems a “normal” social life: *“I couldn’t go to many parties because I had a gala and they just didn’t understand...they don’t really understand the commitment [to] swimming.”*

Several participants reported frustrations with society as a whole because, despite often not understanding the intricacies or requirements of sport, society demands the impossible of athletes by asking that they make time for social, fun life elements, while also displaying discipline at all times. The participants explained that the societal pressures focused on what society believes an athlete should do in terms of food and regime. Thus, when the athletes did exhibit a more balanced, relaxed approach in their food intake and behaviour, several reported that judgmental comments from society reverted them back to the extreme. Emily and Georgia offered quotes that showcase this tension:

People tell you that you’re an athlete ... so maybe you go out for a meal with your friends and then it’s like often, like very often, people make a joke and they’ll say, ‘hey you shouldn’t be eating that you’re an athlete remember’. (Emily)

Georgia explained further, *“I think there’s very much a little bit of almost like a stereotype that comes with it because you run or because you’re active, then therefore you should be eating healthier food.”*

Athletes may have internalised this perceived judgment, which drove away from balance and toward unhealthy levels of disciplined behaviour that could be associated with disordered eating. Athletes may be forced, based on their sport schedules, to miss out on social events or even opt to avoid social situations to avoid this judgment. Participants described how it was nearly impossible for them to find a balance between the requirements of their sport and the pressures non-athlete friends, or society at large,

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put upon them. This sometimes led to feelings of trying to live up to an unmanageable double standard, and even feelings of negative affect and loneliness:

The societal pressure 'oh you shouldn't be doing this' or 'why didn't you come out with us last night'. You need to manage that. And you can get that isolating loneliness or people don't understand why it's important to you too. (Dan)

The athletes spoke about how the required lifestyle and their intense interest in sport, combined with feeling misunderstood by society (especially for more obscure sports), meant that they tended to shy away from talking about their sport or even engaging with non-athletes as part of their social sphere.

They don't really understand the commitment swimming has to it, because as soon as you miss one session of swimming, you go back the day after and you just feel really different in the water ... most of my time is spent with swimmers, I don't really spend much time away from them so my society is just swimmers in general.

(Ben)

This forced withdrawal from non-athlete society then put added pressure on sporting achievement and success, as social life then depended on sport commitment.

This sentiment was captured by Henry:

If I'm no longer in that calorie deficit and my weight then starts to go up, if my body weight then starts to increase and I'm no longer running these quick times, I'm worried that am I not going to be able to train with that group anymore... When I decided to take running seriously I had an existing group of friends who I used to go out with at the weekend and we'd go out drinking, and we'd have fun, we'd do all these non-running related activities, [but] as I drifted more into the running community and I started to develop friendships there, I almost felt that I didn't want to be associated with the old me, the old life and that whole group of friends.

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In all the themes described above, comparison between the pressures from sport, the social sphere, and society created tension. This tension created the conflation between what an athlete can do in terms of sporting success became inescapably linked to what they looked like, what they ate, and how they behaved. The athletes discussed how they lacked support with these issues and had limited access to nutritional information which could have helped them handle the conflicting pressures, with most agreeing with the following sentiment outlined by Alicia: *“I have had a little bit of help with it, but it’s mostly just trying myself.”* A lack of education on appropriate nutrition for training and competition meant that on the start line, when the athletes were searching for a source of confidence, they were resigned to comparing their potential for success to what they could see: physical physique. That physique could subsequently be manipulated or influenced by food intake and by following certain behaviours. When discussing sport pressures alone, athletes spoke about the physique required for sport empirically: a reality of sport. It was when they compared that physique to an ideal within sport – whether a role model or a past self – or to teammates or societal stereotypes, that disordered eating cognition and behaviours arose. This comparison was exacerbated by social media, which focusses on pictures and is used by athletes, their social sphere, and society more broadly, with little separation.

Discussion

The aim of the current investigation was to use thematic analysis to ascertain if athletes’ experiences reflected key elements of Petrie and Greenleaf’s (2007) model, which underpins this thesis. This qualitative work is part of a larger study aiming to examine Petrie and Greenleaf’s (2007) model. The model posits that disordered eating is predicted in athletes by sport pressures and societal pressures, and is mediated by several other factors, such as internalisation, body dissatisfaction, and negative affect (Petrie & Greenleaf, 2007). The thematic analysis was designed to explore these sport pressures

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and societal pressures in a range of sports and to better understand how those pressures related to disordered eating and associated concepts, as these elements of the model were felt to be lacking in constitutive detail.

Throughout the analysis, it became clear that so-called societal elements are so intertwined with the sporting world that they can be difficult to separate. This concept was best illustrated by Ben: “*My society is just swimmers in general.*” If an athlete’s society is interwoven with their sporting world, differentiating between sport pressures and societal pressures is ultimately difficult and problematic. With societal messages often delivered by those in an athlete’s immediate social sphere, such as teammates, coaches, and role models, it can be it is challenging to establish whether the social elements of sport fit within or between sport and societal pressures (Cooper & Winter, 2017). This hints at the overlap between ‘sport pressures’ and the social pressures that arise within sport.

Thus, what Petrie and Greenleaf (2007) term ‘societal pressures’ are perhaps better framed as ‘social pressures’ for the purposes of this research. Social pressures, in this context, are defined as those pressures that are experienced because sportspeople are in contact with broader society, hence the original conception from the model as ‘societal pressures.’ In the original model, ‘societal pressures’ denote concepts, specifically the thin ideal, that arguably enter the athlete experience from ‘the outside world’ and are then internalised by athletes and potentially influence disordered eating development.

The adoption of the term ‘social pressures’ here stems from the idea that pressures from society are transmitted via social interaction with others. An athlete’s social sphere, for instance, acts very much as a conduit for societal norms. Society espouses and shares widely held beliefs and norms, often ensuring conformity of all citizens with social pressures that communicate, validate and replicate prevalent, preferred values that permeate throughout a person’s social groups, irrespective of practice or profession

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(Levine et al., 2000; McNamara & Parsons, 2016). Embracing a more specific definition of social versus societal allows for more nuanced interpretation of the findings presented here.

While the overall design and interview schedule were developed to allow deductive engagement with the two original pressures from the model, the research team embraced the spirit of qualitative analysis and allowed the analysis to elicit original themes. This revealed two themes, each with two corresponding subthemes that represent the pressures experienced by athletes. The themes and subthemes are: (1) conflating physical appearance and sporting ability, with subthemes of (1a) social comparison in a sporting world and (1b) societal notions of ‘the athlete body’; and (2) living as an athlete, with the corresponding subthemes of (2a) discipline and sacrifice and (2b) finding a balance.

The first theme, conflating physical appearance and sporting ability, conveys the pressure to be successful in sport and the relationship between that success and the physical traits of an athlete. Body composition and body shape undeniably play a role in sporting success, and all participants were clear in their belief that there is an ideal body type for success in each sport. Participants espoused the belief that being lean but strong indicates a likelihood for improved performance, and they sought the ‘ideal’ body type for sport via diet, despite knowing that a range of different body types may be associated with excellence in performance. Matching this ideal body shape was a pressure that increased with higher levels of competition. Matching a physical representation of an athletic ideal was closely identified with sporting achievement – especially in the absence of formal nutritional support, with the influence of social media, and with the pressure of getting and maintaining sponsorship. This finding at first seems to provide support for the inclusion of sport pressures in the theoretical model as a separate concept. However, exploration into the subthemes shows that it is the entanglement of sport pressures with

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social pressures that creates the most conflict with food, body image, and other concepts related to disordered eating. This idea is consistent with existing literature, where the notion that the pursuit of an athletic or performance ideal is linked to disordered eating, but upon critical examination, coaches, parents, and teammates have been found to exacerbate this link (Scott et al., 2019; Sundgot-Borgen, 1994; Thompson & Sherman, 1999; Woods, 2004).

As shown in the first subtheme, social comparison of body types to teammates and sporting idols, as well as comments from coaches, increased the harmful confusion between what the body can do and what it looks like. This comparison of body types was intensified by revealing uniforms, consistent with findings of previous research (Cooper & Winter, 2017; Greenspan et al., 2017; Thompson & Sherman, 1999). However, the participants were quick to add that the sporting community was more understanding than general (non-athlete) society, as athletes understood the need to be strong for their sport and the realities of how different sports lead to specific body types. As shown in the second subtheme, society projects a notion of a single, preconceived, slim-but-toned body type for athletes, despite no knowledge of which body type may be best for actual sporting success (Thompson & Sherman, 1999). Pressure increased when participants thought about how they lived up to society's ideal athlete body, and comparison to someone who represented that ideal was common. The judgemental expectations from wider society of how an athlete should look were not only harsher and more hypercritical than those within the sporting world, but they were also amplified by social media. Previous research, like the current study, has shown that the internalisation of and drive to match stereotypical societal expectations is associated with disordered eating in athletes (Anshel, 2004; Cooper & Winter, 2017).

Understanding the role of social interactions within sport, as well as the inescapable social commentary on athletes' bodies, shows that sport pressures do not exist

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in isolation. In fact, it is this entanglement of sport and social pressures that appears to be a driving force behind disordered eating development. Previous qualitative work also highlights how the interaction between sport and social pressures – for example, teammates modelling disordered eating behaviour at communal meals, or comments from parents and coaches encouraging loss of body fat for better athletic performance – is related to disordered eating development (Arthur-Cameselle & Quatromoni, 2011; Cooper & Winter, 2017; Papathomas & Lavalley, 2010; Scott et al., 2019; Woods, 2004). Other qualitative research that has found that the elements contributing to disordered eating symptoms in an athlete's life are not necessarily unique to athletes (Arthur-Cameselle & Quatromoni, 2011, 2014). Quantitative work has exposed elements of the social sphere common to nonathletes and athletes alike, such as attending an elite school and experiencing social pressure, revealing that some of the disordered eating risks posed to athletes may not be sport-specific (Krentz & Warschburger, 2011; Pettersen et al., 2016).

Additional pressure on athletes stems from social media, and specifically from the reality that sponsorship deals are often based on having a body type that fits society's athletic ideal. Thus, athletes feel both psychological and financial pressure to attain that body type, rather than what might be optimal for them as a performing athlete. This study was based in the UK, where sponsorship deals are often career-determining for athletes; this contrasts with research based on student athletes within the NCAA university system in the USA, who do not rely on sponsorships, and where much of the previous research into disordered eating in sport has been located. The inclusion of social media in this investigation was relatively novel in this specific area of research, and was an important innovation in view of existing research which shows that social media is used for online interactions between athletes and nonathletes, including comments and chats (Pegoraro, 2010). Originally a unique theme of its own, social media was instead determined to be a

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constant concept interwoven throughout the themes and subthemes, intensifying the interaction between sport and society. Asking about the use of social media revealed that athletes primarily fill their online feeds with communications from other athletes. However, social media does not exist solely in the sporting world, and the need to adhere to society's expectations online led the athletes to feel as though they needed to portray, or even change, their bodies in accordance with society's image of an ideal athletic body. As the use of social media continues to escalate, including measures of social media usage in future research is clearly warranted.

The second overarching theme, the experience of living as an athlete, is something that every sport participant takes forward into their daily social interactions. An athlete's lifestyle is essential to success, and the discipline and sacrifice inherent to that lifestyle are carried over into daily activities as well as food choice. The day-to-day diet of an athlete requires substantial attention to the quantity, timing, and nutritional value of each meal. This finding corresponds with previous work that also highlights the idea of food as fuel, with the athletes in this study sharing similar experiences of creating a diet that would allow them to train and compete at their best (Lunde & Gattario, 2017). Viewing food as a performance aid and as something that can help manipulate body shape was intensified by the conflation of what the body looks like and how it performs. Additionally, a disciplined lifestyle featuring sacrifice for the sake of sporting success is widely considered an integral part of sport, and has been tied to behavioural tendencies related to eating disorders and disordered eating (Nesti, 2007; Thompson & Sherman, 1999b).

The next subtheme, 'discipline and sacrifice', encapsulates daily choices made by athletes. Despite the regime that undergirds life as an athlete, there is still an expectation that athletes should participate in the food-centred activities and structures that society deems normal (Beardsworth & Keil, 2002; Jastran et al., 2009). Whether this 'normal' is

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the routine of eating three meals per day or going out for a celebratory dinner, athletes felt they were expected to fit these into aspects of daily life even if they were not optimal for athletic endeavours. This tension compelled the athletes to attempt to find a delicate balance between eating to improve their sporting performance and matching societal expectations.

As discussed in the final subtheme, athletes sought to create a balance between the extremes required for elite sport and normal daily life. The athletes often found that a typical social life was unobtainable and felt that whenever they exhibited a more relaxed approach to diet and other behaviours, they were pressured by society to return to extreme displays of discipline to better fit the societal definition of an athlete. Previous research has found that athletes make more extreme and unhealthy sacrifices to match societal ideals or satisfy social elements within their sporting world (Hughes & Coakley, 1991; Waldron & Krane, 2005). Additionally, social isolation as a consequence of elite athlete lifestyle, and an inability to find balance, was observed in this study and is consistent with previous research in sport (Pinkerton et al., 1989). However, the athletes' attempts to moderate extreme behaviours required by sport to create more balance in their lives, only to be driven back toward extremes by societal ideals, has not been reported before in the literature. Living as an athlete and the related first-hand phenomena that are captured in that experience are not part of the T1 model as separate factor, but instead make up the landscape in which disordered eating behaviour and cognitions develop (Stoyel et al., 2020a).

The conclusion that it is the interaction between sport pressures and societal pressures that is most likely to increase the risk of disordered eating symptoms and related factors does not suggest that engaging in sport has no impact on eating behaviour. Rather, it indicates that sport pressures alone are not the major trigger. Society's inescapable messages of what an athlete should attain in terms of body shape, diet, and lifestyle, which

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are often pedalled by the social sphere within sport, appear to be what leads to pathology. Sport is the context in which societal pressures take place. Therefore, it could even be posited that, in revised model (Figure 4-2), the factor labelled “societal pressures” actually represents a tangled interaction between sport and social pressures. This combined factor could be explained by the fact that, to athletes, sporting pressures are already an integral part of living as an athlete and are taken as a baseline way of life.

These findings offer some tentative clues as to why sport pressures no longer fit the theoretical model when applied to a large and diverse sample of athletes in the quantitative phase of this project (Stoyel et al., 2020a). Due to the qualitative nature of the current study, the aim of this study was never to confirm or disconfirm the entire model. Future research should explore the role of other elements of the model, such as body dissatisfaction and internalisation of messages from others and ideals, qualitatively, examining their connection with disordered eating symptomatology. Given that social pressures appear to compound the effect of sport pressures on athletes, interventions should be aimed at coping with these social pressures, especially when social media allows for total omnipresence. This finding potentially means that interventions and treatment options for disordered eating devised for the general population could be adapted to work with athletes, as long as they incorporate an understanding of the specific pressures on athletes and how they may fit with or contradict social pressures. For example, modifying social media usage or education about resisting unhelpful societal messaging, both in person and online, may a good place to start. As athletes are already using online platforms, an intervention that exists on these platforms could have widespread reach and impact (Guest et al., 2019). When working with athletes, it important to realise that the pressures they feel are not isolated to sport, as has been shown in previous work; instead, disordered eating thoughts and behaviours appear to arise from

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a complex interaction of risk factors and correlates that can exist both in and out of sport (Striegel-Moore & Bulik, 2007).

It is also important to address that despite previous histories of eating disorders and disordered eating, participant EDE-Q scores were not at clinical levels. It is possible that this is because the questions asked did not take into account the realities of being an elite athlete. This discrepancy is highlighted in this study: author of this thesis and conductor of the interviews was a practicing sport psychologist, which meant that sufficient rapport was built such that one male participant disclosed in the interview for the first time that he believed he had an eating disorder, yet his EDE-Q score does not reflect this self-diagnosis. Elite sport requires extremes, such as over 15 hours a week of exercise, or micromanaging food intake for the sake of performance. These “extremes” that are normal to sport may present as pathologic in clinical contexts. Therefore, scales and diagnostic tools must take into account sporting endeavours. For instance, an athlete may score low on an EDE-Q question about going long periods without eating, due to the fuel requirements of their sport, but it is possible that that score may mask underlying pathological cognitions.

Limitations

While, this study and overall project is strengthened by the inclusion of male and female participants, this study was limited by the lack of diversity in the sports represented, with the vast majority categorised as endurance racing sports. This is noteworthy, as the training load of these sports influences body shape such that female participants might, in fact, more closely match ideal societal standards, compared with those participating in more strength-based sports, such as weightlifting (Byrne & McLean, 2001). Additionally, most of the interviews were conducted virtually, and while previous research has deemed this an acceptable practice, the ability to build rapport within a single interview, especially a virtual one, might have affected the openness of

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the responses (Janghorban et al., 2014). This is particularly true of openness or disclosure on a subject that is sensitive, and many athletes worry about disclosure of any disordered eating due to stigma (Papathomas & Lavalley, 2010). Finally, due to the timing of this project, the final three interviews took place at the start of the Covid-19 pandemic, which might have led to unusual eating or exercise practices. To check for this, participants were asked whether their experience during the pandemic lockdown influenced their view of food as an athlete; however, they did not report anything of consequence for this study.

Conclusion

Overall, the findings of this study indicate that there is a tendency to assume that looks and lifestyle are synonymous with sporting success, and that a successful athlete is one that looks like society's image of an athlete, behaves like one socially, and eats like one. It may be that living up to this concept of a successful athlete, combined with the scrutiny from the social sphere, is linked to the development of disordered eating in athletes. Participants described how the conflict between sport and social pressures increased the risk of disordered eating, rather than discrete sport pressures alone. The unhelpful fusion of physical appearance and sporting success has sent heightened messages from society to these athletes. Striving to match a potentially unhealthy aesthetic to attain success in sporting competition is not a winning combination.

Chapter 5.

Understanding risk factors for disordered eating symptomatology
in athletes: a prospective study

Key Points:

- The T1 model from chapter 3 was tested across time using Cross-Lag Mediation modelling
- Key significant pathway was from Societal Pressures (at Time 1) to Internalisation (at time 2) to predict Bulimic Symptomatology (at Time 3)
- Substandard across-time reliabilities created issues with interpretation of results and showed the need for measurement tools to be developed specifically for athletes

Introduction

The chapter that follows is a longitudinal study of what began in chapter three as cross-sectional work. This longitudinal work fills a gap in the literature on this topic, as most previous studies have been cross-sectional. This study is currently accepted with revisions pending in Plos One.

Understanding how to predict the development of eating disorders and disordered eating to facilitate prevention is paramount, as eating disorders and disordered eating can have long term impact on both health and quality of life (Smink et al., 2012; Steinhausen, 2002; Stice, 2001). For athletes, not only is the performance standard of each athletic endeavour put at risk by disordered eating, but so is their mental and physical health (Drinkwater et al., 2005; Mountjoy et al., 2018). To adequately test for risk factors, longitudinal research is needed (Bratland-Sanda & Sundgot-Borgen, 2013).

This chapter's groundwork theory can be traced to the same underpinning model by Petrie and Greenleaf (2007) used thus far in this thesis. As shown in chapter three, Petrie and Greenleaf's model offered an inadequate fit to a large, mixed-gender data set that encompassed a variety of sports (Stoyel et al., 2020a). Therefore, by using an approach that data-driven but with theoretical knowledge informing any final adjustments, a new, more parsimonious model was developed (Figure 3-3), which offered a satisfactory fit. This revised model, termed the T1 model and described in chapter three, is similar to Stice's 1994 dual pathway model; body dissatisfaction and societal pressures predict bulimic symptomatology in athletes, with these effects operating indirectly via the twin mediators of negative affect and internalisation, respectively (Stoyel et al., 2020a).

While the T1 model from chapter three provided some insight into how disordered eating may develop in athletes, the study employed a cross-sectional design. This made any probing of causal paths and uncovering of potential reverse causality or bidirectional relationships impossible. Therefore, the aim of the current study was to test the utility and

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applicability of the T1 model using a longitudinal design. Data was collected at two subsequent time points, six months apart, on the same participants as in the original study, enabling the testing of a cross-lagged type mediation model (Cole & Maxwell, 2003). The primary hypothesis was that the T1 model, when extended to this cross-lagged form, would explain how disordered eating arises over time by maintaining a good model fit across time. Second, it was hypothesised that each path of the model would constitute a significant effect, with Body Dissatisfaction at Time 1 having a positive and significant effect on Bulimia at Time 3, mediated by Negative Affect at Time 2; and Societal Pressures at Time 1 having a positive and significant relationship with Bulimia at Time 3, mediated by Internalisation at Time 2.

Methods

Procedure

Data collection took place at three time points over the course of a year. Timepoint one (T1) was a three-week period in February 2019, time point two (T2) was a three-week period in October 2019, and time point three (T3) was a three-week period in February 2020. All data was collected online, using Opinio (opinion.ucl.ac.uk) for T1 and Qualtrics (www.uclpsych.eu.qualtrics.com) for T2 and T3.

At T1, 1017 participants responded (and these responses were used in the cross-sectional study described in chapter three/Stoyel et al, 2020a). T1 participants who had given consent for follow-up contact were invited via email to participate at T2. At T2, 879 responses were collected. Those who responded at T2 were then asked to participate again at T3, at which time 744 responses were collected. From T1 to T3 there was a 26.8% attrition rate. At each time point, participants gave informed consent and received a £5 voucher for completing the questionnaire.

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Data Preparation

The data was cleaned and prepared in IBM SPSS (version 25) before formal analysis. As the first step in data preparation, across-time reliabilities were calculated (see Table 5-2). The reliabilities for all the scales except for Bulimia (EDI-B) and Negative Affect (PANAS Negative Items) were below an acceptable standard for use in analysis. Therefore, two steps were taken. Firstly, all participants who completed the questionnaire too quickly – based on analysis of those in the outer quartiles of a normal distribution curve – were removed, giving a final analysis sample of 802 observations. Of the 802 remaining respondents, 802 responded at T1, 551 at T2 and 469 at T3 with the participant numbers decreasing at each subsequent time point due to routine drop out that is expected in longitudinal work. In terms of data preparation, ‘too quickly’ was defined as under eight minutes at T1 and under six minutes at T2 and T3 (as the second and third timepoint questionnaires were shorter). To understand more about those cases that were removed during data preparation compared to those who remained for analysis, descriptive analysis was undertaken. The subsample of those who answered the questionnaire too quickly and were therefore removed differed in several ways: sport type, lean/nonlean, hours/week, level, and if actively competing. The chi-square tests showing these differences can be found in Table 5-1. The age makeup of the removed sample did not significantly differ $\chi^2(1) = 0.85, p=0.82$, but it did in terms of sex $\chi^2(1) = 6.24; p=0.01$.

The removed subsample differed significantly in terms of BMI (calculated from participants’ height and weight), which was significantly lower than those included ($t=4.56; p<0.001$). However, it should be noted that entering weight was not required of the participants and over half of those removed had declined to provide this information. Those removed did not differ significantly in terms of disordered eating as their EDE-Q global ($t=0.42; p=0.68$) score nor their bulimia score on the EDI-B ($t=1.09; p=0.28$) was not significantly different to those kept for analysis. While the removed sample did

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significantly differ in descriptive make-up, they were eliminated on the basis that the respondents had rushed and that their data was not trustworthy. As such, the analyses benefitted from the removal of these responses. More descriptive information of those removed can be found in Table 5-1 and further discussion on these differences can be found in chapter six.

Secondly, reverse-scored items were eliminated. While the removal of the reverse-coded items could perhaps be seen as an extreme decision, as seen in Table 5-2, this removal improved the reliabilities of the scales to be utilised in analysis. Using negatively worded within a questionnaire that has positively worded items is problematic and creates confusion and carelessness in the participant sample and previous research has recommended the removal of such items (Chyung et al., 2018; Roszkowski & Soven, 2010; Suarez-Alvarez et al., 2018; van Sonderen et al., 2013). Details of each scale, including the items completed by participants and subsequently used in analysis, can be found in the item map in Table 5-3.

Participants

This research engaged a volunteer sample via social media as well as the author's connections as a sport psychologist at local sporting clubs. The inclusion criteria at T1 were that participants had to be over the age of 18; had to consider themselves an athlete (determined with a simple yes/no answer to the question "Do you identify as an athlete?"); had to be actively competing; and has a final back-stop has to be training for a minimum of ten hours a week. Again, these criteria were set to ensure that those included in the study were athletes, rather than regular exercisers.

The T1 sample was made up of 54.9% males and 45.1% females. The majority were aged between 18 and 26 (84.9%), with 15.1% of the sample aged 27 years or older. Other sample characteristics are given in Table 5-1. At T1, the main sports represented were basketball (19.6%), swimming (17.6%), distance running (11.2%), football (11.8%),

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dancing (8.3%), tennis (7.5%), volleyball (8.5%), and other track and field events (7.6%). Other sports were represented at lower rates, including hockey, badminton, lacrosse, cricket, cycling, golf, triathlon, rugby, boxing, and rowing. Body Mass Index (BMI) and EDE-Q global scores (used to indicate possible eating disorder diagnosis) are also presented in Table 5-1. The mean EDE-Q global scores are considered healthy and not indicative of an eating disorder. The range of BMI scores is also presented, with the percentages for those that fall outside the healthy range (below 18.5 and above 25) also included. While the extreme BMI scores do indicate an unhealthy weight to height ratio for some participants, and many fall outside the set indicators for healthy BMI, it is important to note that BMI is an insensitive and inaccurate indicator for those with large muscle mass, as is likely to be the case with a sample of athletes (Rothman, 2008).

Table 5-1. Descriptive Statistics and Clinical Information

Descriptive Variable	Time 1	Time 2	Time 3	Chi Square comparing Cases Removed vs Kept
Lean/Nonlean Sport	59.1% nonlean 40.1% lean	44.0% nonlean 56.0% lean	48.3% nonlean 51.5% lean	$\chi^2 (1) = 21.11; p < 0.01$
Hours/Week	10-15 hrs: 20.3% 16-25 hrs: 58.1% 26+ hrs: 21.6%	10-15 hrs: 31.6% 16-25 hrs: 67.5% 26+ hrs: 0.9%	10-15 hrs: 42.6% 16-25 hrs: 56.3% 26+ hrs: 1.1%	$\chi^2 (2) = 18.69; p < 0.01$
Level	Nonelite: 83.5% Elite: 16.5%	Nonelite: 53.3% Elite: 46.6%	Nonelite: 39.0% Elite: 61.0%	$\chi^2 (1) = 22.42; p = 0.01$
Years done sport	1-3 years: 8.6% 4-8 years: 58.1% 9-15 years: 32.3% 16+ years: 1%	N/A	1-3 years: 12.2% 4-8 years: 62.4% 9-15 years: 24.9% 16+ years: 0.4%	$\chi^2 (3) = 94.25; p < 0.01$
In season/off season	77.2% in season 22.8% off season	57.1% in season 42.9 off season	66.1% in season 33.9% off season	$\chi^2 (1) = 37.14; p < 0.01$
EDE-Q Global	M = 2.26 (SD = .85)	M = 2.00 (.89)	M = 1.59 (SD = .91)	M = 1.93 (SD = .89)
BMI	Range: 14.15-35.22 M = 22.41 (SD = 3.46) 13.5% below 18.5; 20% over 25	Range: 15.19-36.35 M = 22.64 (SD = 4.16) 11.4% below 18.5; 23.6% above 25	Range: 14.36-36.79 M = 23.65 (SD = 4.97) 14.7% below 18.5; 38.2 above 25	Range: 14.88-22.99 M = 19.70 (SD = 4.95) 3% below 18.5 with none above 25

* Nonelite = regional & county; Elite = national & international; T2 & T3 'valid percent' was used

Materials

The same materials used in chapter two were used here. This section is a brief recap of those materials. To capture both societal pressures and internalisation, the third edition of the sociocultural attitudes towards appearance was utilised (SATAQ; Heinberg, Thompson, & Stormer, 1995). The SATAQ internalisation dimension has both general and athlete subscales and has exhibited good measurement properties in previous studies (Thompson, et al 2004). Likewise, the SATAQ subscales of Pressures and Information were used to measure the risk factor Societal Pressures in Petrie and Greenleaf's model, alongside additional questions that the research team developed in an attempt to modernise the scale by capturing social media pressures. These new items matched the typical wording of the SATAQ (Heinberg et al., 1995). For example, one of the new items reads, "Social media is an important source of information about fashion and 'being attractive.'" Both the General and Athlete Internalisation subscales of the SATAQ were used to measure Internalisation, another risk factor in Petrie and Greenleaf's (2007) model. Across-time reliabilities of all scales can be found in Table 5-2, and a full listing of items is given in Table 5-3. Response coding for these items were: Definitely Disagree, Mostly Disagree, Neither Agree nor Disagree, Mostly Agree and Definitely Agree.

The ten negative items in the Positive and Negative Affect Schedule (PANAS) were used to measure Negative Affect (Crawford & Henry, 2004; Watson et al., 1988). Response coding asked about emotions and feelings and the extent to which they were felt was from Very slightly or not at all (1) to Extremely (5) over the past week.

To capture the experiences of body dissatisfaction and bulimia-related symptomatology, the 9-item Eating Disorder Inventory Body Dissatisfaction (EDI-BD) and the 7-item Bulimia (EDI-B) subscales, respectively, were utilised (Garner, Olmstead, & Polivy, 1983; Thiel et al., 1993). Response coding for both the subscales was Never (0), Rarely (0), Sometimes (0), Often (1), Usually (2), Always (3) (and the reverse for

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reverse-scored). The across-time reliabilities of all scales can be found in Table 5-2 and the items for each scale can be found in Table 5-3.

Table 5-2. Across-time Reliabilities

Factor	Items	Reverse items	Adjustment suggested	Pre-adjustment of scale			Post-adjustment of scale			Conclusion
				alpha t1	alpha t2	alpha t3	alpha t1	alpha t2	alpha t3	
Body Dissatisfaction	1-9	3,4,5,7,9	Drop rev items	0.29	0.26	0.23	0.6	0.52	0.58	Use 1 2 6 8
Bulimia	1-7	--	NA	0.75	0.59	0.7	--	--	--	Use all
Negative Affect	1-10		NA	0.89	0.68	0.76	--	--	--	Use all
Social Pressures (Information)	1-9	3, 4, 8	Drop rev items	0.3	0.48	0.22	0.77	0.65	0.41	Use items 1,2,5,6, 7,9
Social Pressures (Pressures)	1-7	2	Drop rev item	0.59	0.56	0.4	0.77	0.63	0.47	Use items 1, 3-7
Internalisation General	1-9	1, 6, 9	Drop rev items	0.37	0.53	0.33	0.76	0.63	0.46	Use items 2-5 7, 8
Internalisation Athlete	1-5	1	Drop rev item	0.41	0.5	0.25	0.7	0.56	0.34	Use items 2-5
Social Media	5-9	5	--	0.70	0.33	0.52	--	--	--	Use all

Table 5-3. Item Map

Model Component	Scale Used	Items Asked:	Items Included in Analysis
Body Dissatisfaction	EDI-BD	<p>I think that my stomach is too big</p> <p>I think that my thighs are too large</p> <p>I think that my stomach is just the right size</p> <p>I feel satisfied with the shape of my body</p> <p>I like the shape of my buttocks</p> <p>I think my hips are too big</p> <p>I think that my thighs are just the right size</p> <p>I think my buttocks are too large</p> <p>I think that my hips are just the right size</p>	<p>I think that my stomach is too big</p> <p>I think that my thighs are too large</p> <p>I think my hips are too big</p> <p>I think my buttocks are too large</p>
Negative Affect	PANAS Negative	<p>Distressed</p> <p>Upset</p> <p>Guilty</p> <p>Scared</p> <p>Hostile</p> <p>Irritable</p> <p>Ashamed</p> <p>Nervous</p> <p>Jittery</p> <p>Afraid</p>	<p>Distressed</p> <p>Upset</p> <p>Guilty</p> <p>Scared</p> <p>Hostile</p> <p>Irritable</p> <p>Ashamed</p> <p>Nervous</p> <p>Jittery</p> <p>Afraid</p>
Societal Pressures	SATAQ Pressures	<p>I've felt pressure from TV or magazines to lose weight</p> <p>I've felt pressure from TV and magazines to be thin</p> <p>I've felt pressure from TV or magazines to have a perfect body</p> <p>I've felt pressure from TV or magazines to diet</p> <p>I've felt pressure from TV or magazines to exercise</p> <p>I've felt pressure from TV or magazines to change my appearance</p>	<p>I've felt pressure from TV or magazines to have a perfect body</p> <p>I've felt pressure from TV or magazines to diet</p> <p>I've felt pressure from TV or magazines to exercise</p> <p>I've felt pressure from TV or magazines to change my appearance</p>
	SATAQ Information	<p>TV programmes are an important source of information about fashion and "being attractive"</p> <p>TV commercials are an important source of information about fashion and "being attractive"</p> <p>Music videos on TV are not an important source of information about fashion and "being attractive"</p> <p>Magazine articles are not an important source of information about fashion and "being attractive"</p> <p>Magazine advertisements are an important source of information about fashion and "being attractive"</p>	<p>TV programmes are an important source of information about fashion and "being attractive"</p> <p>TV commercials are an important source of information about fashion and "being attractive"</p> <p>Magazine advertisements are an important source of information about fashion and "being attractive"</p> <p>Pictures in magazines are an important source of information about fashion and "being attractive"</p> <p>Movies are an important source of information about fashion and "being attractive"</p> <p>Famous people are an important source of information about fashion and "being attractive"</p>

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		<p>Pictures in magazines are an important source of information about fashion and "being attractive"</p> <p>Movies are an important source of information about fashion and "being attractive"</p> <p>Movie stars are not an important source of information about fashion and "being attractive"</p> <p>Famous people are an important source of information about fashion and "being attractive"</p>	
	Social Media	<p>Social media is an important source of information about fashion and "being attractive"</p> <p>I compare my appearance to the appearance people on social media</p> <p>I've felt pressure from social media to be thin</p> <p>I wish I looked like the influencers on social media</p> <p>I compare my life to the life portrayed by people on social media</p>	<p>Social media is an important source of information about fashion and "being attractive"</p> <p>I've felt pressure from social media to be thin</p> <p>I wish I looked like the influencers on social media</p>
Internalisation	SATAQ internalisation General;	<p>I do not care if my body looks like the body of people who are on TV</p> <p>I compare my body to the bodies of people who are on TV</p> <p>I would like my body to look like the models who appear in magazines</p> <p>I compare my appearance to the appearance of TV and movie stars</p> <p>I would like my body to look like the people who are in movies</p> <p>I do not compare my body to the bodies of people who appear in magazines</p> <p>I wish I looked like the models in music videos</p> <p>I compare my appearance to the appearance of people in magazines</p> <p>I do not try to look like the people on TV</p> <p>I do not wish to look as athletic as the people in magazines</p>	<p>I compare my body to the bodies of people who are on TV</p> <p>I would like my body to look like the models who appear in magazines</p> <p>I compare my appearance to the appearance of TV and movie stars</p> <p>I would like my body to look like the people who are in movies</p> <p>I wish I looked like the models in music videos</p> <p>I compare my appearance to the appearance of people in magazines</p>
	SATAQ internalisation athlete	<p>I compare my body to that of people in "good shape"</p> <p>I wish I looked as athletic as sports stars</p> <p>I compare my body to that of people who are athletic</p> <p>I try to look like sports athletes</p>	<p>I compare my body to that of people in "good shape"</p> <p>I wish I looked as athletic as sports stars</p> <p>I compare my body to that of people who are athletic</p> <p>I try to look like sports athletes</p>
Bulimia	EDI-B	<p>I eat when I am upset</p> <p>I stuff myself with food</p> <p>I have gone on eating binges where I have felt that I could not stop</p> <p>I think about bingeing (overeating)</p> <p>I eat moderately in front of others and stuff myself when they're gone</p> <p>I have the thought of trying to vomit in order to lose weight</p> <p>I eat or drink in secrecy</p>	<p>I eat when I am upset</p> <p>I have gone on eating binges where I have felt that I could not stop</p> <p>I think about bingeing (overeating)</p> <p>I eat moderately in front of others and stuff myself when they're gone</p> <p>I have the thought of trying to vomit in order to lose weight</p> <p>I eat or drink in secrecy</p>

Bolded indicates reversed items

Data Analysis

The analysis took place in three stages. The first stage involved conducting confirmatory factor analyses (CFA) to examine the structural validity, temporal (across-time) invariance, and multigroup invariance (between genders and lean/nonlean sports) of the proposed measurement model and the scales within it. Given the multiple time points and large number of items within each scale, a global CFA of all scales at once would have resulted in an unsatisfactorily low case-free parameter ratio. Hence, the Societal Pressure, Negative Affect, Bulimia, Body Dissatisfaction and Internalisation measures were each considered separately. Once necessary adjustments were made, reliability analyses were then conducted (Cronbach's alpha coefficient) to check the internal consistency of the proposed scales.

In stage two of the analysis, mean scale (i.e., composite) scores were calculated for each construct measured, and a series of path analysis models were then fitted to test the hypothesised cross-lagged mediation model (Figure 5-3). When fitting the cross-lagged mediation model, analysis began with a model in which paths were free to differ across time. The stability of paths across time (stationarity) was then tested by fixing them equal across time, in sequence: T1 to T2 and T2 to T3 autoregressive paths between the same variables across time; T1 to T2 and T2 to T3 paths from the predictors (societal pressures and body dissatisfaction) to the mediators (Internalisation and Negative Affect); and T1 to T2 and T2 to T3 paths from the mediators to the outcome (Bulimia). The aim was to show that these fixings did not significantly depreciate model fit, i.e., there was no evidence of variation in these relationships across time. The indirect effects from societal pressures and body dissatisfaction to the outcome of Bulimia were then calculated to test whether mediation via internalisation and negative affect, respectively, was occurring as hypothesised (Hayes, 2017).

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Mplus statistical software was used to fit and test between models, with Full Information Maximum likelihood estimation employed on all cases (Muthén & Muthén, 2018). The $p < 0.05$ level of statistical significance was used, with exact p values and effect sizes reported throughout. Throughout, for the fit indices of CFI, GFI, and NFI, a value $>.90$ is considered to indicate acceptable fit, and for RMSEA, a value $<.08$ is needed for acceptable fit (Marsh, 2007).

Results

Table 5-4 gives the results of the CFA for each of the five constructs that made up this model. It shows both the fit of proposed number of factors with no restrictions in loadings and intercept parameters across time (configural temporal invariance), and the comparisons with models in which equivalent loadings and then intercepts were fixed equal across time (metric temporal and scalar temporal invariance). Metric temporal invariance is used to assess whether the questions are understood consistently across time, and scalar temporal invariance is used to assess whether the response code is understood consistency across time. The chi-square difference test was utilised to assess if model did or did not significantly vary when moving from the least constrained configural model to more constrained metric and scalar models. The model fit is assessed using fit indices of CFI, RMSEA, and SRMR.

For each of Negative Affect, Body Dissatisfaction, and Bulimia, the proposed 1 factor models provided an adequate fit to the data, which was not significantly compromised by fixing factor loadings to be equal across time. Therefore, it can be concluded that the understanding of the items as measures of the respective concepts was consistent across time. Comparing the configural and metric invariance for Negative Affect shows a chi-square difference from 571.00 to 594.18 and no change in the degrees of freedom, which does not constitute a significant change, with $p = 0.18$. Scalar temporal invariance was not achieved for Bulimia and Body Dissatisfaction as seen by the

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significant *p* values in Table 5-4. However, the fit of Body Dissatisfaction with scalar invariance, though significantly worse than the metric invariance model, was still satisfactory, with the CFI greater than 0.90 for metric and configural models. Table 5-4 outlines these results.

For internalisation, a two-factor model of general and athlete dimensions offered a satisfactory fit (with a CFI of 0.91 for both configural models) and outperformed a potentially competing factor model, meaning that the division into two subscales was the best option for analysis. When applying metric invariance, the fit of the two-factor model was not significantly reduced, with the CFI remaining at 0.91, but scalar invariance was not achieved. Similarly, the three-factor model for Societal Pressures achieved a good level of fit (0.91), outperformed a one factor model, and achieved metric invariance (see Table 5-4).

Table 5-4. Confirmatory Factor Analyses

Scale	Model	chi-sq	df	chi-sq difference	ch df	p	CFI	RMS EA	SRMR	chisq - df ratio
Negative Affect	Configural	571.00	402	--	--	--	0.89	0.03	0.05	1.42
	Metric	594.18	420	23.19	18	0.18	0.89	0.03	0.06	1.41
	Scalar	702.00	438	107.82	18	<0.01	0.83	0.04	0.06	1.60
Bulimia	Configural	140.31	132	--	--	--	0.99	0.01	0.04	1.06
	Metric	163.79	142	23.49	10	0.01	0.97	0.02	0.04	1.15
	Scalar	183.95	152	20.16	10	0.03	0.96	0.02	0.05	1.21
Body dissatisf action	Configural	62.42	51	--	--	--	0.97	0.02	0.04	1.22
	Metric	80.88	57	18.46	6	0.01	0.93	0.03	0.04	1.41
	Scalar	120.10	63	39.21	6	<0.01	0.83	0.05	0.05	1.91
Internali sation (2 factors)	Configural	522.70	390	--	--	--	0.91	0.03	0.02	1.34
	Metric	546.34	406	23.64	16	0.10	0.91	0.03	0.05	1.35
	Scalar	582.73	422	36.39	16	<0.01	0.89	0.03	0.05	1.38
Societal Pressure (3 factors)	Configural	976.93	783	--	--	--	0.91	0.02	0.04	1.25
	Metric	1004.9 2	805	27.98	22	0.18	0.91	0.02	0.05	1.25
	Scalar	1066.3 5	827	61.43	22	<0.01	0.89	0.03	0.05	1.29

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Multigroup CFA

For each of the above measures, the satisfactory metric invariance models were taken forward to run a series of multigroup CFAs in which loadings and then intercepts were allowed to vary between male/female athletes, or between lean/nonlean sport athletes. Table 5-5 gives the equivalent tests for the multigroup invariance of these respective measurement models between genders and between participants of lean and nonlean sports.

The Societal Pressures, Internalisation, Body Dissatisfaction and Negative Affect measurement models all exhibited both metric and scalar invariance between groups for both gender and lean/nonlean sport. Bulimia failed to achieve metric invariance between genders, though the fit of the metric invariance model, while significantly weaker than the configural invariance model, was itself still satisfactory

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Table 5-5. Group Invariance for Gender and Lean/Nonlean

Scale	Model	chi-sq	df	ch chi- sq	ch df	p	CFI	RMSEA	SRMR	chisq - df ratio	
Negative Affect	<i>Lean vs Nonlean</i>										
	Configural	1068.74	840.00				0.86	0.04	0.07	1.27	
	Metric	1075.32	849.00	6.58	9.00	0.68	0.86	0.04	0.07	1.27	
	Scalar	1109.06	876.00	33.74	27.00	0.17	0.85	0.04	0.07	1.27	
	<i>Gender</i>										
	Configural	1082.57	840.00				0.85	0.04	0.07	1.29	
Internalisation	<i>Lean vs Nonlean</i>										
	Configural	986.81	812.00				0.89	0.03	0.06	1.22	
	Metric	998.69	820.00	11.88	8.00	0.16	0.88	0.03	0.06	1.22	
	Scalar	1011.83	844.00	13.15	24.00	0.96	0.89	0.03	0.06	1.20	
	<i>Gender</i>										
	Configural	945.19	812.00				0.91	0.03	0.06	1.16	
Body Dissatisfaction	<i>Lean vs Nonlean</i>										
	Configural	137.59	114.00				0.93	0.03	0.06	1.21	
	Metric	144.76	117.00	7.17	3.00	0.07	0.92	0.03	0.06	1.24	
	Scalar	155.45	126.00	10.69	9.00	0.30	0.91	0.03	0.06	1.23	
	<i>Gender</i>										
	Configural	143.29	114.00				0.91	0.03	0.06	1.26	
Societal pressure	<i>Lean vs Nonlean</i>										
	Configural	1907.35	1610.00				0.86	0.03	0.06	1.19	
	Metric	1918.87	1621.00	11.52	11.00	0.40	0.86	0.03	0.06	1.18	
	Scalar	1961.78	1654.00	42.91	33.00	0.12	0.86	0.03	0.06	1.19	
	<i>Gender</i>										
	Configural	1878.17	1610.00				0.88	0.03	0.06	1.17	
Bulimia	<i>Lean vs Nonlean</i>										
	Configural	342.52	284.00				0.93	0.03	0.06	1.21	
	Metric	347.89	289.00	5.36	5.00	0.37	0.93	0.03	0.06	1.20	
	Scalar	364.93	304.00	17.04	15.00	0.32	0.92	0.03	0.06	1.20	
	<i>Gender</i>										
	Configural	1878.17	1610.00				0.88	0.03	0.06	1.17	

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Gender

Configural	334.74	284.00				0.94	0.03	0.06	1.18
Metric	359.36	289.00	24.62	5.00	0.00	0.91	0.03	0.07	1.24
Scalar	374.17	304.00	14.81	15.00	0.47	0.91	0.03	0.07	1.23

Note. taking forward metric temporal invariance

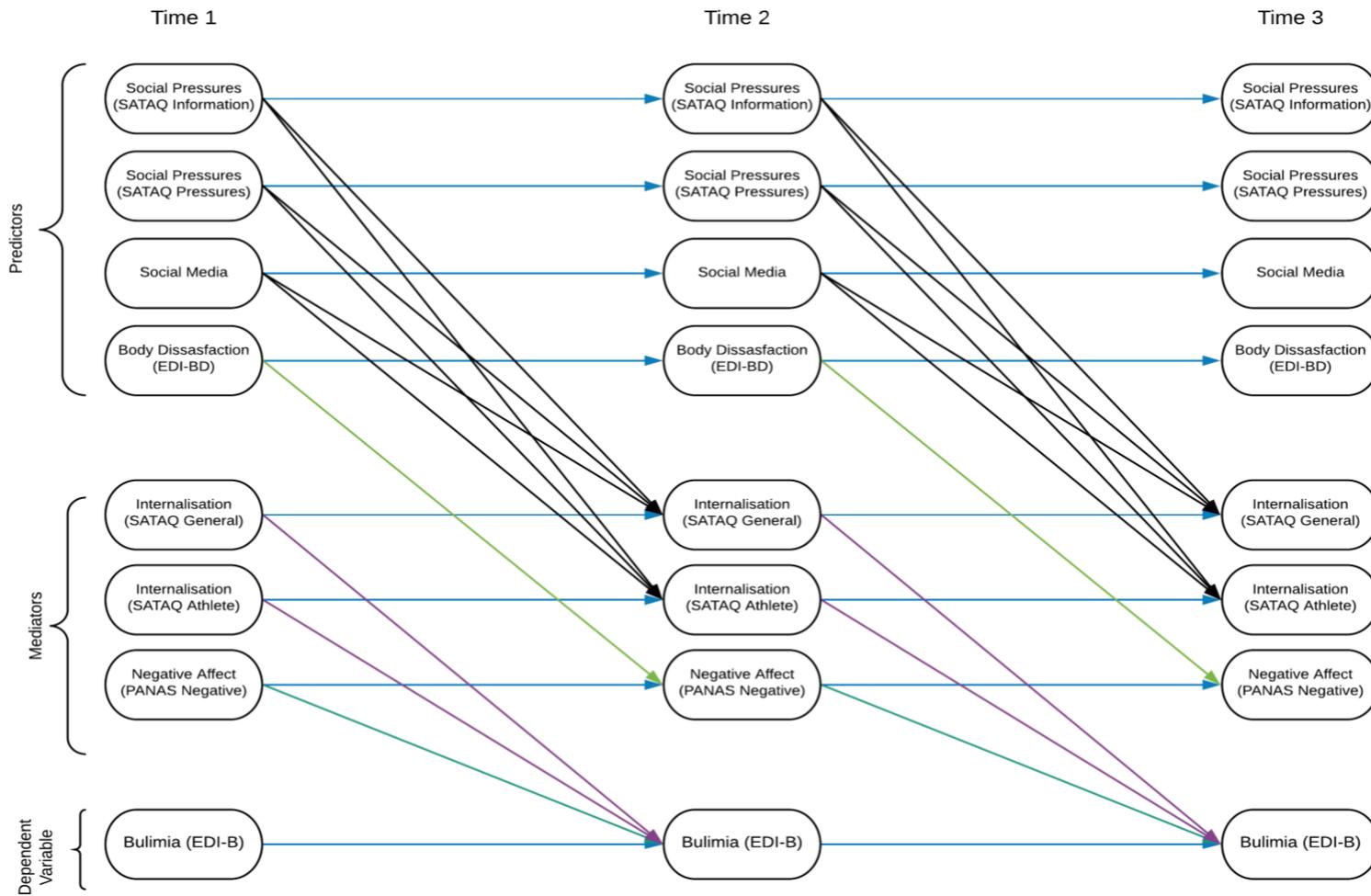


Figure 5-1. Cross-lag mediation

This baseline model with all paths free, model 1, and all of the subsequent models failed to achieve a good fit, thus failing to support the primary hypothesis that the T1 model would remain a good fit across time when extended to a cross-lagged mediation model (see Table 5-6 for fit indices).

When adding constraints across time to investigate the stationarity of effects, neither fixing the autoregressive pathways (blue paths, Figure 5-3) nor the predictor to mediator paths (black and light green paths, Figure 5-3) resulted in a significantly weaker fit. However, fixing the mediators and dependent variable paths (purple and dark green) to be equal across time significantly reduced the model fit.

Table 5-6. Path analysis model comparisons, testing stationarity of hypothesised model

		chi-sq	df	ch chi-sq	ch df	p	CFI	RMSEA	SRM R	chisq - df ratio
model 1	Free model	1903.3 8	179.00				0.47	0.11	0.19	10.63
model 2	fix autoregressive paths equal	1925 .34	187.00	21.96	8	0.01	0.47	0.11	0.19	10.30
model 3	fix pred-med paths equal for all	1939 .93	194.00	14.58	7	0.04	0.47	0.11	0.19	10.00
model 4	fix med-dv paths equal for all	2023 .96	197.00	84.03	3	<0.01	0.44	0.11	0.19	10.27

Within the final, most constrained model (model 4), there were several significant pathways, despite the model lacking an acceptable fit. The pathway from all types of societal pressures to general internalisation was significant. The pathways from the mediator of internalisation were also significant for bulimia. The significant pathways are shown in Table 5-7 below, while Figure 5-4 shows these findings visually.

Table 5-7. Significant pathways in model 4

Pathway	Estimate	S.E	p-value
Social information to General Internalisation	0.10	0.04	0.00
Social Pressures to General Internalisation	0.12	0.04	0.00
Social Media to General Internalisation	0.11	0.03	0.00
General Internalisation to Bulimia	0.06	0.02	0.01
Athlete Internalisation to Bulimia	0.04	0.02	0.05

While the final, most constrained model, model 4, failed to establish a good fit, it did show that, with all paths set equal over time, there is a significant indirect effect of

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Societal Pressures (operationalised as SATAQ pressures, SATAQ information, and social media questions) on Bulimia, operating via General Internalisation (see Table 5-8). However, this pathway is the only significant pathway in the model, indicating only partial support for the second hypothesis which predicted that all paths of the model cross-lagged mediation would constitute a significant effect. See Figure 5-4 for a visual representation of Table 5-8, both of which show that across time, societal pressures predict bulimic symptomatology, and that the relationship is mediated by general internalisation. Several direct effects were also significant across time, also shown in Table 5-8 and Figure 5-4. Furthermore, Table 5-9 shows what parts of the model accounted for percent change in Bulimia at T3.

Structural Equation Modelling for Path Analysis

With evidence for metric invariance and good fit for most scales, the CFAs were subsequently extended to a structural equation model (SEM), also within MPlus. The next step was to test the hypothesised path model, illustrated in Figure 5

Table 5-8. Indirect and Direct Effects in Model 4

	Path	Estimate	S.E.	Est./S.E.	Two-tailed p-value	
Social Media (T1) to Bulimia (T3) Pathway	Direct to General Internalisation (T2)	0.11	0.03	3.97	<0.01*	
	Direct to Athlete Internalisation (T2)	0.04	0.03	1.21	0.23	
	Via General Internalisation (T2)	0.01	0.00	2.24	0.03*	
	Via Athlete Internalisation (T2)	0.00	0.00	1.03	0.30	
	Direct Effect with Bulimia T3	-0.02	0.02	-0.96	0.34	
	Social Information (T1) to Bulimia (T3) Pathway	Direct to General Internalisation (T2)	0.10	0.04	2.86	0.00*
		Direct to Athlete Internalisation (T2)	0.05	0.04	1.20	0.23
		Via General Internalisation (T2)	0.01	0.00	1.96	0.05*
		Via Athlete Internalisation (T2)	0.00	0.00	1.02	0.31
		Direct Effect	0.09	0.03	2.90	0.00*
		Social Pressures (T1) to Bulimia (T3) Pathway	Direct to General Internalisation (T2)	0.12	0.04	3.36
	Direct to Athlete Internalisation (T2)		0.07	0.04	1.53	0.13
Via General Internalisation (T2)	0.01		0.00	2.12	0.03*	
Via Athlete Internalisation (T2)	0.00		0.00	1.21	0.23	
Direct Effect	-0.01		0.03	-0.14	0.89	
Body Dissatisfaction (T1) to Bulimia (T3)	Direct to Negative Affect (T2)		0.05	0.03	1.64	0.10
	Via Negative Affect (T2)	0.00	0.00	1.16	0.25	
	Direct Effect	-0.01	0.03	-0.17	0.87	

*significant at $p < .05$

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Table 5-9. Percent change for variables in model 4

Observed Variable	Estimate (R ²)	S.E.	Est./S.E.	Two-tailed p-value
Negative Affect T2	0.28	0.04	7.961	0.00
Internalisation General T2	0.11	0.02	4.74	0.00
Internalisation Athlete T2	0.04	0.02	2.67	0.01
Bulimia T2	0.13	0.03	4.74	0.00
Negative Affect T3	0.06	0.01	5.24	0.00
Internalisation General T3	0.05	0.01	3.26	0.00
Internalisation Athlete T3	0.01	0.01	2.39	0.02
Bulimia T3	0.07	0.02	3.57	0.00

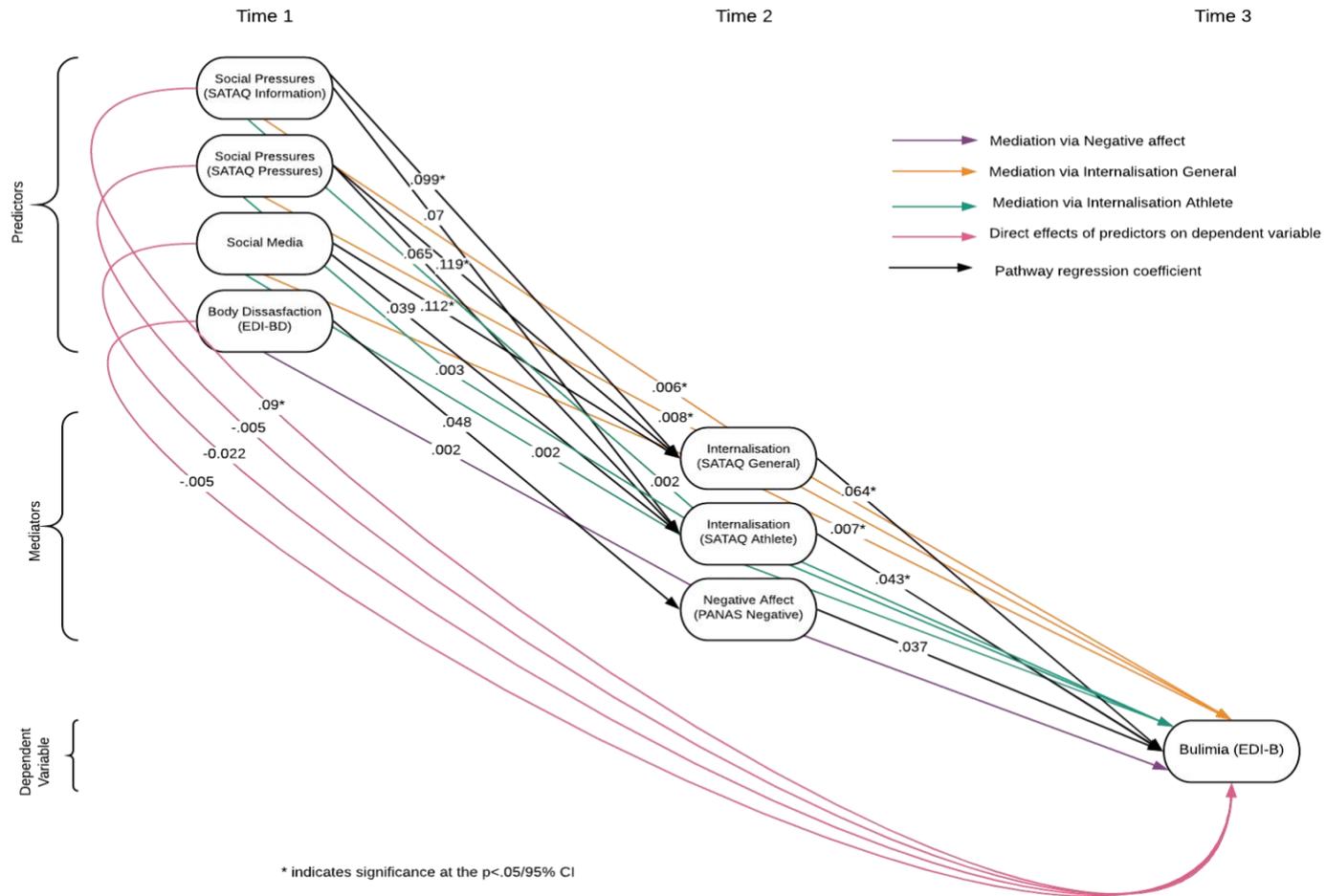


Figure 5-2. Visual of indirect, mediated, and direct effects

Discussion

The main aim of this study was to test the T1 model of disordered eating in athletes longitudinally. This chapter used structural equation modelling in the form of using a cross-lagged mediation model to test the T1 model across time.

It was hypothesised that the T1 model would show parsimonious goodness of fit across time in the form of a cross-lag mediation model, but this primary hypothesis was not supported, with the model failing to achieve a good overall fit. Specifically, it was hypothesised that Body Dissatisfaction at T1 would have a positive and significant relationship with Bulimia at T3 as mediated by Negative Affect at T2; however, this was not supported. It was also predicted that Societal Pressures at T1 would have a positive, significant relationship with Bulimia at T3, mediated by Internalisation at T2. Part of this hypothesis was supported: Societal Pressures – in the forms of pressures, information, and social media – significantly predicted bulimia symptomatology a year later, mediated by general internalisation. This suggests that athletes are not only exposed to societal pressures in the form of overt pressure, social media and mass media, but that it is the internalisation or incorporation of these messages into one's self-worth that predicts bulimic symptomatology. This finding is consistent with results that show that internalisation of the thin ideal, promoted by society and media, in a clinical or nonathlete population is linked to the development of eating disorders (Stice et al., 1994; Van Diest & Perez, 2013). The non-significance of the body dissatisfaction pathway was unexpected. It is possible that the use of general, rather than athlete-specific, body dissatisfaction scales explains this result. Scales that look at general body dissatisfaction may not capture how athletes feel about their body weight and shape: an athlete may feel that their body is satisfactory for societal beauty standards, but not for sport performance, and perhaps the measurement tools in this study did not capture that sentiment. Further

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study of the impact of body dissatisfaction across time is warranted, as previous work on this topic has been largely done cross-sectionally (e.g. Rousselet et al., 2017).

Limitations

Despite its many strengths, the current study had several limitations, the first being the poor reliabilities of the measurement tools across time. In the systematic review of relevant literature in chapter two, it came to light that there was inconsistency in the scales utilised to measure disordered eating and related concepts. Scales with high reliability and frequent usage in the clinical population were therefore chosen in an effort to create consistency. Thus, the first step in exploring why this model did not fit across time is to look at the reliabilities of the scales used in this population. Previously, in published clinical, nonathlete samples, these scales all had reliabilities with $\alpha > 0.8$ (Calogero et al., 2004; Clausen et al., 2011; Crawford & Henry, 2004; Garner et al., 1983; Andreas Thiel & Paul, 2006). This is one of the reasons these scales were chosen for the current study. However, the across-time reliabilities in the athlete sample in this study were poor, and they worsened across the three time points. Preparation of the data set, including the removal of all reverse-coded items, was needed to increase the reliabilities so that reliable analysis was possible. The removal of these scale items was the only way to drastically improve the across-time reliabilities of the scales used. While removing reverse-coded items from use is recommended in other research, this method meant that the scales then differed from how originally written, which must be acknowledged as a limitation of the current work and limits any claims made about the findings presented in this thesis (Chyung et al., 2018; Roszkowski & Soven, 2010; Woods, 2006). Interestingly, the make-up of the sample became increasingly elite-heavy across time, perhaps indicating that the scales are less reliable with higher-level competitive athlete samples. Furthermore, confirmatory factor analyses revealed issues with metric and scalar invariance. While not so ill-fitting that structural equation modelling could not be done, this does show that the

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gold standard measures from clinical research do not perform as well within this athlete sample.

Further limitations include the fact that recruitment was done via social media and participants were rewarded with a voucher. These decisions may have encouraged careless or dishonest responding and meant that some items and participants had to be removed from analysis. Additionally, increasing the number of time points, either within the yearlong period or over a longer stretch of time, would have allowed for even more sophisticated latent growth curve analysis; ideally, four or more time points are needed for nonlinear analysis (Duncan & Duncan, 2009).

Implications

This research suggests that societal pressures and their internalisation could be the focus of prevention interventions for athletes, thereby helping to inform applied practice. These findings indicate that mitigating the harmful effects of societal pressures, in the form of both information and more overt pressure from an athlete's social sphere and social media, is key. While it is not possible to impede all incoming messages by society, a focus for sport psychologists, clinical psychologists, coaches and athletes might be to look at how those messages can be prevented from being internalised into an athlete's self-worth. With societal pressure playing a central role in the creation of disordered eating symptomatology, further consideration must also be paid to the evidence from the current study that all types of athletes and both genders are at risk (Lentillon-Kaestner, 2014; Shanmugam et al., 2011; Steinfeldt et al., 2011). Screening for disordered eating should include all athletes, not just females or those in lean/aesthetic sports. Furthermore, focussing efforts on creating a social environment for all types of athletes that is supportive for wellbeing may be an important aspect of prevention efforts (Crow & Macintosh, 2009; Mountjoy et al., 2016). This finding reiterates the applied implications in previous chapters: athletes do not exist in a sporting bubble that goes untouched by

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society's expectations. Furthermore, it suggests that interventions developed and tested in nonathlete samples may be able to be adapted for athletes (Shanmugam et al., 2014). When working with athletes to mitigate pressures related to disordered eating development, those people working with athletes must be aware of those pressures outside of, and tangential to, the sporting realm.

Future research should focus on developing valid and reliable questionnaires to operationalise disordered eating, eating disorders, and related concepts for athletes. These questionnaires should also be tested with the rigour afforded to those used in the clinical realm. How we operationalise, measure, and therefore diagnose disordered eating and eating disorders in athletes needs to be tailored to the athlete population specifically (Giles et al., 2020). It is not necessarily the case that athletes develop disordered eating symptomatology due to their participation in sport; however, measurement and intervention may need to be adjusted for athletes. The current scales have items that are not suitable for athletes and may therefore under- or overestimate disordered eating. For instance, for an athlete who is headed into a lightweight rowing race or wrestling match with weight requirements, the question "Have you had a definite fear that you might gain weight?" (which appears on the EDE-Q) may not point to disordered eating cognitions even when answered in the affirmative. In short, there is power in words, and the wording must match the context.

Chapter 6. General Discussion

Overview of key findings, implications for applied practice, and directions for future research

This general discussion provides an overview of the key findings of this thesis. The summary shows how limitations of previous work in the field led to the central ideas in the thesis, and also aims to integrate findings from the different studies. Future research ideas and implications for applied practice and policy are also discussed.

Overview of Thesis: Findings and Limitations

The broad aim of this thesis was to study the risk factors for disordered eating in athletes over time. To recap, the first aim for the thesis was to critically examine and review the evidence and research underpinning an existing theoretical framework for the development of disordered eating in athletes. The second aim was to test the applicability and utility of this theoretical model, which outlines risk factors for disordered eating in athletes, using a large and diverse sample. The results of the first two aims resulted in the creation of a new model. The third aim was to increase understanding of how and why this new model and the original theoretical model differ, by employing qualitative investigation. Finally, to fill a gap in the literature, this thesis had the final aim of testing the new model longitudinally, to determine whether it was able to predict the development of eating disorders and disordered eating.

This research employed mixed-method approach to study how and why disordered eating symptomology develops in athletes. This research started with a systematic review of the existing theory and research which showed inconsistent results and difficulties in comparing literature. Therefore, a cross-sectional study to test the underlying theory was undertaken. This cross-sectional study created a new model that better explained disordered eating in athletes. Discrepancies between the original theoretical model and the new model was explored qualitatively where it was found that social and societal pressures, including those on social media are relevant for the development of disordered eating in a sporting context. The new model was then tested across time which is where

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the key finding that social and societal pressures are what gives rise to disordered eating symptomatology overtime was determined, but this finding needs to be understood within the context of potential measurement issues. A summary of key findings is found in the text below and briefly in Table 6-1.

Table 6-1. Key Findings of Thesis by Chapter

Chapter	Method	Key finding(s)	Implication for Thesis
2	Systematic Review	37 studies reviewed, inconsistent measurement tools, sampling made critical comparison of literature difficult. Lack of longitudinal research in field to date.	Use of gold-standard measurement tools, a large diverse sample, and conduct longitudinal research.
3	Large cross-sectional study using Structural Equation Modelling	Petrie and Greenleaf (2007) model failed to achieve a good fit. New model (T1 model) was created to fit data and therefore cross-sectionally explains the development of disordered eating in athletes. Sport pressures no longer in model.	Need to test this new model across time as well as qualitatively explore why Petrie and Greenleaf's model differed from the T1 model.
4	Qualitative Thematic Analysis	Disordered eating thoughts and behaviours arise for athletes due to societal pressures, through social interactions in person and online.	Continue to include social media as part of societal pressure measurement. Understand that for athletes, sport pressures alone do not create rise of disordered eating, but rather sport is the context in which societal pressures operate for athletes.
5	Longitudinal Cross-Lag Mediation	Societal pressure, mediated by internalisation, leads to bulimic symptomatology among athletes across time.	Poor across-time reliabilities make it difficult to make robust claims about findings.

The design and methodology of this thesis offer several contributions to the canon of work on this topic. The large and diverse sample of athletes comprised both male and

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female athletes across a wide range of sports, thereby addressing one of the primary shortcomings of other work in this topic area. With the vast majority of other work on disordered eating in athletes existing only as cross-sectional studies, this project's longitudinal design made the results of this thesis more robust and allowed a stronger test of hypotheses about the development of disordered eating. Furthermore, the multimethod approach, incorporating qualitative and quantitative analyses, as well as the use of sophisticated statistical techniques, created a paradigm shift that can and should be employed in future research.

In the systematic review in chapter two, it became apparent that drawing confident conclusions about eating disorders in athletes and relevant risk factors was nearly impossible for a number of reasons. First, there is a lack of longitudinal research—only three of the 37 articles reviewed were longitudinal—so the factors in the model reviews must be downgraded to correlates rather than causal risk factors. This is a consistent issue highlighted by other reviews (Bar et al., 2016). Drawing conclusions about evidence for each path of the model was also challenging due to the different measurement tools and the samples included in each study. For example, some studies included only one gender or a single sport, others included adolescents, and others recruited adults. Some had a control group of non-athletes or compared two different athlete groups while others included a single sample. Some studies used scales to measure eating disorder symptomatology developed for clinical populations, whereas others used scales designed specifically for athletes. More than 30 different scales were used across the reviewed studies to measure the factors specified in the model and eating disorder outcomes. The issues with measurement and scales were first highlighted in the review and became a theme throughout this work. Several previous authors have cited the vast range of scales used in eating disorder research in athletes and the need to validate these scales for use within an athlete population (Byrne & McLean, 2001; Pope et al., 2015).

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The findings of this systematic review critically appraise a range of work conducted in this field. The inconsistencies raised in this review align with those of similar reviews (e.g., Byrne & McLean, 2001). Previous reviews have made recommendations to address these issues, but these recommendations have been inconsistent. Some called for more focussed studies in which one type of sport is studied at a time, while others called for larger, more diverse athlete sampling (Bar et al., 2016; Byrne & McLean, 2001). The main conclusion of this review was that only limited conclusions could be drawn about eating disorders and disordered eating in athletes, due to the many inconsistencies between studies, the variable quality of studies, and the lack of prospective designs.

The inconsistencies in the literature review shaped the design for the subsequent chapters. To address the issue of sampling, a larger sample than seen in previous work was recruited for the cross-sectional study ($n = 1017$), and a range of sport types and both male and female athletes were included, in sufficient numbers that they could be compared in the analysis. Furthermore, the measurement tools used for the factors in the model were those that constitute a gold standard in the eating disorders field, bringing the same rigour often afforded to clinical research to the sport psychology realm. This decision was made in response to calls to address the use of measures with ‘questionable psychometric properties’ and to choose scales used frequently in general psychology research with high validity and reliability whenever possible (Chatterton & Petrie, 2013, p 330). The contribution of the systematic review is that it gives this thesis and future work a more theory-led underpinning.

Chapter three details the cross-sectional study. The results of this first applied study showed that the model developed by Petrie and Greenleaf (2007) did not mathematically fit the large sample of athletes tested. Instead, a new, well-fitting model that explained the development of specifically bulimic symptomatology in athletes was created, termed the T1 model. The key finding from the cross-sectional study was that the T1 model

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differed from the model proposed by Petrie and Greenleaf. Most significantly, the new T1 model incorporated social media as an element of societal pressure. This modernisation of social pressures is crucial to consider if research is to capture the true lived experience of athletes in the 21st century. The T1 model also differed in that modelled behaviours, sport pressures, and restricted food intake were removed because they did not predict the outcome variable of binge eating and bulimia. The removal of sport pressures from the new model is a major contribution of this thesis and speaks again to the idea that athletes and the pressures they experience are not isolated to the sporting experience. Understanding the athletes as people first is crucial to uncovering how to help them cope with pressures related to disordered eating, both in research and in practice.

This was not the first study to find a lack of fit for Petrie and Greenleaf's model, with previous work indicating a lack of fit for a male sample of athletes (de Sousa Fortes et al., 2015). de Sousa Fortes and colleagues also found that sport pressures and modelled behaviours needed to be removed for adequate model fit. Previous work that had found support for the model was conducted by the authors themselves and used scales developed for the purposes of that work and similar samples of collegiate athletes (Greenleaf et al., 2010; Petrie et al., 2014; Petrie et al., 2009). The work by these authors is very significant, but it is important for other groups, especially those from other countries, to contribute to this area to broaden its generalisability. It is positive that some beyond the North American group have begun investigating this model, to test it rigorously in new contexts.

This chapter is one of the few studies to employ structural equation modelling, thereby contributing to the small but growing body of statistically-sophisticated work in this area. With previous work in the field conducted by Petrie and Greenleaf and colleagues, and many other studies of disordered eating and eating disorders in sport using less powerful regression techniques, this analytical contribution is key. The use of structural equation modelling allowed for a more sophisticated study of the theory

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outlined by Petrie and Greenleaf, as many aspects of the model were simultaneously tested thus allowing for true modelling that can be tested in other samples and across time (Shanmugam & Marsh, 2015). Furthermore, this chapter measured the usage of social media as part of societal pressures, something rarely done in this topic area and something that brings this study and its findings firmly into the 21st century and ensures that this research reflects the true experience of participants sampled.

Moreover, the cross-sectional study had a larger, more diverse sample size than previous cross-sectional work conducted by the original authors and their teams (Greenleaf et al., 2010; Petrie et al., 2014). Overall, working with an athlete population means working with an incredibly self-motivated and invested population, which lent itself to a large sample with low dropout rates. However, this large data collection did have a potential downside. Use of the author's personal social media connections, which included elite and famous athletes who kindly agreed to share information for the study, along with the £5 reward for completing the survey, meant that a large number of people did the survey in a short period. Some attempted to complete the survey more than once for the monetary reward, leading to several duplicate responses that had to be deleted. Most of these instances were discovered during the data-cleaning process. It is also possible that some participants' responses were of lower quality than desired, either because they rushed to finish the survey, or perhaps even because they pretended to be athletes to receive the monetary reward. The balance between attempting to secure a large sample and recruit one of sound quality was carefully considered. Therefore, careful data cleaning was used to remove duplicate or non-athlete respondents as far as possible. Another limitation of the T1 study was that the answer of N/A was a response option to the question of when in the season the athletes were at the time of questionnaire completion. While only 41 of the 1017 participants, less than 5%, chose this answer, it meant that an assumption was made that those who chose this answer were competing

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year-round. However, this assumption may not have been correct for all 41 cases and meant that potentially some participants were coded incorrectly for analysis. This N/A option was not included in later time points.

A key limitation of the cross-sectional study that had consequences for the entire project was the inability to include any of the moderators proposed in Petrie and Greenleaf's model. This was due to a lack of scope and feasibility in the PhD timeframe to include an additional half-dozen scales and subsequent analysis of those scales. Hence, it was decided to focus only on the risk factors specified in the model. Future research should build upon this work by including key moderators, such as perfectionism. It would be helpful for future research to continue to employ a model to underpin research, as research in this area has heretofore lacked a cohesive theoretical foundation, which has made it difficult to draw firm conclusions.

The results of the cross-sectional study are expanded upon in the qualitative chapter, which shows that social media is a key part of an many athletes' lives, and to ignore its presence would not only lead to a limited understanding of societal pressures in this research but would also have consequences in the applied realm. The qualitative study in chapter four was undertaken to provide this type of deeper understanding of the T1 model and why it differed from the theory put forward by Petrie and Greenleaf, and specifically why sport pressures was removed from the T1 model. This use of qualitative insight to further understand the quantitative data demonstrates why a mixed-method approach provides such needed advancement to this area.

This qualitative chapter showed that conflation of what the body looks like with what it can do in terms of physical performance, intensified by social comparisons within sport, played a central role in the development of feelings and behaviours associated with disordered eating. Additionally, it appeared that society's image of an athlete, exacerbated by social media, led to issues with body image and other issues pertaining to disordered

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eating. This study had several novel components –its male and female sample, its inclusion of social media, and its sociological slant – which led to some unique findings and contributions. This focus highlighted the need for nuance in the language used around the terms ‘social pressures’ and ‘societal pressures’ to describe the types of pressures that affect athletes and their eating patterns and body image. Other findings are consistent with previous literature; these are detailed in chapter four, but of particular note is a replication of the idea that societal messages delivered by the social sphere can impact the development of disordered eating (Cooper & Winter, 2017; Krentz & Warschburger, 2011; Thompson & Sherman, 1999). The importance of understanding the impact of societal pressures on athletes, and especially how these harmful messages can arise from social media, is the key contribution from this study. This finding indicates the need for further study of the use of social media by athletes and how it may need to be moderated and regulated to reduce negative impacts. Social media is an active and integral part of all our lives in the 21st century, and it clearly needs to be the subject of ongoing research efforts. Using qualitative research to provide insight into quantitative findings adds dimension to the numbers, and conversely, means that the qualitative work is backed by theory and quantitative measurements that allow for more comparable and critiquable results (Venkatesh et al., 2013).

One limitation of this qualitative work was the self-selective nature of the sample. While the sample provided some rich insights into the experience of an athlete, it is important to note that all those who chose to partake in the interviews volunteered to do so, and so it is possible that self-selection bias was present. Furthermore, while the aim of qualitative sampling is not to generalise findings, and rather to provide detailed commentary on a single phenomenon (as was done in this work), this group of athletes consisted entirely of endurance athletes. Future work could benefit from exploring this topic qualitatively with athletes from other sport types (Byrne, 2001). While the

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information that gave rise to the findings was still sufficiently rich and impactful to lend a deeper understanding to the quantitative work in this PhD project, it is possible that a more diverse sample may have led to additional or different findings, so further investigation into other sport subtypes is necessary.

Chapter five returned to a quantitative approach. In response to the severe lack of longitudinal research in this topic area, as highlighted in the systematic review, the T1 model was tested across a year-long period. As a follow-up to the first time point, participants were asked to complete another round of questionnaires. Low dropout rates were a strength of the study: At T2, the dropout rate was only 13.5%, and at T3, the dropout rate was 15%. However, more cases were removed, on the basis of overall response time, to improve the reliability of the results. As discussed in the chapter, those that were removed were significantly different than those who were kept for analysis in terms of descriptive characteristics (sport type, if in season, years done sport, hours/week and level), but not in terms of the main outcome variable of bulimia. Although the cases removed during data preparation of the final study differed in many ways, chapter three's invariance testing showed that the model fit well across these descriptive variables. However, crucially, the primary reason for removing these responses was a rushed response time. Therefore, none of the data from these responses, including the descriptive variables which differ from the included responses, should be considered reliable or worthy of inclusion for analysis. Ideally, all responses would have been deemed reliable and no cases would have been removed, as removing cases reduces the power of the sample. Yet, given the reliability issues indicated, removing any untrustworthy responses was a necessary step and one that only benefitted the analysis in this thesis. However, future research should more carefully consider how to recruit more reliable participants, perhaps by not relying on social media or by devising a shorter questionnaire.

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The analysis used for this portion of the PhD used MPlus. The structural equation model from the T1 study was expanded to a cross-lag mediation model (Muthén & Muthén, 2018). Using a repeated measures longitudinal design and employing cross-lag mediation modelling are key strengths of this chapter, as few studies in this area have used such approaches (e.g., Neves et al., 2017). However, the limitation must be acknowledged that additional time points would have allowed for even more sophisticated modelling, including latent growth curve modelling, with more time points allowing for greater accuracy and precision (Diallo & Morin, 2015). However, the cost, the scope, and, most importantly, the onset of the Covid-19 pandemic did not allow for additional time points, as all competitive sport was suspended, and eating habits were likely to have changed during the national lockdown. Finally, as discussed in the chapter, this study was also limited by reliability issues that could only be rectified by removing hundreds of participants and reverse-coded scale items.

Considering the results of this longitudinal study, the central findings indicate that societal pressures over time do impact the development of bulimic symptomology in athletes. This chapter contributes to the wider field by providing additional insight into the pivotal role that societal pressures play on athletes. This encourages psychologists to view athletes not only in the context of their sport but also as people subject to the same scrutiny as all members of society, who have the added pressures and rewards of being an athlete. These results support the findings from the qualitative chapter and begin to provide clues about where and how to target intervention for athletes. For instance, because risk for susceptibility for disordered eating arises from societal pressures, then perhaps interventions already created to mitigate those pressures in the general population can be utilised (Guest et al., 2019). Interventions designed for the general population may be relevant for athletes, as interventions should focus primarily on how someone internalises societal pressures. However, while the underpinning theory may be taken

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from those interventions with nonathletes it is still of vital importance to tie in language or examples that feel familiar to athletes. Thus while the theoretical root of the intervention may not need to be athlete or sport specific, athletes often feel that their experience of disordered eating and eating disorders is unique to the athlete experience and so any intervention design still needs to help athletes feel that they are being listened to and that their needs are being addressed (Plateau et al., 2017).

While the conceptual design of this project was strong and the findings exhibited some interesting output, the final study was hampered by poor scale reliability. Any finding adopted from the study must be used with an understanding of this limitation. One of the key takeaways from this research is the need to develop scales designed for athletes, male and female, that have been subjected to the same validation and rigour as those in clinical psychology, again echoing the findings of previous work (Pope et al., 2015). It has been a flawed assumption in work across many fields to apply a scale designed for one population for use in another (Hagger & Chatzisarantis, 2009).

Future Research

Looking more broadly at this entire project, this author has several recommendations for future research. First, there should be an understanding that ‘athletes’ as a blanket term for a diverse population is problematic. Gender, sport type, and the level of an athlete’s involvement in sport must be considered. The field needs more accurate information on prevalence rates, rather than overgeneralised claims about athletes and their vulnerability to the development of eating disorders. Taking time to develop measurement tools for elite athletes, both male and female, in lean sports in addition to the tools for recreational nonlean sport participants, and diligently studying each of those athlete populations’ susceptibility to eating disorders and disordered eating across time, is a necessary next step. Ensuring that the scales developed are relevant for all types of sport participants, both male and female. Looking at the findings of the

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qualitative work around the identification of language choice between ‘social’ and ‘societal’ is something that needs to be taken into account when designing adequate measurement tools and scales in the future. The scales used in the quantitative work, both in the cross-sectional and longitudinal study, used this terminology interchangeably, leading to a lack of clarity. Without the qualitative work, however, this subtlety may have been overlooked altogether, showcasing the need for both quantitative and qualitative methods to fully understand concepts that will influence future research and practice. Those in sport psychology research and practice must advocate for their understanding of sport and challenge generalisations that hinder sophisticated understanding of the field and the field’s ability to help those suffering.

So many of the resources in sport and applied practice are directed toward the elite few (e.g. Giel et al., 2016; Scoffier et al., 2010). There is particular interest in Olympians and professional athletes, but these athletes are often those with the most extensive and knowledgeable support structure. This research project has highlighted that serious, yet aspiring athletes likewise need support for their mental wellbeing. As more carefully considered research is produced, it is paramount that those competing at varying levels are also given the support they deserve.

Applied Practice and Policy Implications

The limitations and resultant future research proposals described above flow into implications for applied practice and policy. Just as a nuanced understanding is required for designing measurement tools, those working with and treating athletes for disordered eating and eating disorders must possess an underlying knowledge about sport in general, the athlete’s specific sport, and how sport experience coupled with that athlete’s experience in society creates vulnerability for the athlete. An issue in current practice and care is that those working in sport psychology are not well-versed in or qualified to treat disordered eating or eating disorders, and those in the clinical field know little about

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working in sport. In short, we require more specialists who cross over between sport and clinical psychology in both research and practice, but this begins with policy and qualification changes, as many psychology training programmes do not offer comprehensive guidance in both.

Sport psychology research and practices tend to focus on performance enhancement and are therefore often considered separate from the work in mental ill health (Keegan, 2015). That means topics covered in this thesis are unlikely to be studied within sport psychology, and also that a sport psychologist may not be aware of even basic information about eating disorders and disordered eating. As the findings from this work point to societal and social pressures playing a troubling role, interventions from outside sport may be applicable, and so sport psychologists should be able to understand and apply some of these interventions. Thus, to allow for an improvement in the field, mental health training (including study of disordered eating and eating disorders) must form part of the training of sports psychologists. This training will allow them to understand how mental ill health can develop both within and away from the sporting context. This notion stems from protocols that mental health training for those working in sport psychology is currently insufficient for application to research and practice. Many sport psychologists have attended additional training certifications that do offer mental health training (some of which may focus on disordered eating and eating disorders), but there is no formal recognised route for this option, and employers who may want to hire sport psychology experts who can help with disordered eating prevention are unable to differentiate between those who have such training and those who do not. While a sport psychologist might not need to treat the severely mentally ill, they must be literate enough in mental health to notice signs of mental ill health among athletes, in order to know when to refer to a clinical psychologist or specialist service.

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Furthermore, it is important to note that clinical psychologists are unlikely to be the first point of contact for athletes experiencing disordered eating or eating disorder symptoms. Therefore, an additional focus must be placed on equipping those within sporting environments who have more consistent contact with athletes – sport psychologists, coaches, and physiotherapists – to notice signs of disordered eating and eating disorder development and to deliver their messages of excellence in a way that does not exacerbate any body image or food-related issues. As reviewed in chapter two, coaches' comments can contribute to disordered eating, and so helping coaches create a supportive environment conducive to mental well-being – such as one that limits body comparison between athletes, which was shown in the qualitative chapter to exacerbate issues with disordered eating, is the right starting point (Gomes et al., 2011; Scoffier et al., 2010). As shown in the qualitative study, athletes found it all too easy to conflate body shape with performance ability. This was exacerbated by social comparisons in sport, which include teammates, competitors, and sporting idols. Coaches should therefore be taught to avoid this confusion themselves, and also to avoid inciting comparisons to another athlete's body shape, especially in relation to performance results (Thompson & Sherman, 1999a). Furthermore, coaches should take care to understand the societal and social media pressures on their athletes that were highlighted in the longitudinal study, and to phrase their feedback and any body composition concerns in a way that takes those pressures into account (Kerr et al., 2006). Finally, coaches can work to reduce stigma around seeking mental health support, which is, of course, vital to the overall support of athletes' mental wellbeing (Castaldelli-Maia et al., 2019). Sport psychologists, who are more likely to be integrated into a sport team than a clinical psychologist, have a critical role to play in helping coaches cultivate these skills, and additional mental health knowledge and training would best equip them to do so.

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It is imperative that findings related to eating disorders and disordered eating, such as the ones presented here, are not consigned to the pages of academic journals and PhD theses, but are presented to people who have regular contact with athletes in a way that they can both understand and act upon. There is evidence that when coaches lack understanding on the topic of disordered eating and eating disorders, they may make the situation around food and diet worse, albeit often inadvertently, or may simply feel ill-equipped to help when noticing disordered eating behaviours (Kerr et al., 2006; Plateau et al., 2014; Sherman et al., 2005). Additionally, there is a need to implement policies and practices that can break down barriers of stigma and ignorance so that when coaches discuss mental health issues, athletes feel comfortable with opening up and can be signposted to appropriate support as early as possible (Papathomas & Lavalley, 2010). Simple media campaigns can reach masses of coaches and athletes and educate them about mental well-being; one recent example is the campaign launched by Swim England in May 2020, #ItsOkNotToBeOk, that helped coaches and athletes to discuss emotions and to “ask twice” when checking how someone is doing.

While measurement issues have made it difficult to draw generalisable conclusions from this work, the general foundation on which this work was laid – bridging the fields of sport and clinical psychology – provides its own important insight. Presented here are a few concluding thoughts about the context of sport and sport psychology for a clinical audience. First, the competitive world of sport is demanding on the mind and the body. Those outside sport often blame the demanding culture of sport for ‘causing’ eating disorders. This wholesale approach does not account for the athletes’ interaction with wider society, and it is a generalisation as simplistic as accusing diet culture or media of causing all eating disorders in the general public. The same attention to detail given to eating disorder research and care for a general or clinical population must also be used for those in sport. It is the lack of understanding from those outside sport that often makes

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athletes feel they would rather speak with a sport psychologist or leads them to require specialist treatment from someone who understands the sporting context in which they base the majority of their lives. Therefore, those working in mental health, and in particular disordered eating and eating disorders, need to understand more about the sporting context and help athletes feel understood and supported. In the past, athletes have not sought mental health support due to stigma. Having someone who understands sport does increase the likelihood that an athlete will access and have a positive experience with mental health support (Castaldelli-Maia et al., 2019).

Finally, those in the clinical world may pose a question regarding the neediness of this population of athletes, given that disordered eating does not pose the same high medical risk as clinically diagnosable eating disorders. Here, it is important to highlight that if our goal as a profession is mental wellness, then simply aiming for the absence of mental ill health is not sufficient. The goal should be a mental state that allows those in question to thrive, not merely survive (Giles et al., 2020).

A final strength that this author would like to highlight harkens back to the acknowledgements section. It was the collaboration of a multidisciplinary group of experts that made this project possible. As an early-career researcher looking to work across sport psychology and clinical psychology and qualitative and quantitative research, the author could not have done this work single-handedly. The guidance of the formal supervisors, Lucy Serpell and Vaithehy Shanmuganathan-Felton, as well as the statistical guidance of Chris Stride and Antony Cooper, the input on over-exercise by Caroline Meyer, and the qualitative expertise of Russell Delderfield, have allowed this project to expand into areas that would have otherwise been left untouched.

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Appendices

Finance & Business Affairs
Legal Services

Application for inclusion of a research project

All research projects using personal data must be registered with the UCL Data Protection Registration Service **before the data is collected**. This includes projects approved by the Joint Research Office (a partnership between University College London, UCL Hospitals NHS Foundation Trust and the Royal Free Hampstead NHS Trust).

Where it the controller, UCL is required by law to comply with the data protection legislation. For students who are processing personal data in the course of their studies, UCL will be the controller.

This form should only be completed if identifiable data is being collected and used as part of research on the basis that identifiable data is personal data and data protection law applies. **Data protection legislation does not apply to anonymous (also known as de-identified) data. Registration will not be required when staff or students are only processing anonymous data.**

As part of registering your research, we also need to be notified of changes which effect data protection compliance. You can find out more about the changes you need to tell us about by visiting the [research and data protection](#) website.

All sections must be completed before submitting this form to the data protection team.

A. APPLICATION DETAILS		
A1.	Project title:	Risk Factors for Disordered Eating/Eating Disorders in Athletes
a.	Proposed start date: 14 January 2019	Proposed end date: 14 th January 2022
B. CHIEF INVESTIGATOR (CI); PRINCIPAL INVESTIGATOR (PI)		
B1.	<i>(Undergraduate, postgraduate or research postgraduate cannot be the CI/PI for Ethics purposes).</i>	
a.	Full Name:	Lucy Serpell
b.	Position held:	Associate Professor
c.	School:	Division of Psychology and Language Sciences
d.	Faculty:	Faculty of Brain Sciences
e.	Department:	Clinical, Educational and Health Psychology
f.	Email:	Telephone:

Disordered eating in athletes

	<i>Please note that if the CI/PI is not a UCL employee you should provide details below of a responsible UCL employee below).</i>	
g.	Full Name*:	Hannah Stoyel
h.	Position held:	PhD student
I	School:	Division of Psychology and Language Sciences
J	Faculty:	Faculty of Brain Sciences
k.	Department:	Clinical, Educational and Health Psychology
l.	Email:	Telephone:
C. DATA COLLECTOR (S)		
C1.	Data Collector(s) Details (<i>if Applicant is not the PI e.g. student details</i>):	
a.	Full Name:	Rebecca Clawson
b.	Position held:	Taught Master's Student
c.	School:	Division of Medicine
d.	Faculty:	Postgraduate Taught Degrees
g.	Department:	MSc Eating Disorders and Clinical Nutrition
h.	Email:	Telephone:
D. DETAILS OF THE PROJECT		
<p>Please provide a brief summary of the project, including an explanation of the aims, design, methodology and plans for analysis that you propose to use.</p> <p>Summary of Research</p> <p>It is particularly important to provide sufficient detail of the research protocol and the measures that will be used, to enable evaluation of the application on ethical grounds. It is also important to clearly demonstrate that the proposed measures are 'innocuous' and fall within PaLS Ethics remit.</p> <p>Please provide a brief summary of the project/programme of research including</p> <ul style="list-style-type: none"> • Background • Aims • Participants and recruitment • Procedure (including whether face-to-face or online study) • Measures • Examples of measures (tests, questionnaires, interviews etc.) as per RD guidelines <p>NB When providing examples of each measure you plan to use, please select the most emotive/distressing examples so that the Ethics Chair can judge the potential for causing any distress.</p> <p>Background: Based on the theoretical model by Petrie and Greenleaf (2007), this research will investigate links between disordered eating or eating disorders and high-level sport participation. This</p>		

Disordered eating in athletes

programme of research seeks to understand whether the unique lifestyle of high-level athletes would mean a unique risk profile for eating disorders/disordered eating (ED/DE) for this population and if subsequently a theoretical model that includes both psychological and physiological markers specific to high level athletes is warranted.

The proposed programme of research has three components. The first is a cross-sectional quantitative design in which psychological and biological information (saliva samples to measure leptin, ghrelin etc) is collected at Time 1 and analysed for any statistically significant relationship to eating disorder symptomology. The second is a longitudinal component in which a paired down number of tests and questionnaires will be chosen for re-testing at Time 2 (six months after T1) and at Time 3 (nine months after T1). Finally, a qualitative element will be included. Semi-structured interviews will be conducted at T1 with those participants screened to be eligible to examine what sport pressures they have experienced and how these may contribute to eating disorder symptomology.

Aims:

The aims of the current study are to the answer the following questions:

1. What risk factors, psychological and otherwise, cause the development or worsening of eating disorders/disordered eating in high level athletes?
2. How does the existing theoretical model need to be adjusted? What biological factors need to be included?
3. Through qualitative interviews, what unique to sport participation is related to the development of disordered eating and eating disorder psychopathology?

Participants and Recruitment:

Participants will be recruited through online advertising, and by directly contacting various sport teams around the country. Hannah Stoyel has professional links to a number of sporting organisations. During both the recruitment and data collection phases, email addresses and phone numbers will be collected from participants, however, this information will be stored securely according to GDPR and data protection guidance. All participants will be above the age of 18 and be a high-level athlete participating in high level sport. High-level sport is defined as being coached in the sport at a minimum of 10hours/week and representing a team at consistent competitions.

The main focus of the current research is on psychological features which may elevate risk for eating disorders, and so most of the testing will focus on different psychological measures.

The majority of the measures have been chosen from previous related research that has tested the theoretical model alluded to above (see Petrie et al., 2014; Petrie et al., 2009b for scales

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unless otherwise noted). Novel measures will be created only where strictly necessary. Additionally, short versions will be chosen when possible to minimise any burden to participants. This research will be carried out using online questionnaires for the psychological and demographic information.

1. Demographic and Training Information: Information about age, gender, sport type, level of competition, hours spent training will be included.
2. Self-reported height and weight: Height and weight will be self-reported such that no invasive skin folds measurements need to be taken. All the athletes should have easy access to scales and stadiometers (height measures) at their respective clubs. Female participants will also be asked about menstrual cycle history as there is evidence that menstrual irregularities are related to eating disorder status.
3. Athletic Identity: This will be measured with a simple yes or no to determine if that participant identifies as an athlete, something that has shown to be important in previous disordered eating literature.
4. EDE-Q and EDI-2 (Fairburn & Beglin, 2008; Garner, Olmsted, & Polivy, 1983): Global scores will determine level of disordered eating symptomology in the sample. The subscales in these questionnaires will help determine if factors such as body dissatisfaction and internalisation of the thin ideal, and food restraint are relevant factors in the development or worsening disordered eating/eating disorders in these high-level athletes. It will be the scores on these measures that will determine which participants are invited to take part in the qualitative semi-structured interviews that will take place in person or appropriate video conferencing when travel is not possible.
5. Compulsive Exercise Test: Not originally included in the theoretical model, compulsive exercise is emerging as a unique and important factor in understanding how disordered eating and eating disorders can affect those involved in exercise and sport (Meyer, Taranis, Goodwin, & Haycraft, 2011).
6. Positive and Negative Affect: Relevant measure to test for negative affect which is a factor in the theoretical model.
7. The Sociocultural Attitudes Towards Appearance Questionnaire 3 (Heinberg & Thompson, 1995): Used in previous work to measure internalisation.
8. Modelled Behaviour of Friends and Family: Questions related to modelling of friends and family will need to be created for the current study, as no current questionnaires exist to test this aspect of the theoretical model.
9. Veganism/other restricting diets: In order for this research to remain relevant to the current culture will also ask about any diets the participants prescribe to that involve

Disordered eating in athletes

restricting certain foods or groups of foods to determine if following these diets at time 1 has any impact on DE/ED at time 3.

10. Other psychological measures referenced in similar works may also be included.

Free Smart Phone Apps will be used for (1) food diary, (2) sleep information, and (3) social media usage. These three measures are not included in the original theoretical model, but related research in the field has determined that this information may impact DE/ED both directly and indirectly via moderators and mediators.

The final information collected from the participants will offer a novel insight into the field of DE/ED and athletes. This study hopes to collect saliva samples from participants. This data will allow the researcher to determine if any biological markers accompany the psychological information that give clues regarding the development of disordered eating/eating disorders in athletes.

Saliva kits will be analyzed using Stratceh- C-Reactive Protein ELISA Kits. The saliva samples will test hormones and mediators potentially associated with the regulation of appetite, energy expenditure, and others (i.e. inflammation, sex hormones, leptin, ghrelin, cortisol etc.). It is important to note that no DNA information will be stored and all saliva samples will destroyed immediately after analysis. Saliva samples will only be collected at T1 and T3.

Please note that the experiment described is the first in a series of similar experiments in this programme of research. New experiments will be added by amendment.

E. PRIVACY IMPACT SCREENING QUESTIONS

If the answer to any of these questions is 'yes', then a PIA is required

Will the project require individuals to provide information about themselves?

Will information about individuals be shared with organisations or people who have not prev routine access to the information?

Will the project use information about individuals for a purpose it is not currently used for, or it is not currently used?

Does the project involve you using new technology that might be perceived as being privacy For example, the use of biometrics or facial recognition.

Will the project result in you making decisions or treating individuals in ways which can hav significant impact on them?

Is the information about individuals likely to raise privacy concerns or expectations, eg healt information that people would consider to be particularly private?

Disordered eating in athletes

Will the project require contact with individuals in ways they may find intrusive, eg unexpected telephone calls?		✓
Will the project use personal data, including personal data obtained from live or operational systems for access or transfer outside the UK (e.g. use of Cloud, Hybrid or offshore support purposes)?		✓
Will the project involve processing sensitive personal data*?	✓	

F. DETAILS OF PARTICIPANTS

Please provide details of the potential participants for this project, including how they will be selected and recruited.

Participants will be recruited through online advertising, and by directly contacting various sport teams around the country. Hannah Stoyel has professional links to a number of sporting organisations. During both the recruitment and data collection phases, email addresses and phone numbers will be collected from participants, however, this information will be stored securely according to GDPR and data protection guidance. All participants will be above the age of 18 and be a high-level athlete participating in high level sport. High-level sport is defined as being coached in the sport at a minimum of 10hours/week and representing a team at consistent competitions.

G. DETAILS OF THE DATA BEING PROCESSED

Please describe the details of the personal data that is being collected, including the methods of data collection and analysis.

Questionnaire data will be collected online using SurveyMonkey. Sleep patterns and phone usage will be collected via email or text. The saliva sampling will be collected in sterilised test tubes and then analysed using Stratceh- C-Reactive Protein ELISA Kits.

H. SHARING (DISCLOSURE)

Please describe how the outcomes of the research will be disseminated (for example provide an explanation as to where, and how, will the results be published, or other mechanisms you will be using to share the potential participants personal data).

The findings of the research will be shared in scientific journal, MSc dissertations, PhD theses, and discussed at sport and psychology conferences in the forms of talks and posters. However, no identifying information or individual level data will be included in the dissemination of the results.

I. CONSENT

Please include the information sheet and consent forms you will be using for this project, and or protocol. If you are not including an information sheet and consent form, please explain how the consent will be recorded.

Information sheet and consent forms attached below. Informed consent will be recorded by electronic signature of the attached sheet.

J. DATA STORAGE

Please describe the arrangements you will make for the security of the data, including how and where it will be stored. i.e. UCL network, *encrypted USB stick, *encrypted laptop etc.

Data will be encrypted and stored on the UCL network. In the event of data needing to be transferred an encrypted USB stick will be utilised.

*Advanced Encryption Standard 256 bit encryption which has been made a security standard within the NHS)

Data Safe Haven – Identifiable Data Handling Solution

Will the personal identifiable data collected and processed as part of this research be stored in the UCL Data Safe Haven (mainly used by SLMS divisions, institutes & departments)?

YES/NO

**If no please ensure that you have explained how you will ensure that the data is held securely?

Further information on the Data Safe Haven service is available at:<http://www.ucl.ac.uk/isd/itforslms/services/handling-sens-data/tech-soln>

K. INTERNATIONAL TRANSFER

Will identifiable data be transferred outside the EU as part of this study? **YES / NO**

Data protection legislation prohibits the transfer of personal data to countries or territories outside the European Economic Area (which consists of the 27 EU member states, Iceland, Liechtenstein and Norway).

At the time of writing the following countries have also been deemed adequate - Andorra, Argentina, Canada, Faroe Islands, Guernsey, Isle of Man, Israel, Jersey, New Zealand, Switzerland and Uruguay.

The Data Protection Officer has produced guidance on the transfer of data overseas and particular to the United States. This is available from the [Data Protection webpages](#).

If you intend to transfer data to a country not mentioned above, please supply details of adequate safeguards below:

Use of cloud computing, or the transfer of personal data to other organisations providing a specific service e.g. transcriptions services.

If you are intending to use, or are considering using a cloud service (defined as access to computing resources, on demand, via network), or plan on using a third party organisation to deliver a service that will involve the transfer of personal data, you should ensure that there is an agreement in place which provides adequate levels of protection so that UCL can meet its obligations and protect the rights of the participants involved.

Disordered eating in athletes

Please supply further details below, or seek advice by contacting the UCL Data Protection team data-protection@ucl.ac.uk.

L. NOTIFICATION

(Please note that notification is a prerequisite for registration)

Have you informed your department's Data Protection Coordinator about your project?

YES/NO

M. ETHICS

If you are seeking ethics approval for your research, please provide the relevant project ID Number below.

Any questions regarding ethical approval should be directed to the relevant Ethics Committee or Governance Administrator.

ethics Project ID Number:

Research Office Project ID Number:

Project ID Number:

If you are not seeking ethical approval for your project, please explain why below:

We are seeking departmental ethical approval through the Clinical Educational and Health Psychology Department. Once this form is returned with the registration number we will be able to provide the number for that departmental ethics application.

N. SPONSOR

Please provide details of the sponsor for this research below (if applicable). This can be an individual, company, institution, funding council, or another organisation which takes responsibility for the initiation, management and/or financing of the research.

M1.	Proposed sponsorship arrangement	N/A
a.	Details of sponsor	N/A

O. CHECKLIST

Please submit your application form together with the appropriate supporting documentation that may be applicable from the list below.

N1.	Documents to be included with the application form	Yes if attached. No if not relevant
a.	Participant information sheet (s)	Yes, attached.
b.	Participant consent form (s)	Yes, attached.
c.	Parent/guardian information sheet (s) and consent form (s) for research involving participants under the age of 18	Not relevant.
d.	Questionnaire	Yes, attached.
g.	Advertisement of project	Yes, attached.
h.	Other interview format (s)	Yes, attached.

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i.	Other documentation being used to invite/inform participants about the research	No.
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Approval We may have some questions about the information you provide, but you will normally be provided with a registration number within 10 working days of submitting the form. However, the period leading up to meetings of the Ethics Committee is always very busy, and you should allow more time for your application to be processed. It is therefore very important to check in good time whether you need to register your project.

Please note that Data Protection Registration numbers will NOT be issued when you submit an application form in person to the Data Protection Team.

Submit this form electronically and send to research.data-protection@ucl.ac.uk together with supporting documentation that you are intending to use. Please include 'Data Protection Registration' in the subject field.

This form will be returned to you with the appropriate registration number, which you may quote on your Ethics Application Form, or any other related forms.

Data Protection Registration (Office use only)	
UCL Data Protection Registration Number	Date issued



Ethics Application Form for Non-Invasive Research on Healthy Adults

SECTION A APPLICATION DETAILS

A1	Project details
Project title: Risk Factors of Eating Disorders and Disordered Eating in Athletes	
Date of submission: 14th December 2018	
Proposed start date: 14th January 2019	
Proposed end date: 14th January 2022	

A2	Principal researcher																
<i>(Note: A student – undergraduate, postgraduate or research postgraduate – cannot be the principal researcher for ethics purposes).</i>																	
Full name: Lucy Serpell																	
Position held: Associate Professor																	
Research Department: CEHP																	
The principal researcher must read and sign (electronic signature or scanned pdf with signature are acceptable) the following declaration. Please tick the box next to each of the statements below to acknowledge you have read them and provided all required information.																	
<table border="1" style="width: 100%;"> <tr> <td style="width: 80%;"> <ul style="list-style-type: none"> ▪ I will ensure that changes in approved research protocols are reported promptly and are not initiated without approval by the Departmental Ethics Committee, except when necessary to eliminate apparent immediate hazards to the participant. </td> <td style="width: 20%; text-align: center;">✓</td> </tr> <tr> <td> <ul style="list-style-type: none"> ▪ I have completed a risk assessment for this programme of research and hereby confirm that the risk assessment document will be discussed with any researcher/student involved in this programme of research (currently or in the future). I will ensure that all researchers/students sign the risk assessment form following this discussion. Risk assessment forms for projects can be downloaded from the Ethics section of the PaLS Intranet. </td> <td style="text-align: center;">✓</td> </tr> <tr> <td> <ul style="list-style-type: none"> ▪ I have completed the Information Governance training provided by ISG ▪ I have obtained approval from the UCL Data Protection Officer stating that this research project is compliant with the General Data Protection Regulation. My Data Protection Registration Number is: Z6364106/2019/01/79 You can find a data protection registration form at: http://www.ucl.ac.uk/legal-services/research Note: your data protection number could cover a whole programme of research. It is not always necessary to request a data protection number for each individual project. </td> <td style="text-align: center;">✓</td> </tr> <tr> <td> <ul style="list-style-type: none"> ▪ I have included examples of the Information Sheet and Consent Form for the proposed research. It will be made clear to the participants that they can withdraw from the study at any time, without giving a reason. </td> <td style="text-align: center;">✓</td> </tr> <tr> <td> <ul style="list-style-type: none"> ▪ I will ensure that all adverse or unforeseen problems arising from the research project are reported in a timely fashion to the UCL Research Ethics Committee. </td> <td style="text-align: center;">✓</td> </tr> <tr> <td> <ul style="list-style-type: none"> ▪ I will undertake to provide notification when the study is complete and if it fails to start or is abandoned. </td> <td style="text-align: center;">✓</td> </tr> <tr> <td> <ul style="list-style-type: none"> ▪ I have met with and advised students on the ethical aspects of this project/programme of research. </td> <td style="text-align: center;">✓</td> </tr> <tr> <td> <ul style="list-style-type: none"> ▪ I am satisfied that the proposed research complies with current professional, departmental and university guidelines. </td> <td style="text-align: center;">✓</td> </tr> </table>		<ul style="list-style-type: none"> ▪ I will ensure that changes in approved research protocols are reported promptly and are not initiated without approval by the Departmental Ethics Committee, except when necessary to eliminate apparent immediate hazards to the participant. 	✓	<ul style="list-style-type: none"> ▪ I have completed a risk assessment for this programme of research and hereby confirm that the risk assessment document will be discussed with any researcher/student involved in this programme of research (currently or in the future). 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<ul style="list-style-type: none"> ▪ I am satisfied that the proposed research complies with current professional, departmental and university guidelines. 	✓																
Signature:																	
Date: 23/1/19																	

Disordered eating in athletes

A3	Contact details
Principal Researcher	
Full name: Lucy Serpell	
Position held: Associate Professor	
Research Department:	
Email: [REDACTED]	Telephone: [REDACTED]
Additional applicant 1	
Full name: Hannah Stoyel	
Position held: <i>Research Student</i>	
Research Department: CEHP	
Email: [REDACTED]	Telephone: [REDACTED]
Additional applicant 2	
Full name: Rebecca Clawson	
Position held: <i>Taught Master's Student</i>	
Research Department: Division of Medicine??	
Email: [REDACTED]	Telephone: [REDACTED]

(Add further details on a separate sheet if there are more applicants to be covered by this form)

A4	Approval from the Departmental Ethics Committee
<i>(Approval cannot be given by the principal researcher of this project – if necessary the application must be sent to an Ethics Officer from a different Research Department, or to the College Ethics Committee, for approval)</i>	
Declaration by the Research Department Ethics Chair:	
I have reviewed this project and I approve it. <input type="checkbox"/>	
The project is registered with the UCL Data Protection Officer and a formal signed risk assessment form has been completed.	
Allocated Departmental Project ID Number for the approved application:	

Name of the Research Department Ethics Chair (type in):	
Date:	

2

both the recruitment and data collection phases, email addresses and phone numbers will be collected from participants, however, this information will be stored securely according to GDPR and data protection guidance. All participants will be above the age of 18 and be a high-level athlete participating in high level sport. High-level sport is defined as being coached in the sport at a minimum of 10hours/week and representing a team at consistent competitions.

The main focus of the current research is on psychological features which may elevate risk for eating disorders, and so most of the testing will focus on different psychological measures. The majority of the measures have been chosen from previous related research that has tested the theoretical model alluded to above (see Petrie et al., 2014; Petrie et al., 2009b for scales unless otherwise noted). Novel measures will be created only where strictly necessary. Additionally, short versions will be chosen when possible to minimise any burden to participants. This research will be carried out using online questionnaires for the psychological and demographic information.

1. Demographic and Training Information: Information about age, gender, sport type, level of competition, hours spent training will be included.
2. Self-reported height and weight: Height and weight will be self-reported such that no invasive skin folds measurements need to be taken. All the athletes should have easy access to scales and stadiometers (height measures) at their respective clubs. Female participants will also be asked about menstrual cycle history as there is evidence that menstrual irregularities are related to eating disorder status.
3. Athletic Identity: This will be measured with a simple yes or no to determine if that participant identifies as an athlete, something that has shown to be important in previous disordered eating literature.
4. EDE-Q and EDI-2 (Fairburn & Beglin, 2008; Garner, Olmsted, & Polivy, 1983): Global scores will determine level of disordered eating symptomology in the sample. The subscales in these questionnaires will help determine if factors such as body dissatisfaction and internalisation of the thin ideal, and food restraint are relevant factors in the development or worsening disordered eating/eating disorders in these high-level athletes. It will be the scores on these measures that will determine which participants are invited to take part in the qualitative semi-structured interviews that will take place in person or appropriate video conferencing when travel is not possible.
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7. The Sociocultural Attitudes Towards Appearance Questionnaire 3 (Heinberg & Thompson, 1995): Used in previous work to measure internalisation.
8. Modelled Behaviour of Friends and Family: Questions related to modelling of friends and

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9. Veganism/other restricting diets: In order for this research to remain relevant to the current culture will also ask about any diets the participants prescribe to that involve restricting certain foods or groups of foods to determine if following these diets at time 1 has any impact on DE/ED at time 3.

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Please note that the experiment described is the first in a series of similar experiments in this programme of research. New experiments will be added by amendment.

B2 Will the results be disseminated outside the standard academic outlets? Yes No
If you answered 'yes', please specify:

The information collected may also be shared with those teams who put forward participants to volunteer for the study, but only summaries of the results will be shared to inform clubs and coaches of the general findings if desired.

B3 Please outline any ethical issues that might arise from the proposed study and explain how they will be addressed.

Saliva samples obtained from the participants will not be analysed for any DNA information. Furthermore, the samples will be destroyed once processed. Participating in this research will mean taking part in studies that involve mention and discussion of eating disorder symptomology, which some participants may find difficult. To ease this, The participants

Disordered eating in athletes

will be asked to give fully informed consent before commencing participation and will be reminded that they are free and able to withdraw from participation at any point. The data from those participants who choose to withdraw will be destroyed.
Sign posting and support will also be offered in case any participants find participation distressing. If participation has raised any issues for them regarding their attitudes toward eating or exercise, we will advise them to consider contacting their GP and will provide information directing them to BEAT website and helpline.

SECTION C PARTICIPANT DETAILS

C1	Participants to be studied	
	Number of volunteers:	Up to 60 (depending on power calculations)
	Upper age limit:	30
	Lower age limit:	18
C2	Payment	
	Will payment or any other incentive (e.g. a gift voucher or free services) be made to any research participant?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
C3	Recruitment	
	(i) Describe how potential participants will be identified: Participants will only be identified by a unique subject number. No personal or identifiable information will be stored with the data.	
	(ii) Describe how potential participants will be approached and recruited: Potential participants will be identified by contacting club teams around the country based off of internet research, the teams registered with the English Institute of Sport, and other similar governing bodies. Those potential participants will be approached and recruited through club contact, at competitions, and online.	
C4	Will the participants participate on a fully voluntary basis?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
	Will UCL students be involved as participants in the research project?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
C5	Deception	
	Will any form of deception be used that raises ethical issues? If so, please explain.	
	No.	
C6	Will you provide a full debriefing to the participants?	Yes No
	If 'No', please explain why below.	

6

C7	Information Sheets And Consent Forms
<p>You must attach the final information sheet and consent form for your participants with this application. This will already have received approval from the Data Protection Team. Templates are available on the PaLS intranet (please note that these changed at the end of 2017, so as to be compliant with new Data Protection regulations [GDPR]). The information sheet needs to contain sufficient detail to enable informed consent. However, the information must be provided in lay language and should look different from the summary of research provided in section B1.</p> <p>The template information and consent forms should give you an idea of the level of detail required. NOTE THAT MAILING AND E-MAIL ADDRESS SHOULD BOTH BE INCLUDED IN RESEARCHER CONTACT DETAILS. All information sheets and consent forms should include a) Institutional headed paper, b) information regarding the RD Ethics Chair who approved your study, c) project ethics ID. N.B. Where consent will be obtained online, the information sheet and consent form should be accurate to reflect that.</p> <p>When applying for an ethics approval for a broader research programme, you should provide an example information sheet and consent form for a representative study/experiment. You do not need to provide further examples, unless future studies/experiments substantially depart from the proposed programme of research</p>	

SECTION B PROJECT DETAILS	
B1	<p>Summary of Research</p> <p>It is particularly important to provide sufficient detail of the research protocol and the measures that will be used, to enable evaluation of the application on ethical grounds. It is also important to clearly demonstrate that the proposed measures are 'innocuous' and fall within PaLS Ethics remit.</p> <p>Please provide a brief summary of the project/programme of research including</p> <ul style="list-style-type: none"> • Background • Aims • Participants and recruitment • Procedure (including whether face-to-face or online study) • Measures • Examples of measures (tests, questionnaires, interviews etc.) as per RD guidelines <p>NB When providing examples of each measure you plan to use, please select the most emotive/distressing examples so that the Ethics Chair can judge the potential for causing any distress.</p> <p>Background: Based on the theoretical model by Petrie and Greenleaf (2007), this research will investigate links between disordered eating or eating disorders and high-level sport participation. This programme of research seeks to understand whether the unique lifestyle of high-level athletes would mean a unique risk profile for eating disorders/disordered eating (ED/DE) for this population and if subsequently a theoretical model that includes both psychological and physiological markers specific to high level athletes is warranted.</p> <p>The proposed programme of research has three components. The first is a cross-sectional quantitative design in which psychological and biological information (saliva samples to measure leptin, ghrelin etc) is collected at Time 1 and analysed for any statistically significant relationship to eating disorder symptomology. The second is a longitudinal component in which a paired down number of tests and questionnaires will be chosen for re-testing at Time 2 (six months after T1) and at Time 3 (nine months after T1). Finally, a qualitative element will be included. Semi-structured interviews will be conducted at T1 with those participants screened to be eligible to examine what sport pressures they have experienced and how these may contribute to eating disorder symptomology.</p> <p>Aims: The aims of the current study are to the answer the following questions:</p> <ol style="list-style-type: none"> 1. What risk factors, psychological and otherwise, cause the development or worsening of eating disorders/disordered eating in high level athletes? 2. How does the existing theoretical model need to be adjusted? What biological factors need to be included? 3. Through qualitative interviews, what unique to sport participation is related to the development of disordered eating and eating disorder psychopathology? <p>Participants and Recruitment: Participants will be recruited through online advertising, and by directly contacting various sport teams around the country. Hannah Stoyel has professional links to a number of sporting organisations. During</p>

Ethics Amendment

Amendment Approval Request Form

1	Project ID Number: CEHP2018573	Name and Address of Principal Investigator: Lucy Serpell 1-19 Torrington Place
2	Project Title: Risk Factors of Eating Disorders and Disordered Eating in Athletes	
3	Type of Amendment/s (tick as appropriate)	
	Research procedure/protocol (including research instruments) <input checked="" type="checkbox"/> Participant group <input type="checkbox"/> Sponsorship/collaborators <input type="checkbox"/> Extension to approval needed (extensions are given for one year) <input type="checkbox"/> Information Sheet/s <input type="checkbox"/> Consent form/s <input type="checkbox"/> Other recruitment documents <input type="checkbox"/> Principal researcher/medical supervisor* <input type="checkbox"/> Other <input type="checkbox"/> <i>*Additions to the research team other than the principal researcher, student supervisor and medical supervisor do not need to be submitted as amendments but a complete list should be available upon request *</i>	
4	Justification (give the reasons why the amendment/s are needed) We would like to amend our ethics to include collection and analysis of oral mucosa transudate which will allow for cheaper, more accurate, and easier collection of information in oral fluids. This type of oral fluid collection is also easier for the participants as well and can be mailed into the lab rather than having to send a researcher to each location of the participants.	
5	Details of Amendments (provide full details of each amendment requested, state where the changes have been made and attach all amended and new documentation) In addition to saliva collection and analysis, we would like to submit for an amendment in which the researchers collect oral mucosa transudate. This is done with a quick swab of the mouth. The participants will find this collection type even easier than saliva samples. Oral mucosa is also more stable, and so does not require immediate refrigeration which was incurring high costs for the project. Collecting oral mucosa is safe and non-invasive. Participants will be informed of this subtle change should ethics be granted.	
6	Ethical Considerations (insert details of any ethical issues raised by the proposed amendment/s) None, as the population is not a vulnerable population, and this procedure is non-invasive and safe.	
7	Other Information (provide any other information which you believe should be taken into account during ethical review of the proposed changes)	

Declaration (to be signed by the Principal Researcher)

- I confirm that the information in this form is accurate to the best of my knowledge and I take full responsibility for it.
- I consider that it would be reasonable for the proposed amendments to be implemented.
- For student projects, I confirm that my supervisor has approved my proposed modifications.

Signature: 

Date: 22.2.19

FOR OFFICE USE ONLY:

Amendments to the proposed protocol have been approved by the Research Ethics Committee.

Signature of the REC Chair: 

Date: 08/03/2019



Information and Consent Forms

Participant Information

Sheet For Adult Athletes

UCL Research Ethics Committee Approval ID Number: CEHP2018573

YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET

Title of Study: Risk factors of disordered eating and eating disorders in athletes

Department: Department of Clinical, Education and Health Psychology

Hannah Stoyel
1-19 Torrington Place
London, UK
WC1E 7HB

Dr Lucy Serpell
1-19 Torrington Place
London
WC1E 7HB

Rebecca Clawson

Dear Potential Participant,

You have been invited to take part in a research project that will form part of a PhD project and MSc Dissertation that looks at psychological and biological markers. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, please read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear, or you would like more information. Thank you for taking the time to read this information.

The Purpose of this Project:

The purpose of this study is to help us understand what factors put athletes at a greater risk for the development of disordered eating symptomology, and therefore what can be done to help those at risk. This study examines psychological and biological factors that be related to eating behaviour in high-level athletes. In this study you will complete several psychological questionnaires, all online, be asked to record your food intake and sleep on your phone and record your use of social media. Finally, you will be asked to

Disordered eating in athletes

send in a saliva sample (in the attached tube). Some participants may also be asked to partake in an hour-long interview over video-conferencing, so that their experience in high-level sport can be discovered more fully.

Why have I been chosen?

You have been chosen to take part due to your participation in high-level sport. Those athletes who train for more than 10 hours per week in their sport and compete have been contacted and invited to participate.

Do I have to take part?

It is entirely up to you to decide whether or not to take part. If you choose not to participate, you won't incur any penalties or lose any benefits to which you might have been entitled. However, if you do decide to take part, you will be given this information sheet to keep and asked to sign a consent form. Even after agreeing to take part, you can still withdraw at any time and without giving a reason, and it will not affect any benefits that you are entitled to receive. If you choose to withdraw from the study, your answers will be destroyed and not used for any reason in the data analysis.

What will happen if I do take part?

Your informed consent will be recorded by signing the below consent form and filed away in a secure location. You will be asked to participate three times over the next 12-month period, however you can do this from the location of your choice, no visits to the lab are required unless you'd like to give your samples at UCL. You may also be invited to participate in future research. The questionnaires, sleep pattern, and social media use will be analysed using statistical measures. The saliva samples will be analysed using laboratory technology. Each time you are asked to participate it will take about 90 min (excluding possible interview), you can take as many breaks as needed, but all questionnaires, saliva samples, and other information must be recorded within a one-week period. If asked to do an interview (approx. 60 min) this the conversation will be recorded and stored as pseudonyms. All data will be collected and stored in accordance with the Data Protection Act 1998. Your data will be stored for a 24-month period. If you wish for your data to be removed from the study, please inform the principle researcher no later than one week after your third round of involvement in the research.

Will I be recorded and how will the recorded media be used?

If you are asked to participate and willing choose to participate in further qualitative interviews, audio recordings of these activities will be created. They will be used for analysis and illustration in conference presentations and lectures. No other use of them will be made of them without further written permission from you. No one outside this project will be allowed access to the recordings.

What are the possible benefits of taking part?

While there are not immediate benefits of taking part in this research project, future possible benefits of taking part in the research is that you will have the opportunity to learn how your psychological and biological information may be impacting your sport performance and well-being. It is also hoped that by your participating in this research project that we can better understand disordered eating in athletes and further educate coaches and athletes.

What are the possible risks of taking part?

Slight discomfort when discussing or answering questions regarding eating attitudes may arise. Access to the BEAT helpline will be available should this discomfort arise. The researchers will

Disordered eating in athletes

Should any unexpected discomforts, disadvantages and risks to you, the participant arise during the research, the researchers will bring it your immediate attention.

What if something goes wrong?

Your participation in the research is unlikely to cause any distress or adverse reactions. However, if any unexpected risks arise, we, as researchers, will inform you immediately. If you should become distressed at any point please discuss with the researchers. If participation has raised any issues for you consider contacting your GP or visit the BEAT website at <https://www.beateatingdisorders.org.uk/> or phone them on 0808 801 0677.

If at any point during your participation in this research you wish to raise a complaint please contact the principal investigator, Lucy Serpell, whose contact details are above. Should you feel that you need to take the matter further you may contact the chair of the UCL Research Ethics Committee – ethics@ucl.ac.uk

Will my taking part in this project be kept confidential?

All of the information that we collect about you and your sporting participation during the course of this research will be kept strictly confidential. In any ensuing publications, presentations, or reports you will not be able to be identified in any way. Only the researchers listed above will have access to any of the stored information collected about you.

Limits to Confidentiality:

As a potential participant you should be aware of several limits to confidentiality which are stated as follows:

- Please note that assurances on confidentiality will be strictly adhered to unless evidence of wrong doing or potential harm is uncovered. In such cases the University may be obliged to contact relevant statutory bodies/agencies.
- Please note that confidentiality will be maintained as far as it is possible, unless during our conversation I hear anything which makes me worried that someone might be in danger of harm, I might have to inform relevant agencies of this.
- Please note that confidentiality may not be guaranteed; due to the limited size of the participant sample.
- Confidentiality will be respected subject to legal constraints and professional guidelines.
- Confidentiality will be respected unless there are compelling and legitimate reasons for this to be breached. If this was the case, we would inform you of any decisions that might limit your confidentiality.
- Confidentiality may be limited and conditional and the researcher has a duty of care to report to the relevant authorities possible harm/danger to the participant or others.

Results of the project will be published in academic journals, academic posters, and be presented at conferences that are focused on the topic of sport science and psychology. The results will also form parts of PhD thesis and MSc dissertations. The results will be stored for later use in future research.

Local Data Protection Privacy Notice:

The controller for this project will be University College London (UCL). The UCL Data Protection Officer provides oversight of UCL activities involving the processing of personal data, and can be contacted at data-protection@ucl.ac.uk

Disordered eating in athletes

This ‘local’ privacy notice sets out the information that applies to this particular study. Further information on how UCL uses participant information can be found in our ‘general’ privacy notice:

The information that is required to be provided to participants under data protection legislation (GDPR and DPA 2018) is provided across both the ‘local’ and ‘general’ privacy notices.

The categories of personal data used will be as follows:

- Name
- Email address
- Phone Number
- Sport Team

The lawful basis that would be used to process your *personal data* will be performance of a task in the public interest.

The lawful basis used to process *special category personal data* will be for scientific and historical research or statistical purposes.

Your personal data will be processed so long as it is required for the research project. If we are able to anonymise or pseudonymise the personal data, you provide we will undertake this task and will endeavour to minimise the processing of personal data wherever possible.

If you are concerned about how your personal data is being processed, or if you would like to contact us about your rights, please contact UCL in the first instance at data-protection@ucl.ac.uk.

The relevant contact information can be found at the top of this information sheet. You will be given a copy of this sheet as well as a copy of the consent form for your own records.

Thank you for reading this information sheet and for considering taking part in this research study.



T2& T3: Participant Information Sheet For Adult Athletes
UCL Research Ethics Committee Approval ID Number: CEHP2018573

YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET

Title of Study: Risk factors of disordered eating and eating disorders in athletes
Department: Department of Clinical, Education and Health Psychology

Hannah Stoyel
1-19 Torrington Place
London, UK
WC1E 7HB

Dr Lucy Serpell
1-19 Torrington Place
London
WC1E 7HB

Dear Potential Participant,

You have been invited to take part in a research project that will form part of a PhD project that looks at psychological markers that can explain eating attitudes. The below information is pertinent to this data collection time point. It varies slightly from the one you saw at Time 1. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, please read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear, or you would like more information, or a copy from the information presented to you at Time 1. Thank you for taking the time to read this information.

The Purpose of this Project:

The purpose of this study is to help us understand what factors put athletes at a greater risk for the development of disordered eating symptomology, and therefore what can be done to help those at risk. This study examines psychological factors that be related to eating behaviour in athletes. In this study you will complete several psychological questionnaires, all online.

Why have I been chosen?

You have been chosen to take part due to your participation in high-level sport, and because you participated in this study during the first data collection. Those adult athletes who train for more than 10 hours per week in their sport have been contacted and invited to participate.

Do I have to take part?

It is entirely up to you to decide whether or not to take part. If you choose not to participate, you won't incur any penalties or lose any benefits to which you might have been entitled. However, if you do decide to take part, you will be given this information

Disordered eating in athletes

sheet to keep and asked to sign a consent form. Even after agreeing to take part, you can still withdraw at any time and without giving a reason, and it will not affect any benefits that you are entitled to receive. If you choose to withdraw from the study, your answers will be destroyed and not used for any reason in the data analysis.

What will happen if I do take part?

Your informed consent will be recorded by signing the below consent form and filed away in a secure location. Overall, you will be asked to participate three times (this being the second of the three time points) over a 12-month period, however you can do this from the location of your choice, no visits to the lab are required unless you'd like to give your samples at UCL (collected Time 1). You may also be invited to participate in future research. The questionnaires, sleep pattern, and social media use will be analysed using statistical measures. Each time you are asked to participate it will take about 30 min (excluding possible interview). All data will be collected and stored in accordance with the Data Protection Act 1998. Your data will be stored for a 24-month period. If you wish for your data to be removed from the study, please inform the principle researcher no later than one week after your third round of involvement in the research.

Will I be recorded and how will the recorded media be used?

No qualitative interviews will be asked for during this time point, and so no recordings will be made.

What are the possible benefits of taking part?

While there are not immediate benefits of taking part in this research project, future possible benefits of taking part in the research is that you will have the opportunity to learn how your psychological and biological information may be impacting your sport performance and well-being. It is also hoped that by your participating in this research project that we can better understand disordered eating in athletes and further educate coaches and athletes.

What are the possible risks of taking part?

Slight discomfort when discussing or answering questions regarding eating attitudes may arise. Access to the BEAT helpline will be available should this discomfort arise. Should any unexpected discomforts, disadvantages and risks to you, the participant, arise during the research, the researchers will bring it your immediate attention.

What if something goes wrong?

Your participation in the research is unlikely to cause any distress or adverse reactions. However, if any unexpected risks arise, we, as researchers, will inform you immediately. If you should become distressed at any point please discuss with the researchers. If participation has raised any issues for you consider contacting your GP or visit the BEAT website at <https://www.beateatingdisorders.org.uk/> or phone them on 0808 801 0677.

If at any point during your participation in this research you wish to raise a complaint please contact the principal investigator, Lucy Serpell, whose contact details are above. Should you feel that you need to take the matter further you may contact the chair of the UCL Research Ethics Committee – ethics@ucl.ac.uk

Will my taking part in this project be kept confidential?

All of the information that we collect about you and your sporting participation during the course of this research will be kept strictly confidential. In any ensuing publications, presentations, or reports you will not be able to be identified in any way. Only the

Disordered eating in athletes

researchers listed above will have access to any of the stored information collected about you.

Limits to Confidentiality:

As a potential participant you should be aware of several limits to confidentiality which are started as follows:

- Please note that assurances on confidentiality will be strictly adhered to unless evidence of wrong doing or potential harm is uncovered. In such cases the University may be obliged to contact relevant statutory bodies/agencies.
- Please note that confidentiality will be maintained as far as it is possible, unless during our conversation I hear anything which makes me worried that someone might be in danger of harm, I might have to inform relevant agencies of this.
- Please note that confidentiality may not be guaranteed; due to the limited size of the participant sample.
- Confidentiality will be respected subject to legal constraints and professional guidelines.
- Confidentiality will be respected unless there are compelling and legitimate reasons for this to be breached. If this was the case, we would inform you of any decisions that might limit your confidentiality.
- Confidentiality may be limited and conditional and the researcher has a duty of care to report to the relevant authorities possible harm/danger to the participant or others.

Results of the project will be published in academic journals, academic posters, and be presented at conferences that are focused on the topic of sport science and psychology. The results will also form parts of PhD thesis and MSc dissertations. The results will be stored for later use in future research.

Local Data Protection Privacy Notice:

The controller for this project will be University College London (UCL). The UCL Data Protection Officer provides oversight of UCL activities involving the processing of personal data, and can be contacted at data-protection@ucl.ac.uk

This 'local' privacy notice sets out the information that applies to this particular study. Further information on how UCL uses participant information can be found in our 'general' privacy notice:

The information that is required to be provided to participants under data protection legislation (GDPR and DPA 2018) is provided across both the 'local' and 'general' privacy notices.

The categories of personal data used will be as follows:

Name
Email address
Sport Team

The lawful basis that would be used to process your *personal data* will be performance of a task in the public interest.

The lawful basis used to process *special category personal data* will be for scientific and historical research or statistical purposes.

Your personal data will be processed so long as it is required for the research project. If we are able to anonymise or pseudonymise the personal data, you provide we will

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undertake this task and will endeavour to minimise the processing of personal data wherever possible.

If you are concerned about how your personal data is being processed, or if you would like to contact us about your rights, please contact UCL in the first instance at data-protection@ucl.ac.uk.

The relevant contact information can be found at the top of this information sheet. You will be given a copy of this sheet as well as a copy of the consent form for your own records.

Thank you for reading this information sheet and for considering taking part in this research study.

Disordered eating in athletes

****This is a template form and must be tailored to meet the needs of your study and should be displayed on departmental headed paper.**

Consent form:

FOR ADULT ATHLETES IN RESEARCH STUDIES

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Study: Risk factors of disordered eating and eating disorders in athletes

Department: Department of Clinical, Education and Health Psychology

Name and Contact Details of the Researcher(s):

Hannah Stoyel

Name and Contact Details of the Principal Researcher:

Dr Lucy Serpell

1-19 Torrington Place

London

WC1E

Name and Contact Details of the UCL Data Protection Officer: Lee Shailer data-protection@ucl.ac.uk

This study has been approved by the UCL Research Ethics Committee: Project ID number: _____

Thank you for considering taking part in this research. The person organising the research must explain the project to you before you agree to take part. If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

I confirm that I understand that by ticking/initialling each box below I am consenting to this element of the study. I understand that it will be assumed that unticked/initialled boxes means that I DO NOT consent to that part of the study. I understand that by not giving consent for any one element that I may be deemed ineligible for the study.

		Tick Box
1.	<p>*I confirm that I have read and understood the Information Sheet for the above study. I have had an opportunity to consider the information and what will be expected of me. I have also had the opportunity to ask questions which have been answered to my satisfaction</p> <p><i>And would like to take part in (please tick one or more of the following)</i></p> <ul style="list-style-type: none">- Questionnaires- Saliva Sampling- A possible individual interview	

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2.	*I consent to participate in the study. I understand that my personal information <i>regarding my eating habits, sleep schedule, social media use, sport participation, and saliva</i> will be used for the purposes explained to me. I understand that according to data protection legislation, ‘public task’ will be the lawful basis for processing.	
3.	<p>Use of the information for this project only</p> <p>*I understand that all personal information will remain confidential and that all efforts will be made to ensure I cannot be identified</p> <p>I understand that my data gathered in questionnaire form and from the saliva this study will be stored anonymously and securely. It will not be possible to identify me in any publications.</p> <p>I understand that my data from a possible interview will be pseudonymised, and that it will not be possible to identify me in any publications.</p>	
4.	*I understand that my information may be subject to review by responsible individuals from the University for monitoring and audit purposes.	
5.	I understand the potential risks of participating and the support that will be available to me should I become distressed during the course of the research.	
6.	I understand the direct/indirect benefits of participating.	
7.	I understand that the data will not be made available to any commercial organisations but is solely the responsibility of the researcher(s) undertaking this study.	
8.	I understand that I will not benefit financially from this study or from any possible outcome it may result in in the future.	
9.	I understand that I will be compensated for the portion of time spent in the study (if applicable) or fully compensated if I choose to withdraw.	
10.	I agree that my anonymised and/or pseudonymised research data may be used by others for future research. No one will be able to identify you when this data is shared.	
11.	I understand that the information I have submitted will be published as a report and I wish to receive a copy of it. Yes/No	
12.	<p>Should I be chosen for an interview, I consent to my interview being audio/video recorded and understand that the recordings will be:</p> <ul style="list-style-type: none"> - Stored using pseudonyms, using password-protected software and will be used for training, quality control, audit and specific research purposes. <p><i>To note:</i> If you do not want your participation recorded you can still take part in the study.</p>	

Disordered eating in athletes

13.	I hereby confirm that I understand the inclusion criteria as detailed in the Information Sheet and explained to me by the researcher.	
14.	I hereby confirm that: (a) I understand the exclusion criteria as detailed in the Information Sheet and explained to me by the researcher; and (b) I do not fall under the exclusion criteria.	
15.	I agree that my GP may be contacted if any unexpected results are found in relation to my health.	
16.	I have informed the researcher of any other research in which I am currently involved or have been involved in during the past 12 months.	
17.	I am aware of who I should contact if I wish to lodge a complaint.	
18.	Use of information for this project and beyond. This data will not be stored for over 24 months and will only be used in relevant future research and presented at academic or sporting conferences. You will not be able to be identified in any of these instances. I would be happy for the data I provide to be archived at UCL for the next 24 months. I understand that other authenticated researchers will have access to my anonymised and/or pseudonymised data.	

If you would like your contact details to be retained so that you can be contacted in the future by UCL researchers who would like to invite you to participate in follow up studies to this project, or in future studies of a similar nature, please tick the appropriate box below.

<input type="checkbox"/>	Yes, I would be happy to be contacted in this way	
<input type="checkbox"/>	No, I would not like to be contacted	

Name of participant

Date

Signature

Disordered eating in athletes

Scales and Questionnaires

1. Demographics

Age
Gender
Sport type
Years done sport
Average hours in training per week
Best competition results

2. Height and Weight Information

Height
Weight

3. Athletic Identity

Do you identify as an athlete?

BPSS-R (for male AND female athletes)

Using the scale provided, please rate how satisfied you have been with each body part listed below during the past three (3) months:

Extremely Dissatisfied 1 2 3 4 5 6 Extremely Satisfied

1. Weight
2. Hair
3. Complexion
4. Overall Face
5. Arms
6. Stomach
7. Buttocks
8. Hips
9. Upper Thighs
10. Breasts/Chest
11. General Muscle Tone
12. Overall Body

Team weigh-ins

Being on a team where they were weighed

1. Regularly – “Does your team conduct regular ‘weigh-ins,’ YES or NO, and
2. “On average, how many times do you weigh yourself per week?”

Perceived Sociocultural Pressure Scale

Please circle the response that best captures your own experience: none some a lot
1, 2, 3, 4, 5

1. I've felt pressure from my friends to lose weight
2. I've noticed a strong message from my friends to have a thin body
3. I've felt pressure from my family to lose weight
4. I've noticed a strong message from my family to have a thin body
5. I've felt pressure from people I've dated to lose weight
6. I've noticed a strong message from people I've dated to have a thin body
7. I've felt pressure from the media (e.g., TV, magazines) to lose weight
8. I've noticed a strong message from the media to have a thin body
9. Family members tease me about my weight or body shape

Disordered eating in athletes

10. Kids at school tease me about my weight or body shape

Scoring:

Circled responses should be averaged to form a scale score.

MASS (for male AND female athletes) 19

Using the scale that is located next to each question, circle the answer that best described how you have thought, felt or behaved during the past three (3) months. There are no right or wrong answers. Please answer each question honestly.

Definitely disagree (1) Mostly disagree (2) Neither agree nor disagree (3)
Mostly agree (4) Definitely agree (5)

1. When I look at my muscles in the mirror, I often feel satisfied with my current muscle size.
2. If my schedule forces me to miss a day of working out with weights, I feel very upset.
3. I often ask friends and/or relatives if I look big.
4. I am satisfied with the size of my muscles.
5. I often spend money on muscle building supplements.
6. It is OK to use steroids to add muscle mass.
7. I often feel like I am addicted to working out with weights.
8. If I have a bad workout, it is likely to have a negative effect on the rest of my day.
9. I would try anything to get my muscles to grow.
10. I often keep working out even when my muscles or joints are sore from previous workouts.
11. I often spend a lot of time looking at my muscles in the mirror.
12. I spend more time in the gym working out than most others who work out.
13. In order to get big, one must be able to ignore a lot of pain.
14. I am satisfied with my muscle tone/definition.
15. My self-worth is very focused on how my muscles look.
16. I often ignore a lot of physical pain while I am lifting in order to get bigger.
17. I must get bigger muscles by any means necessary.
18. I often seek reassurance from others that my muscles are big enough.
19. I often find it difficult to resist checking the size of my muscles.

Reasons for Exercise Inventory (REI; Silberstein et al., 1988) (for male AND female athletes)

As an athlete, a primary reason you may exercise is to improve your sport performance. However, there may be other reasons you exercise as well. What we want to know are the reasons you actually have for exercising. To help us determine that, please respond to the items below as each one honestly applies to the actual reasons for exercising and training. In other words, to what extent is each of the following an important reason that you have for exercising? Use the scale below, ranging from 1 to 7, in giving your answers.

1 2 3 4 5 6 7
Not at all

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Important

Moderately Important

Extremely Important

I exercise...

1. To be slim
2. To lose weight
3. To maintain my current weight
4. To improve my muscle tone
5. To improve my strength
6. To improve my endurance, stamina
7. To improve my flexibility, coordination
8. To cope with sadness, depression
9. To cope with stress, anxiety
10. To increase my energy level
11. To improve my mood
12. To improve my cardiovascular fitness
13. To improve my overall health
14. To increase my resistance to illness and disease
15. To maintain my physical well-being
16. To improve my appearance
17. To be attractive to other people
18. To be sexually desirable
19. To meet new people
20. To socialize with friends
21. To have fun
22. To redistribute my weight
23. To improve my overall body shape
24. To alter a specific area of my body

ASKED DURING TIME 1:

4. Demographics

Age

Gender

Sport type

Years done sport

Average hours in training per week

Level (elite/non-elite)

Off season/ Currently Competing

5. Height and Weight Information

Height-- cm

Weight-- KG

6. EDI-2

The items ask about your attitudes, feelings and behaviour. Some of the items relate to food or eating. Other items ask about your feelings about yourself.

For each item, decide if the item is true about you ALWAYS (A), USUALLY (U), OFTEN (O), SOMETIMES (S), RARELY (R), or NEVER (N). Circle the letter that corresponds to your rating. For example, if your rating for an item is OFTEN, you would circle the (O) for that item. Respond to all of the items, making sure that you

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circle the letter for the rating that is true about you. If you need to change an answer, make an 'X' through the incorrect letter and then circle the correct one.

- 1) I eat sweets and carbohydrates without feeling nervous A U O S R N
- 2) I think that my stomach is too big A U O S R N
- 3) I wish that I could return to the security of my childhood A U O S R N
- 4) I eat when I am upset A U O S R N
- 5) I stuff myself with food A U O S R N
- 6) I wish that I could be younger A U O S R N
- 7) I think about dieting A U O S R N
- 8) I get frightened when my feelings are too strong A U O S R N
- 9) I think that my thighs are too large A U O S R N
- 10) I feel ineffective as a person A U O S R N
- 11) I feel extremely guilty after overeating A U O S R N
- 12) I think that my stomach is just the right size A U O S R N
- 13) Only outstanding performance is good enough in my family A U O S R N
- 14) The happiest time in life is when you are a child A U O S R N
- 15) I am open about my feelings A U O S R N
- 16) I am terrified of gaining weight A U O S R N
- 17) I trust others A U O S R N
- 18) I feel alone in the world A U O S R N
- 19) I feel satisfied with the shape of my body A U O S R N
- 20) I feel generally in control of things in my life A U O S R N
- 21) I get confused about what emotion I am feeling A U O S R N
- 22) I would rather be an adult than a child A U O S R N
- 23) I can communicate with others easily A U O S R N
- 24) I wish I were someone else A U O S R N
- 25) I exaggerate or magnify the importance of weight A U O S R N
- 26) I can clearly identify what emotion I am feeling A U O S R N
- 27) I feel inadequate A U O S R N
- 28) I have gone on eating binges where I have felt that I could not stop A U O S R N
- 29) As a child, I tried hard to avoid disappointing parents and teachers A U O S R N
- 30) I have close relationships A U O S R N
- 31) I like the shape of my buttocks A U O S R N
- 32) I am preoccupied with the desire to be thinner A U O S R N
- 33) I don't know what's going on inside me A U O S R N
- 34) I have trouble expressing my emotions to others A U O S R N
- 35) The demands of adulthood are too great A U O S R N
- 36) I hate being less than best at things A U O S R N
- 37) I feel secure about myself A U O S R N
- 38) I think about bingeing (overeating) A U O S R N
- 39) I feel happy that I am not a child anymore A U O S R N
- 40) I get confused as to whether or not I am hungry A U O S R N
- 41) I have a low opinion of myself A U O S R N
- 42) I feel that I can achieve my standards A U O S R N
- 43) My parents have expected excellence of me A U O S R N
- 44) I worry that my feelings will get out of control A U O S R N
- 45) I think my hips are too big A U O S R N
- 46) I eat moderately in front of others & stuff myself when they're gone A U O S R N
- 47) I feel bloated after eating a normal meal A U O S R N

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- 48) I feel that people are happiest when they are children A U O S R N
- 49) If I gain a pound, I worry that I will keep gaining A U O S R N
- 50) I feel that I am a worthwhile person A U O S R N
- 51) When I am upset, I don't know if I am sad, frightened, or angry A U O S R N
- 52) I feel that I must do things perfectly or not do them at all A U O S R N
- 53) I have the thought of trying to vomit in order to lose weight A U O S R N
- 54) I need to keep people at a certain distance (feel uncomfortable if someone tries to get too close) A U O S R N
- 55) I think that my thighs are just the right size A U O S R N
- 56) I feel empty inside (emotionally) A U O S R N
- 57) I can talk about personal thoughts or feelings A U O S R N
- 58) The best years of your life are when you become an adult A U O S R N
- 59) I think my buttocks are too large A U O S R N
- 60) I have feelings I can't quite identify A U O S R N
- 61) I eat or drink in secrecy A U O S R N
- 62) I think that my hips are just the right size A U O S R N
- 63) I have extremely high goals A U O S R N
- 64) When I am upset, I worry that I will start eating A U O S R N

EDE-Q 36

The following questions are concerned with the PAST FOUR WEEKS ONLY (28 days). Please read each question carefully and circle the appropriate number on the right. Please answer all the questions.

On how many days of the past 28 days...	No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
1. Have you been deliberately <u>trying</u> to limit the amount of food you eat to influence your shape or weight?	0	1	2	3	4	5	6
2. Have you gone for long periods of time (8 hours or more) without eating anything in order to influence your shape or weight?	0	1	2	3	4	5	6
3. Have you <u>tried</u> to avoid eating any foods which you like in order to influence your shape or weight?	0	1	2	3	4	5	6
4. Have you <u>tried</u> to follow definite rules regarding your eating in order to influence your shape or weight; for example, a calorie limit, a set amount of food or rules about what or when you should eat?	0	1	2	3	4	5	6

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5. Have you wanted your stomach to be empty?	0	1	2	3	4	5	6	
6. Has thinking about food or its calorie content made it much more difficult to concentrate on things you are interested in; for example, read, watch TV or follow a conversation?	0	1	2	3	4	5	6	
7. Have you been afraid of losing control over eating?	0	1	2	3	4	5	6	
8. Have you had episodes of binge eating?	0	1	2	3	4	5	6	
9. Have you eaten in secret? (Do not count binges.)	0	1	2	3	4	5	6	
10. Have you definitely wanted your stomach to be flat?	0	1	2	3	4	5	6	
11. Has thinking about shape or weight made it more difficult to concentrate on things you are interested in; for example, read, watch TV or follow a conversation?	0	1	2	3	4	5	6	
12. Have you had a definite fear that you might gain weight or become fat?	0	1	2	3	4	5	6	
13. Have you felt fat?	0	1	2	3	4	5	6	
14. Have you had a strong desire to lose weight?	0	1	2	3	4	5	6	
Over the past four weeks (28 days)...								
15. In what proportion of times that you have eaten have you felt guilty because of the effect on your shape or weight? (Do not count binges.)	0 - None of the times 1 - A few of the times 2 - Less than half the times 3 - Half the times 4 - More than half the times 5 - Most of the times 6 - Every time							
(Circle the number which applies)								
16. Over the past four weeks (28 days), have there been any times when you have felt that you have eaten what other people would regard as an unusually large amount of food given the circumstances? (Please circle YES or NO)				YES				NO

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17. How many such episodes have you had over the past four weeks? _____

18. During how many of these episodes of overeating did you have a sense of having lost control over your eating? _____

19. Have you had other episodes of eating in which you have had a sense of having lost control and eaten too much, but have not eaten an unusually large amount of food given the circumstances? YES NO

20. How many such episodes have you had over the past four weeks? _____

21. Over the past four weeks have you made yourself sick (vomit) as a means of controlling your shape or weight? YES NO

22. How many times have you done this over the past four weeks? _____

23. Have you taken laxatives as a means of controlling your shape or weight? YES NO

24. How many times have you done this over the past four weeks? _____

25. Have you taken diuretics (water tablets) as a means of controlling your shape or weight? YES NO

26. How many times have you done this over the past four weeks? _____

27. Have you exercised hard as a means of controlling your shape or weight? YES NO

28. How many times have you done this over the past four weeks? _____

Over the past four weeks (28 days)...							
(Please circle the number which best describes your behaviour)	Not at all		Slightly		Moderately		Markedly
29. Has your weight influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
30. Has your shape influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6

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31. How much would it upset you if you had to weigh yourself once a week for the next few weeks?	0	1	2	3	4	5	6
32. How dissatisfied have you felt about your weight?	0	1	2	3	4	5	6
33. How dissatisfied have you felt about your shape?	0	1	2	3	4	5	6
34. How concerned have you been about other people seeing you eat?	0	1	2	3	4	5	6
35. How uncomfortable have you felt seeing your body; for example, in the mirror, in shop window reflections, while undressing or taking a bath or shower?	0	1	2	3	4	5	6
36. How uncomfortable have you felt about others seeing your body: for example, in communal changing rooms, when swimming or wearing tight clothes?	0	1	2	3	4	5	6

7. Positive and Negative Affect

Indicate the extent you have felt this way over the past week.

Very slightly or not at all (1); A little (2); Moderately (3); Quite a bit (4); Extremely (5)

- a. Interested 1 2 3 4 5
- b. Distressed 1 2 3 4 5
- c. Excited 1 2 3 4 5
- d. Upset 1 2 3 4 5
- e. Strong 1 2 3 4 5
- f. Guilty 1 2 3 4 5
- g. Scared 1 2 3 4 5
- h. Hostile 1 2 3 4 5
- i. Enthusiastic 1 2 3 4 5
- j. Proud 1 2 3 4 5
- k. Irritable 1 2 3 4 5
- l. Alert 1 2 3 4 5
- m. Ashamed 1 2 3 4 5
- n. Inspired 1 2 3 4 5
- o. Nervous 1 2 3 4 5
- p. Determined 1 2 3 4 5
- q. Attentive 1 2 3 4 5
- r. Jittery 1 2 3 4 5
- s. Active 1 2 3 4 5
- t. Afraid 1 2 3 4 5

8. Sociocultural Attitudes Towards Appearance Questionnaire

Internalization-General: Items: 3, 4, 7, 8, 11, 12, 15, 16, 27

Internalization-Athlete: Items: 19, 20, 23, 24, 30

Pressures: Items: 2, 6, 10, 14, 18, 22, 26

Information: Items: 1, 5, 9, 13, 17, 21, 25, 28, 29

Reverse-keyed items: 3, 6, 9, 12, 13, 19, 27, 28

Disordered eating in athletes

Please read each of the following items carefully and indicate the number that best reflects your agreement with the statement.

Definitely Disagree = 1; Mostly Disagree = 2; Neither Agree Nor Disagree = 3; Mostly Agree = 4; Definitely Agree = 5

1. TV programs are an important source of information about fashion and "being attractive"
2. I've felt pressure from TV or magazines to lose weight.
3. I do not care if my body looks like the body of people who are on TV
4. I compare my body to the bodies of people who are on TV
5. TV commercials are an important source of information about fashion and "being attractive."
6. I do not feel pressure from TV or magazines to look pretty
7. I would like my body to look like the models who appear in magazines
8. I compare my appearance to the appearance of TV and movie stars
9. Music videos on TV are not an important source of information about fashion and "being attractive."
10. I've felt pressure from TV and magazines to be thin
11. I would like my body to look like the people who are in movies
12. I do not compare my body to the bodies of people who appear in magazines
13. Magazine articles are not an important source of information about fashion and "being attractive."
14. I've felt pressure from TV or magazines to have a perfect body
15. I wish I looked like the models in music videos
16. I compare my appearance to the appearance of people in magazines
17. Magazine advertisements are an important source of information about fashion and "being attractive."
18. I've felt pressure from TV or magazines to diet
19. I do not wish to look as athletic as the people in magazines
20. I compare my body to that of people in "good shape"
21. Pictures in magazines are an important source of information about fashion and "being attractive."
22. I've felt pressure from TV or magazines to exercise
23. I wish I looked as athletic as sports stars
24. I compare my body to that of people who are athletic
25. Movies are an important source of information about fashion and "being attractive."
26. I've felt pressure from TV or magazines to change my appearance
27. I do not try to look like the people on TV
28. Movie stars are not an important source of information about fashion and "being attractive."
29. Famous people are an important source of information about fashion and "being attractive."
30. I try to look like sports athletes

9. Social media

How long do you spend per day using social media?

What is the main purpose for your social media usage

- Talking to people
- Looking at photos
- Catching up on news
- Posting material
- Promoting your own business/work/sport

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Comparing to other athletes

Which of the following social media platforms do you use?

How long do you spend per day using social media?

Social media is an important source of information about fashion and "being attractive"

I compare my appearance to the appearance people on social media

I've felt pressure from social media to be thin

I wish I looked like the influencers on social media

I compare my life to the life portrayed by people on social media

The following scales were administered but not used for any analysis. They are included for completeness:

Compulsive Exercise Test

Instructions Listed below are a series of statements regarding exercise. Please read each statement carefully and circle the number that best indicates how true each statement is of you. Please answer all the questions as honestly as you can.

Never true (0) Rarely true (1) Sometimes true (2) Often true (3) Usually true (4) Always true (5)

Reverse 8 and 12

Avoidance and rule-driven behaviour (items 9, 10, 11, 15, 16, 20, 22, 23) 3

Weight-control exercise (items 2, 6, 8 [reverse-scored], 13, 18)

Mood improvement (items 1, 4, 14, 17, 24)

Lack of exercise enjoyment (items 5, 12 [reverse-scored], 21)

Exercise rigidity (items 3, 7, 19)

- 1) I feel happier and/or more positive after I exercise. 0 1 2 3 4 5
- 2) I exercise to improve my appearance. 0 1 2 3 4 5
- 3) I like my days to be organised and structured of which exercise is just one part. 0 1 2 3 4 5
- 4) I feel less anxious after I exercise. 0 1 2 3 4 5
- 5) I find exercise a chore. 0 1 2 3 4 5
- 6) If I feel I have eaten too much, I will do more exercise. 0 1 2 3 4 5
- 7) My weekly pattern of exercise is repetitive. 0 1 2 3 4 5
- 8) I do not exercise to be slim. 0 1 2 3 4 5
- 9) If I cannot exercise, I feel low or depressed. 0 1 2 3 4 5
- 10) I feel extremely guilty if I miss an exercise session. 0 1 2 3 4 5
- 11) I usually continue to exercise despite injury or illness, unless I am very ill or too injured. 0 1 2 3 4 5
- 12) I enjoy exercising. 0 1 2 3 4 5
- 13) I exercise to burn calories and lose weight. 0 1 2 3 4 5
- 14) I feel less stressed and/or tense after I exercise. 0 1 2 3 4 5
- 15) If I miss an exercise session, I will try and make up for it when I next exercise. 0 1 2 3 4 5
- 16) If I cannot exercise, I feel agitated and/or irritable. 0 1 2 3 4 5
- 17) Exercise improves my mood. 0 1 2 3 4 5
- 18) If I cannot exercise, I worry that I will gain weight. 0 1 2 3 4 5
- 19) I follow a set routine for my exercise sessions e.g. walk or run the same route, particular exercises, same amount of time, and so on. 0 1 2 3 4 5
- 20) If I cannot exercise, I feel angry and/or frustrated. 0 1 2 3 4 5
- 21) I do not enjoy exercising. 0 1 2 3 4 5
- 22) I feel like I've let myself down if I miss an exercise session. 0 1 2 3 4 5
- 23) If I cannot exercise, I feel anxious. 0 1 2 3 4 5
- 24) I feel less depressed or low after I exercise. 0 1 2 3 4 5

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Modelled Behaviours (example questions below)

Never-0

Rarely-1

Sometimes-2

Often-3

Always-4

- a. My friends diet or use weight control behaviours
- b. My teammates diet or use weight control behaviours
- c. People in my family diet or use weight control behaviours
- d. Does your sport encourage dieting or use of weight control behaviours
- e. Others outside my sport may see my diet as extreme, but it is accepted within my sport.

Veganism and other restrictions (example questions below)

Never-0

Rarely-1

Sometimes-2

Often-3

Always-4

- f. I subscribe to a diet which dictates which foods I can and cannot eat
- g. I do not eat meat
- h. I do not eat any animal products
- i. I follow this type of diet for my health
- j. I follow this type of diet to help my sport performance
- k. I follow this type of diet to control my weight/shape
- l. If there was no other option for food before a competition, I would eat animal products
- m. If there was no other option for food before a competition, I would eat meat
- n. I sometimes choose to not follow my subscribed diet
- o. If I do not follow my subscribed diet, I feel guilty

Qualitative Interview Schedule

Thank you for being here. This study looks at the risk factors in athletes that may affect eating attitudes in athletes. I am specifically interested in this interview how your life as an athlete, and how you just as a person in society came to form your views on food. I expect this interview to last an hour. Please be as truthful as you can, there are no right or wrong answers. *The questions may be a bit repetitive.*

Semi Structured Interview: Questions

Do you consent to this interview? ; Do you agree for it to be recorded?

Introduction Questions.

What is your first name?

What sport do you play?

How many hours a week do you train?

How many years have you done your sport?

What got you involved in your sport? What has kept you involved?

Understanding what a lean and nonlean sport is, would you classify your sport as Lean or Nonlean?

Sport and Athlete Lifestyle

What do you love about your sport?

What do you wish you could change about your sport?

How would you describe the culture of your sport?

Do you have someone who helps manage your nutrition?

How is that culture in relation to food and body image?

Talk about how being an athlete has impacted your life.

How does being an athlete influence your day to day life?

How does your lifestyle influence how you view food?

Does your involvement in sport affect what you eat and how you view food?

In season? Out of season?

Is there anything unique to being an athlete that you think makes you view food differently than a non-athlete?

Is there anything unique to your sport in particular that you think influences how you view food?

What pressures do you feel as an athlete? (Do any of these relate to how you should look or what you should eat?)

Society and General Lifestyle

What pressure do you feel from society? (Do any of these relate to how you should look or what you should eat?)

Do you feel like you live up to societal expectations of you as a human being?

You as athlete?

Do these pressures as an athlete differ from pressure you feel from society?

Talk about the role of social media in your life.

How do you feel your gender is particularly under pressure from sport and societal pressures?

Discuss your daily diet. (Are you vegan or vegetarian, etc.) Why?

How closely do you follow your set diet plan? What if you have to deviate?

Is there anything else you think is relevant to share with me regarding your experience as an athlete and human that relates to your attitudes toward food?

Has Covid19 impacted you in terms of your sport and eating habits?

Conference Outputs from this Thesis

- Stoyel, H.,** Shanmuganathan-Felton, V. & Serpell, L (2020). *Risk factors of disordered eating in athletes*. Poster Presentation. Applied Association Sport Psychology Virtual Conference. October 2020.
- Stoyel, H.,** Shanmuganathan-Felton, A., Meyer, C., & Serpell, L (2020). Risk factors of disordered eating in athletes. Oral Presentation at International Conference on Eating Disorders. Virtual Conference, May 2020.
- Stoyel, H.,** Shanmuganathan-Felton, V., Slee, A., Meyer, C., & Serpell, L (2019) Eating psychopathology in athletes: A critique of an etiological model. Oral Presentation at Division of Sport & Exercise Psychology Annual Conference | BPS, Birmingham, England December 2019.
- Stoyel, H** (2018). *How Females cope with Stress and RED-S*. Swim England Sport Science and Medicine Conference. Loughborough, UK, March 2018.

Publications resulting from this thesis

Stoyel, H., Shanmuganathan-Felton, V., Meyer, C., & Serpell, L. (2020). Psychological risk indicators of disordered eating in athletes. *PloS one*, *15*(5), e0232979.

Stoyel, H., Slee, A., Meyer, C., & Serpell, L. (2020). Systematic review of risk factors for eating psychopathology in athletes: A critique of an etiological model. *European Eating Disorders Review*, *28*(1), 3-25.

Stoyel, H., Delderfield, R., Stoyel, A., Shanmuganathan-Felton, V., Meyer, & Serpell, L. (2021). A qualitative investigation into the sport and social pressures on elite athletes. *Frontiers in Psychology*. doi: [10.3389/fpsyg.2021.633490](https://doi.org/10.3389/fpsyg.2021.633490).

Under Review:

Stoyel, H., Stride, C., Shanmuganathan-Felton, V., Meyer, & Serpell, L. (2021).

Understanding risk factors for disordered eating symptomatology in athletes: a year-long study *Plos One*. Accepted with revisions pendings.