Men's health and fitness-related technology use and its link with disordered eating

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Dissertation accepted in fulfilment of the requirements for the degree Master of Health Sciences in Research Psychology at the North-West University

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"Trust in the Lord with all your heart and lean not on your own understanding; in all your ways submit to Him, and He will make your paths straight." – Proverbs 3:5-6

To my Heavenly Father – for Your goodness and mercy, I am eternally grateful. Thank you for being with me every step of the way, for blessing me in abundance, and for providing me with more opportunities than I can count. Thank you for guiding me throughout this journey – You deserve all the praise and glory!

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SUMMARY

Men's health- and fitness-related technology use and its link with disordered eating.

Keywords: disordered eating; eating behaviours; eating attitudes; fitness-related technology; health-related technology; males; quantitative research.

The use of health- and fitness-related technology has been growing exponentially over the past few years. Various advantages have been associated with these types of technologies, and it has been said to inspire behaviours and attitudes related to health- and fitness. However, several researchers have recently been interested in the possible risks in using these types of technologies: more specifically the link that it may have with disordered eating.

Within the South African context, no research could be found relating to this topic, whereas several international research studies identified a lack of male representation in their sample population as one of their study limitations. Based on this, the aim of this quantitative research study was to investigate if there is a possible link between the use of health- and fitness-related technology and disordered eating in a sample of males living in South Africa.

Potential participants were recruited via social media platforms, where they willingly agreed to complete an online questionnaire. The questionnaire included items related to demographic information and their health- and fitness-related behaviour, as well as the Eating Disorder Assessment for Men (EDAM). Data collection was closely followed by statistical data analysis, which included both descriptive (e.g. percentages, mean, standard deviation, etc.) and inferential statistics (e.g. t-tests). The findings were presented in article format as set out by the journal *Eating Disorders: The Journal of Treatment and Prevention*, guidelines. This article will also be submitted for potential publication after the examination of the mini-dissertation.

The findings for this study indicated that there is a statistically significant difference in the mean scores for males that use (users) health- and fitness-related technology and those

who do not (non-users) with regards to body dissatisfaction. In other research studies, body dissatisfaction has been described as a potential risk factor for triggering and maintaining disordered eating amongst males. A link between body dissatisfaction and using calorie counting applications (apps) was also found when analysing and interpreting the data for this study. Certain health- and fitness-related technology, which - in this case - was calorie counting apps, can be utilised by males as a strategy to relieve anxiety, related to experiencing body dissatisfaction. It was concluded that these findings should be considered when focusing on the identification and treatment of disordered eating in males.

PREFACE

- For this mini-dissertation, all guidelines - as stipulated in the A-rules and the Manual for Higher Degree Studies of the North-West University - are adhered to.
- The article found in Section 2 of this mini-dissertation will be submitted for possible publication in *Eating Disorders: The Journal of Treatment and Prevention.*
- Section 1 and 3 of this mini-dissertation adhered to the guidelines set out by the American Psychological Association Publication Manual 7th Edition; whereas, Section 2 adheres to the author guidelines provided by the Journal of *Eating Disorders: The Journal of Treatment and Prevention.*
- The page numbers for this mini-dissertation is placed in the centre and bottom of each page, and is in chronological order. Section 1 starts on page 1 and will continue in chronological order until Appendix C.
- The submission of this mini-dissertation for examination was approved by the research supervisor, Professor Ruan Spies (see section below). The mini-dissertation is submitted in partial fulfilment of the requirements for the degree Master of Health Sciences in Research Psychology at the North-West University.
- Approval was obtained from a Scientific Committee (COMPRES) (see Appendix A).
- Ethical approval was obtained from the Health Research Ethics Committee (HREC) of the Faculty of Health Sciences of the North-West University (NWU-00248-21-A1) (see Appendix B).
- This mini-dissertation was submitted for language editing by a registered and proficient language practitioner, *Karin Petersen* (see Appendix C).
- This mini-dissertation was submitted to Turn-It-In. The similarity report indicated a similarity index which fell within the norms of acceptable.

PERMISSION LETTER FROM SUPERVISOR

I, Ruan Spies the supervisor of this Magister of Health Sciences in Research Psychology study by Jessica Daniel, hereby declare that the mini-dissertation entitled *"Men's health and fitness-related technology use and its link with disordered eating"*, reflects the entire research endeavour as was planned and executed. I hereby grant permission that she may submit the mini-dissertation (article format) for examination purposes and I confirm that the mini-dissertation submitted is in fulfilment of the requirements for the degree.

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Ruan Spies
Supervisor

DECLARATION

NWU Higher Degrees Administration

SOLEMN DECLARATION AND PERMISSION TO SUBMIT

1. Solemn declaration by student

I, Jessica Daniel

declare herewith that the thesis/dissertation/mini-dissertation entitled (**exact registered/approved title**),

Men's health and fitness-related technology use and its link with disordered eating

which I herewith submit to the North-West University is in compliance/partial compliance with the requirements set for the degree:

Master of Health Sciences in Research Psychology

is my own work, has been text-edited in accordance with the requirements and has not already been submitted to any other university.

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Signatures of supervisor(s) and Promoter(s): (only compulsory in cases where there are co- or assistant- supervisor(s)/promoters)

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STRUCTURE OF RESEARCH MINI-DISSERTATION

This mini-dissertation consists of three separate sections. Section 1 provides an in-depth, comprehensive literature overview of the research topic, the research methodology, and the ethical considerations for this study (pages 2-31). Section 2 provides an article which includes: a literature overview, the research methodology utilised, the research findings and discussion, the recommendations and the study limitations, as well as a conclusion (pages 31-55). Section 3 provides a critical reflection of the researcher's experiences throughout the research process, as well as a personal reflection (pages 56-61).

SECTION 1: INTRODUCTION

Introduction

Historically, eating disorders (EDs) were recognised to be mostly prevalent amongst young, white, middle-class females from western societies (Jordaan, 2016; MacNeill et al., 2017; Morris & Szabo, 2012). However, as cultural groups started to undergo change, researchers started becoming aware of an increase in eating and feeding disorders amongst groups once believed not to be affected — more specifically males (Calzo et al., 2016; Chapman & Woodman, 2015; Dakanalis & Riva, 2013; Darcy & Lin, 2012; Freeman & Szabo, 2005; Gorrell & Murray, 2019; Jordaan, 2016; Lavender et al., 2017; Limber et al., 2018; MacNeill, et al., 2017; Smith et al., 2017; Stanford & Lemberg, 2012a; Stanford & Lemberg, 2012b).

According to Lavender et al. (2017), in the past it was believed that males were not affected by these types of disorders, since important characteristics for a clinical ED diagnosis (e.g. amenorrhea), was not applicable to them. However, with media and society placing more pressure on males to attain certain body ideals - such as the strong muscular body type - disordered eating in this specific group could be increasing (MacNeill et al., 2017). It is therefore no surprise that several researchers have indicated that more studies need to be done which focus on disordered eating attitudes and behaviours in males (Lavender et al., 2017; MacNeill et al., 2017; Mitchison & Mond, 2015; Smith et al., 2016) and investigating possible factors related to ED symptomology in this population group (MacNeill et al., 2017).

Health- and Fitness-Related Technology

The use of smartphone applications (apps) and fitness watches has been growing exponentially over the last few years (Ceci, 2022a; Chiu & Cho, 2019; Franco et al., 2016; Hahn et al., 2021; Linardon & Messer, 2019; Lyons et al., 2014; Simpson & Mazzeo, 2017;

Tan et al., 2016; Windasari et al., 2021). Health-related technology refers to technology specifically focused on weight management and includes, for example, calorie-counting apps (Solbrig et al., 2017); whereas fitness-related technology refers to technology specifically designed to enhance physical activity or training (Ceci, 2022a). On the other hand, fitness trackers and/or watches are wearable electronic devices which can be used for monitoring various health- and fitness-related elements such as exercise, heart rate, sleep quality, etc. (Laricchia, 2022a). It has been indicated that the use of these types of technologies can be associated with beneficial behavioural changes (Sarcona et al., 2017) such as increased physical activity and lowered risk of chronic disease (Akabor, 2022).

Recent Statistics on These Types of Technologies

Globally

More than half of the individuals that use a smartphone will most likely have downloaded a health and/or fitness app to help them record, keep track of and analyse their health data (Sarcona et al., 2017). In the first few months of 2020, health- and fitness apps were downloaded worldwide approximately 593 million times, which was an increase from the 446 million downloads recorded in 2019 (Ceci, 2021). It also seems as if the Covid-19 pandemic had an influence on the increased use of fitness-related apps (Ceci, 2022a). However, even as individuals are allowed to return to their local exercise and training centres (e.g. gyms), it seems these apps will be upholding the increase gained during the pandemic (Ceci, 2022a). This statement is strengthened by the fact that in January 2022 the predominantly used fitness apps had an estimate of 17 million downloads, which was an increase from the 16.3 million downloads during January 2020 (Ceci, 2022a). Not much could be found on health-related technologies such as calorie counting apps. Ceci (2022b) indicated that in June 2022, MyFitnessPal (MFP; a calorie counting app), was the fifth leading Android health app globally during that year. It was also indicated that this app

generated over US$ 594 thousand in revenues from individuals using Android devices (Ceci, 2022b).

A similar growth trend was identified for wearable fitness trackers and/or watches. Around the third quarter of 2021, these types of devices accounted for approximately 30.5% of the global wearable device market (Laricchia, 2022b). The shipment of fitness trackers globally in 2015 was approximately US$ 41.7 million, and in 2019 approximately US$ 68.2 million (Paxton, 2020). It was also indicated that the shipment of these devices in 2019 saw a 32% increase from 2018 (Paxton, 2020). Moving beyond the shipment of these types of wearable devices, it has also been indicated that the sales for these devices have increased. According to Vailshery (2021), Fitbit has sold an estimated 76 million devices globally since 2010, and from 2010 to 2016 the company recorded a. In 2019, Fitbit indicated a revenue of approximately 1.4 billion US dollars (Vailshery, 2021).

The growth in using health- and fitness-related technology has also led to companies becoming aware of their commercial value, especially wearable devices. Within the last few years' companies such as Fitbit, Apple, and Garmin have focused on improving their products with newer, more cutting-edge technology (Murad, 2019). In April 2015, Apple released their first watch (Verizon, n.d.). It was originally designed to be a fashion accessory but was later released with focus on the fitness-oriented features that it provided (Verizon, n.d.). The same thing happened to Fitbit. The company released its first clip-on device in 2009 (Comstock, 2015). Its main function was step-counting and measuring calories burnt (Comstock, 2015). It wasn't until October 2013 that they released a device that not only had watch-like features but also included functions such as counting steps, measuring daily calories burnt, and calories burnt while doing some form of physical activity (Comstock, 2015). The Fitbit watch which was released in 2020, now has 25 health- and fitness-related features ranging from all day activity tracking to sleep tracking (Fitbit, n.d.). Other features

include automatic recognition of exercise, reminders to move, measuring daily calories burnt, cardio fitness score, and more (Fitbit, n.d.).

Within the South African Context

Research on the use of health- and fitness-related technology within the South African context is lacking. However, in 2017 Statista (Kunst, 2022) conducted a survey to identify which types of health apps and smart health devices South African respondents used in that year. The results were as follows: 44% of the respondents used fitness apps (e.g. apps that track physical activity), 29% of the respondents used health apps (e.g. nutrition apps), 14% of the respondents used smartwatches with fitness functions, and 31% of the respondents indicated not using any of the technology identified in the survey (Kunst, 2022).

This report suggests that health- and fitness-related technology is also being utilised by the South African population. Various medical aid schemes within the South African context have also started offering incentives to members who purchase and use wearable devices and share the related health information with them (KPMG, 2016).

The Purpose of Health- and Fitness-Related Technology

The growth and development of mobile apps "… has revolutionised how people maintain physical fitness and monitor their health in their daily lives" (Chiu & Cho, 2020, p. 807). These types of technologies attempt to promote a variety of ways in which health- and fitness behaviours and attitudes can be endorsed such as tracking one's behaviour; setting health- and fitness goals; providing feedback, rewards, and social connectivity; as well as personal training opportunities (Chiu & Cho, 2020; Hahn et al., 2021; Honary et al., 2019; Sarcona et al., 2017). They can also be used to facilitate behavioural changes such as improving eating habits and increasing physical activity (Higgins, 2016). They include a variety of features such as helping individuals keep track of their exercise and diet, as well as helping with weight management, stress relief, and monitoring sleep (Chiu & Cho, 2020;

Higgins, 2016). In 2018, Morning Consult (2018), a marketing research company in the United States, conducted a poll to determine consumers' views of mobile apps and fitness wearables that allow them to track their health- and fitness. They indicated the following:

- 34% of the participants indicated using apps that help them track or manage their health;
- 85% of the participants indicated using apps to monitor exercise, fitness, or heart rate;
- 44% of the participants stated that they used apps to track their diet, food intake, and counting calories (Morning Consult, 2018).

The U.S. Food and Drug Administration (U.S. Food and Drug Administration, n.d.) states that health- and fitness-related apps can empower users to make better-informed decisions about their health- and fitness, but that it should also be used by individuals to manage chronic conditions outside of traditional care settings. When it comes to maintaining a healthy lifestyle, health- and fitness-related apps on smartphones can be utilised by individuals to motivate and monitor themselves (Sarcona et al., 2017). Some individuals have indicated that these apps were related to them feeling better about themselves and that they also felt encouraged to motivate those around them to start exercising and losing weight (Sarcona et al., 2017).

According to Sarcona et al. (2017) individuals who used these apps in weight loss programmes were more likely to comply - and lost significantly more weight - than individuals who were not using these apps. The same could be said regarding wearable fitness trackers. Advantages of wearable technology includes monitoring your fitness levels, as well as providing you with a platform to set health- and fitness-related goals and help you monitor progress towards these goals (GCFGlobal, n.d.). Akabor (2022) stated that individuals who use these types of devices tend to be more active than those who don't. Akabor (2022) also reported on a study done by Discovery Vitality, which indicated that,

during the Covid-19 pandemic, these wearable devices helped individuals stay fit and in shape. The benefits of increased activity during the pandemic were not just related to the potential decrease of chronic disease (e.g. cardiovascular disease), but were also essential for physical and mental health during these uncertain times (Akabor, 2022).

In conclusion, using health- and fitness-related technology to monitor one's health- and fitness behaviours and attitudes has become a way of life for numerous individuals globally (Kimball, 2015). These types of technologies make individuals much more aware of how their own body functions and how they can go about improving their health- and fitness (Midgley, 2018). Using this technology not only includes potential physical benefits, but it has also been identified as being essential for individual's mental health (Akabor, 2022).

Eating Disorders and Disordered Eating

Eating Disorders

Eating disorders include anorexia nervosa, bulimia nervosa, binge-eating disorder and other specified feeding and/or eating disorders (Jordaan, 2016). According to the National Association of Anorexia Nervosa and Associated Disorders (ANAD, n.d.-a) about 9% of the world's population struggles with an eating disorder (ED). This could, however, be an over-estimate when compared to prevalence rates of individual eating disorders in the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition, Text Revision (DSM-5-TR). In the DSM-5-TR (American Psychiatric Association, 2022), with clinical populations, a 10:1 female-to-male ration is found. Bulimia nervosa had a higher prevalence amongst younger females: 1-1.5% (American Psychiatric Association, 2013), again with a 10:1 female-to-male ratio (American Psychiatric Association, 2022).

In America alone, at least 28.8 million people will have an ED in their lifetime (ANAD, n.d.-a). Netcare, one of South Africa's leading health care providers, also states that four out of ten people have either personally experienced an ED or know of someone who has

(Netcare, 2018). Statistics regarding EDs in South Africa are difficult to find, as little research has been done on this specific topic (Freeman & Szabo, 2005; Netcare, 2018). However, there seems to be a rise in disordered eating and EDs within the South African context (Jordaan, 2016). Consequently, the focus is shifting to increasing awareness on how it is affecting South Africans, in order to increase research around the topic and develop effective treatment programmes (Netcare, 2018).

According to ANAD (ANAD, n.d.-b) EDs can be conceptualised as "… illnesses in which people experience severe disturbances in their eating behaviours and related thoughts and emotions" (p. 1). These individuals will most likely become fixated on their diet and body weight (ANAD, n.d.-b), and they usually have "… unrealistic and self-critical thoughts about their body image, which begin to consume and affect daily activities" (Hefner et al., 2016; p. 2). An individual with an ED will most likely have fixed attitudes and behaviours regarding their weight and calorie intake (Simpson & Mazzeo, 2017). They often become obsessed with meeting goals associated with their weight, and these goals can sometimes be unrealistic (Simpson & Mazzeo, 2017). Other behaviours and attitudes include extreme calorie and/or dietary restriction; intense fear of weight gain; extreme weight loss; fixation on weight, calories, and food; excessive exercise; as well as in some cases bingeing and purging behaviours (Eikey & Reddy, 2017).

These disorders are usually associated with psychosocial impairments and comorbid psychopathology and have been characterised by high levels of inpatient hospitalisation and attempted suicides, as well as increased depression and/or substance abuse (Stice, 2002). If an individual does not meet the diagnostic criteria for an ED, they may still engage in disordered eating behaviours such as binge-eating, emotional eating, restraint and strict dieting, which can be identified and perceived as risk factors for EDs (Yu & Tan, 2016).

Disordered Eating

The absence of a diagnosed eating disorder does not necessarily imply that a person has a healthy relationship with food and their weight (Gottlieb, 2014). This is where the term *disordered eating* becomes applicable (Gottlieb, 2014). Disordered eating includes symptoms, behaviours, and attitudes of EDs but at a lower severity level (National Eating Disorders Collaboration, n.d.). Therefore, disordered eating can be found on a spectrum between normal eating behaviours and EDs (National Eating Disorders Collaboration, n.d.).

Symptoms of disordered eating can include behaviours such as restricting food intake, binge eating, as well as purging behaviours (Gottlieb, 2014). It may also include excessive exercising and calorie counting, basing one's self-esteem on body image and weight, and a disturbance in how one perceives one's body (e.g. perceiving themselves as being overweight when the person is underweight) (Gottlieb, 2014). Even though the symptoms for disordered eating may be less severe, individuals exhibiting these types of symptoms may be at risk for developing a diagnosable ED if not taken seriously (Gottlieb, 2014), hence the use of the term *disordered eating* within this proposed research study.

Disordered eating could negatively impact an individual's daily functioning and result in a reduced ability to deal with situations that are stressful (National Eating Disorders Collaboration, n.d.). It has also been indicated that, in some instances, these individuals will isolate themselves because they fear socialising in situations where others are eating, which in turn could contribute to lower levels of self-esteem and social withdrawal (National Eating Disorders Collaboration, n.d.). Feelings of guilt, shame, and/or failure have also been identified as common responses by individuals with disordered eating, as a result of binge eating or breaking their diet. (National Eating Disorders Collaboration, n.d.). Other possible risks associated with disordered eating include fatigue and lack of sleep, digestive issues, headaches, symptoms and behaviours relating to depression and anxiety, and nutritional concerns (National Eating Disorders Collaboration, n.d.).

Disordered Eating in Males

Evidence suggests an increase in the prevalence of EDs amongst males, and that the symptoms are just as severe for them as they are for females (Gorrell & Murray, 2019; Lavender et al., 2017; Limbers et al., 2018). The presentation of ED symptoms in males may differ from the traditional diagnostic criteria, and it is important that researchers take this into consideration (Darcy & Lin, 2012; Lavender et al., 2017; Smith et al., 2017; Stanford & Lemberg, 2012a; Stanford & Lemberg, 2012b). This has been identified as one of the reasons why the number of males suffering from disordered eating and/or EDs is underestimated (Stanford & Lemberg, 2012b). Another reason could be the social stigma related to disordered eating in males, which may cause them to minimise or deny the presence of any symptoms (Limbers et al., 2018).

In their study, Stanford and Lemberg (2012b) mentioned that males with an ED are usually diagnosed under the eating disorder not otherwise specified category found in the DSM-5. They stated that males might express body dysmorphic symptoms, or other forms of disordered eating that do not necessarily meet the diagnostic criteria for disorders like anorexia nervosa or bulimia nervosa (Stanford & Lemberg, 2012b). Calzo et al. (2016) seemed to agree with this statement, indicating that males will most likely "… exhibit unique presentations of eating disorders tied to gendered ideals about appearance and performance (e.g. muscle dysmorphia)" (p. 693). Unlike females, males do not necessarily strive for minimal appropriate weight or fear gaining weight (Calzon et al., 2016). Males rather focus on leanness and a muscular body (Calzon et al., 2016; Griffiths et al., 2014; Jordaan, 2016; Lavender et al., 2017; Limbers et al., 2018), which could be based on the perception created by the media, advertisements - and even action figures - that the ideal male body is muscular (Nagata et al., 2019). Griffiths et al. (2014) describe a muscular body as "… well-developed muscle mass and low body fat" (p. 1). Thus, emphasis is placed on the size and definition of

their muscles (Calzo et al., 2016). To be able to achieve this ideal body type, there is the likelihood that they will partake in excessive dieting behaviours and exercise routines, possibly to the detriment of other healthy behaviours (Jordaan, 2016; Lavender et al., 2017).

Several researchers also agree that when it comes to EDs and/or disordered eating in males, muscle dysmorphia is common (Dakanalis et al., 2013; Gorrell et al., 2019; Lavender et al., 2017; Limbers et al., 2018; Stanford & Lemberg, 2012b). Gorrell et al. (2019) describe muscle dysmorphia as the opposite of anorexia nervosa, since with anorexia nervosa the focus is on the thin body ideal whereas with muscle dysmorphia the focus is on the muscular body ideal. There are however some similarities between these two, such as distorted body image, obsessive thoughts, and rigid dietary regimens (Gorrell et al., 2019).

Males who experience body dissatisfaction may place extreme emphasis on controlling their weight with exercise and a fixed diet, and in some cases they might even use anabolic steroids and untested dietary supplements (Gorrell et al., 2019; Jordaan, 2016). Males tend to place their focus on being fit and healthy and may also attempt to increase their strength and muscle (Darcy & Lin, 2012). This can result in them becoming involved in restrictive behaviours, or even binge-eating and purging (Darcy & Lin, 2012). This is however contradictory to a statement made by Stanford and Lemberg (2012b). According to them, males will be more likely to use excessive and rigorous exercise as a compensatory method as opposed to typical disordered eating behaviours such as using laxatives or vomiting (Stanford & Lemberg, 2012b).

"Bulking and cutting" (p. 5) is another phenomenon that can be found amongst males displaying disordered eating behaviours and attitudes (Gorrell et al., 2019). During the *bulking* phase, males have rigid guidelines regarding the consumption of protein such as how much, when, and what type of protein (Gorrell et al., 2019). Straying from these guidelines may result in feelings of distress and/or anxiety, which in turn could start the *cutting* phase

(Gorrell et al., 2019). During this phase, the focus is on extreme dietary restriction so that the male can decrease his body fat to improve muscle definition (Gorrell et al., 2019). This phase can result in limited muscle development which may cause further distress, thereby creating a maladaptive cycle of muscle building characterised by rigid dietary restrictions and excessive exercise (Gorrell et al., 2019).

While developing the Eating Disorder Assessment for Men (EDAM), Stanford and Lemberg (2012b) did extensive research on how males display ED symptoms. From this, they identified five domains of concern in males with EDs (Stanford & Lemberg, 2012b). These five domains are: weight concerns; food issues; exercise issues; body image/ appearance concerns and disordered eating habits (p. 428; Stanford & Lemberg, 2012b). These domains were later used to identify the four subscales of the EDAM (Stanford & Lemberg, 2012b). It is important to be aware of the fact that disordered eating and EDs in males can be displayed in traditionally identified symptoms, or muscularity-related symptoms that are driven by the appropriate body ideal identified by society, today (Lavender et al., 2017).

Disordered Eating vs Eating Disorders in Males

Several studies that focus on the topic of disordered eating amongst males do not seem to indicate identifiable differences between the terms ‘eating disorder’ and ‘disordered eating’ (see Hoerr et al., 2002; Lavender & Anderson, 2009; Murray et al., 2016; Sanlier et al., 2017). It was therefore difficult for the researcher to identify what disordered eating in males would look like, and whether it presents differently from an ED. However, Chapman and Woodman (2015) indicate that when behaviours associated with EDs are not displayed frequently enough or are not identified as severe enough, they will be considered sub-clinical behaviours relating to EDs. These sub-clinical behaviours are identified as disordered eating (Chapman & Woodman, 2015). Therefore, disordered eating seems to be when an individual

displays less severe ED-related symptoms that do not meet the criteria for a diagnosable ED, but if not dealt with or managed properly can result in a diagnosable ED (Chapman & Woodman, 2015; Gottlieb, 2014).

Link Between Health- and Fitness-Related Technology and Disordered Eating

Research done on health- and fitness-related technologies have mostly focused on how they can be used to promote wellness, weight loss, following a healthy diet and increasing physical activity (Eikey et al., 2017). Therefore, these types of technologies are valuable in promoting health- and fitness behaviours and attitudes. However, they may also trigger disordered eating behaviours and attitudes (Eikey & Reddy, 2017). This was identified in a study done by Simpson and Mazzeo (2017) on 493 undergraduate students. Between groups univariate effects indicated that participants who used calorie trackers showed higher levels of eating restraint and dietary concerns than those who did not use this type of technology ($p < .05$) (Simpson & Mazzeo, 2017). According to Simpson and Mazzeo (2017), this is of concern when individuals who showed higher levels of eating restraint and dietary concerns are vulnerable to developing disordered eating symptomatology.

A quantitative study in a sample of 122 male participants investigated if the use of MyFitnessPal (MFP) was associated with ED symptomatology in males (Linardon & Messer, 2019). The study concluded a consistent association between using MFP, and ED symptoms (Linardon & Messer, 2019). Of the study's participants 42% of them said they believed that MFP did not contribute to a pattern of disordered eating, however, 37.6% of them concluded that it very much, moderately, or somewhat, contributed to a possible pattern of disordered eating. The percentages above indicate that there could be an association between using MFP and possible disordered eating. They also compared MFP users with non-users (Linardon & Messer, 2019). The results showed that MFP users had significantly higher scores on the Eating Disorder Examination Questionnaire (EDE-Q); on the four sub-scales measured by the

EDE-Q (Restraint, Eating Concern, Shape Concern, and Weight Concern); on the Objective Binge Eating Frequencies; the Dichotomous Thinking in Eating Disorder Scale (DTES) and the Clinical Impairment Assessment (CIA) (Linardon & Messer, 2019).

These types of technologies may trigger disordered eating behaviours and attitudes such as:

- extreme food or calorie restriction;
- becoming fixated on achieving 'rewards' set by the app or watch for eating less;
- exercising more, and losing weight;
- becoming obsessed with logging health- and fitness data (Eikey & Reddy, 2017);
- becoming fixated on extreme feelings of guilt when missing an exercise session or exceeding daily calorie intake; as well as
- obsessive exercise to reduce calorie intake or to reach fitness goals (Hefner et al., 2016).

Problem Statement

According to Martin et al. (2018) there are a few studies that "have suggested that problematic relationships exist between the use of these apps and unhealthy behaviours related to eating symptomatology" (p. 608). Most of these studies have been done in the USA, UK, and Thailand; and have identified that there could be some form of problematic association or link between using this type of technology and disordered eating or ED symptomatology (Eikey & Reddy, 2017; Hahn et al., 2021; Hefner et al., 2016; Honary et al., 2019; Linardo & Messer, 2019; Martin et al., 2018; Plateau et al., 2018; Simpson & Mazzeo, 2017; Tan et al., 2015).

The researcher could not find research focusing on the association, or link, between health- and fitness-related technology and disordered eating in males, or even research on disordered eating in males that was relevant to this proposed study. However, previous studies linking ED behaviours and the use of health- and fitness-related technology mentioned the main limitation of their research being a lack of male participants (Hefner et al., 2016; Honary et al., 2019; Tan et al., 2016) and that future research should focus on including more male participants when doing research relating to this topic (Hahn et al., 2021). Therefore, the purpose of this study was to investigate if there is a link between using health- and fitness-related technology (such as a smart watch, calorie counting app, and/or fitness app) and disordered eating in a sample of male participants.

Research Methodology

This section focuses on the specific methodology used in this research study as well as justification for its use.

Research Approach

This research study followed a quantitative approach. According to Delport and De Vos (2011) the objective of this research approach is to "… describe the trends or explain the relationship between variables" (p. 64). In this case, describing the link between using health- and fitness-related technology and disordered eating in a sample of South African males.

The researcher does this by identifying a research question about observable or measurable variables, collecting numerical data, and analysing the data using statistical methods to see if what the researcher predicted was true or not (Delport & De Vos, 2011).

To answer the research question for this specific research study, the researcher used a demographic questionnaire and questions regarding health- and fitness technology use, as well as the Eating Disorder Assessment for Men (EDAM). This provided the researcher with numerical data that was then analysed statistically, and conclusions were drawn from that.

Research Design

The research design for this research study, was a cross-sectional survey design. In cross-sectional survey design, participants are chosen based on the inclusion and exclusion criteria identified by the researcher (Setia, 2016). This design can be used to identify if a particular phenomenon exists within a group of participants (Fouché et al., 2011). It is usually used in exploratory and descriptive research studies (Fouché et al., 2011), and participants are only assessed once (Kumar, 2011).

Population Sample

The sample population for this study included 304 South African males between the ages of 18 and 30 years. Only males were identified for the sample population since similar studies on this topic mentioned the main limitation of their research being a lack of male participants, and that future research should focus on including more male participants when doing research relating to this topic (Hahn et al., 2021; Hefner et al., 2016; Honary et al., 2019; Tan et al., 2016). They also had to be able to understand and read English to some extent to be able to complete the questionnaire on Google Forms.

The specific age range was included because several studies have identified young adults to be prone to display ED symptomatology and at risk for developing disorder eating, such as body dissatisfaction, excessive weight and dietary concerns, extreme exercise routines and more (Eisenberg et al., 2011; Honary et al., 2019; Martin et al., 2018, Sanlier et al., 2017).

According to Honary et al. (2019), marketing companies also tend to largely focus on younger adults when advertising these types of technology. They go further by stating that individuals between the ages of 18 and 29 years also seem to use this type of technology more regularly than other demographic groups (Honary et al., 2019). This was also

mentioned by Simpson and Mazzeo (2017). Hence, the population for this study focuses specifically on males between the ages of 18 and 30 years.

Sampling Method

Non-random, purposive sampling was used in this research study. With this type of sampling, participants are included based on specific qualities or characteristics that they possess. It is based on the notion that the researcher wants to know something about a particular phenomenon and then identifies individuals who are willing to provide information on this (Etikan et al., 2016). Etikan et al. (2016) state that: "Unlike random studies, which deliberately include a diverse cross section of ages, backgrounds and cultures, the idea behind purposive sampling is to concentrate on people with particular characteristics who will better be able to assist with the relevant research" (p. 3).

In this study the researcher was interested in knowing if there is a link between males who use health- and fitness-related technology, and disordered eating. The researcher identified South African males between the ages of 18 and 30 years as individuals who could possibly provide information on the above-mentioned phenomenon. Participants were either part of the control group or the comparison group. The control group included male participants who did not use health- and fitness-related technology (non-users). The comparison group included male participants who use health- and fitness-related technology (users).

Sample Size

A power analysis using G*Power software was calculated to identify the appropriate sample size (Faul et al., 2007). Based on the statistical test for data analysis that was identified prior to conducting the research study, with alpha set at .05, power at 0.8, and a medium effect size of 0.5, a total sample size of 128 participants was indicated. Thus, the final sample size ($N = 304$) for this study was sufficient for the data analysis proposed.

Data Collection

Participants had to electronically agree to participate in the study voluntarily, after which they were asked to complete an online questionnaire on Google Forms. The first section of the questionnaire was demographic-type questions (e.g. age, gender, race, etc.), which was followed by questions relating specifically to the type of health- and fitness-related technology they used and how often they used it. After that, they needed to complete the EDAM which has been developed to measure disordered eating behaviour in males.

The Eating Disorder Assessment for Men (EDAM)

The EDAM is a 50-item self-report questionnaire that has four subscales that attempt to measure EDs in males (Stanford & Lemberg, 2012b). These subscales are binge eating, muscle dysmorphia, body dissatisfaction, and disordered eating (Stanford & Lemberg, 2012b). The research team which developed this assessment identified these four scales - and each item under them - by conducting an extensive literature review, having experts in the field review the assessment, and brainstorming with health professionals who were treating males with EDs (Stanford & Lemberg, 2012b).

They started the process by reviewing literature and discussing clinical cases, which was followed by the identification of five dimensions that showed particular concern in males with EDs (Stanford & Lemberg, 2012b). These were: weight concerns, food issues, exercise issues, body image/ appearance concerns, and disordered eating habits (Stanford & Lemberg, 2012b). They identified 95 items related to specific issues for males with eating disorders, which were also designed to identify targeted issues that differentiate males from females (Stanford & Lemberg, 2012b). More than 20 experts in the field were then asked to review and evaluate the EDAM (Stanford & Lemberg, 2012b). They were asked to rate each item on a scale from 1 to 3 and to provide feedback and suggestions, after which items were then

removed, added, or adapted (Stanford & Lemberg, 2012b). The final 50 items were identified (Stanford & Lemberg, 2012b).

The preliminary version of the EDAM was distributed amongst a sample of 108 participants (78 males and 30 females) (Stanford & Lemberg, 2012b). These participants were patients at treatment centres being treated for either EDs or Addiction (Stanford & Lemberg, 2012b). A binary logistical regression was used to identify if the EDAM could discriminate between males with and without EDs, and it was also used to identify if the EDAM could significantly predict an ED in males (Stanford & Lemberg, 2012). "The omnibus test of model coefficients resulted in $X^2 = 36.026$, $df = 1$, $N = 78$, $p < .001$" (p. 431; Stanford & Lemberg, 2012b). They concluded that this assessment was significant in predicting an ED correctly in 82.1% of the males and that the internal reliability statistics done in this study showed that the EDAM has a Cronbach's alpha of .91 (Stanford & Lemberg, 2012b). According to Stanford and Lemberg (2012b) this indicates that the 50 items used in this assessment are consistently measuring the underlying construct of ED symptoms in males.

The four factors identified after the factor analysis were: Binge Eating, Muscle Dysmorphia, Body Dissatisfaction, and Disordered Eating. "Each of the components loaded with a no less than a .312 correlation, some with up to a .783 correlation in the component matrix" (p. 432; Stanford & Lamberg, 2012b).

Data Analysis

Statistical analytic software such as SPSS (Statistical Package for the Social Sciences) and JASP (Jeffrey's Amazing Statistics Program) was used to analyse the quantitative data. A statistician also assisted with the interpretation of the results. Descriptive statistics - more specifically frequencies, percentages, means, and standard deviation - were used to summarise the data.

The impact of participants' demographic data, more specifically their usage of health- and fitness-related technology on the four EDAM subscales (binge eating, muscle dysmorphia, body dissatisfaction, and eating disorder), was determined by comparative analyses. The following statistical technique was used: independent samples t-test. If there was a statistically significant relationship between the mean scores, the following guideline values were used for interpreting effect size: an effect size of .2 indicates a small or practical non-significant effect, .5 indicates a medium or practical visible effect, and .8 indicates a large or practical significant effect (Fields, 2013).

Ethical Considerations

This research study received approval from the NWU Faculty of Health Sciences Research Ethics Committee (HREC; NWU-00248-21-A1). To ensure the anonymity and confidentiality of the participants, they were not asked to provide any identifiable information such as their name, surname, or contact details. Before being able to complete the questionnaire on Google Forms, participants were first provided with an online informed consent request. Only once they indicated that they willingly and voluntarily agreed to participate were they able to complete the questionnaire. Each participant was only able to complete the questionnaire once, after which a general information sheet informed them that they should contact the researcher (Ms Daniel) for further information.

Once 304 participants had completed the questionnaire, data analysis commenced. The extracted Excel spreadsheet was safely stored on a password-protected laptop, and only the researchers (Prof Spies and Ms Daniel), as well as a statistician, had access to the data. This was all explained to the research participants as part of the researcher's attempt to ensure their confidentiality, anonymity and privacy.

References

Akabor, N. (2022, May 17). *Research finds fitness trackers increase physical activity*. https://mg.co.za/sci-tech/2022-05-17-research-finds-fitness-trackers-increase-physical-activity/

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Publishing.

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.). American Psychiatric Publishing.

Calzo, J. P., Horton, N. J., Sonneville, K. R., Swanson, S. A., Crosby, R. D., Micali, N., Eddy, K. T., & Field, A. E. (2016). Male eating disorder symptom patterns and health correlates from 13 to 26 years of age. *Journal of the American Academy of Child & Adolescent Psychiatry, 55*(8), 693–700. https://doi.org/10.1016/j.jaac.2016.05.011

Ceci, L. (2021, July 6). *Health and fitness app downloads worldwide from 1st quarter 2019 to 2nd quarter 2020 (in millions).* https://www.statista.com/statistics/1127248/health-fitness-apps-downloads-worldwide/

Ceci, L. (2022, March 22a). *Health and fitness apps - Statistics & facts.* https://www.statista.com/topics/9204/health-and-fitness-apps/#dossierKeyfigures

Ceci, L. (2022, July 25b). *Leading health and fitness apps in the Google Play Store worldwide in June 2022, by revenue*. https://www.statista.com/statistics/695697/top-android-health-apps-in-google-play-by-revenue/

Chapman, J., & Woodman, T. (2015). Disordered eating in male athletes: A meta-analysis. *Journal of Sports Sciences, 34*(2), 101–109. https://doi.org/10.1080/02640414.2015.1040824

Chiu, W., & Cho, H. (2020). The role of technology readiness in individuals' intention to use health and fitness applications: A comparison between users and non-users. *Asia*

Pacific Journal of Marketing and Logistics, *33*(3), 807–825. https://doi.org/10.1108/apjml-09-2019-0534

Comstock, J. (2015, May 11). *Eight years of fitbit news leading up to its planned IPO.* https://www.mobihealthnews.com/43423/eight-years-of-fitbit-news-leading-up-to-its-planned-ipo

Dakanalis, A., & Riva, G. (2013). Current considerations for eating and body-related disorders among men. In L. B. Sams & J. A. Keels (Eds.), *Handbook on body image: Gender differences, sociocultural influences and health implications* (pp. 195-216). Nova Publishers, Incorporated.

Darcy, A. M., & Lin, I. H. (2012). Are we asking the right questions? A review of assessment of males with eating disorders. *Eating Disorders, 20*, 416-426. https://doi.org/10.1080/10640266.2012.715521

Delport, C. S. L., & de Vos, A. S. (2011). Professional research and professional practice. In A. S. de Vos, H. Strydom, C. B. Fouché, & C. S. L. Delport (Eds.), *Research at grass roots: For the social sciences and human service professions* (4th ed., pp. 45-60). Van Schaik Publishers.

Eikey, E. V., & Reddy, M. C. (2017). "It's definitely been a journey": A qualitative study on how women with eating disorders use weight loss apps. *Conference on Human Factors in Computing Systems, 2017*, 642-654. http://dx.doi.org/10.1145/3025453.3025591

Eikey, E. V., Reddy, M. C., Booth, K. M., Kvasny, L., Blair, J. L., Li, V., & Poole, E. S. (2017). Desire to be underweight: Exploratory study on a weight loss app community and user perceptions of the impact on disordered eating behaviors. *JMIR mHealth and uHealth, 5*(10), 1-11. https://doi.org/10.2196/mhealth.6683

Eisenberg, D., Nicklett, E. J., Roeder, K., & Kirz, N. E. (2011). Eating disorder symptoms among college students: Prevalence, persistence, correlates, and treatment seeking. *Journal of American College Health, 59*(8), 700–707. https://doi.org/10.1080/07448481.2010.546461

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics, 5,* 1-4. https://doi.org/10.11648/j.ajtas.20160501.11

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175-191. https://doi.org/10.3758/bf03193146

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). SAGE Publications Ltd.

Fitbit. (n.d.). *Charge 4*. https://www.fitbit.com/global/us/products/trackers/charge4

Fouché, C. B., Delport, C. S. L., & de Vos, A. S. (2011). Quantitative research designs. In A. S. de Vos, H. Strydom, C. B. Fouché, & C. S. L. Delport (Eds.), *Research at grass roots: For the social sciences and human service professions* (4th ed., pp. 142-158). Van Schaik Publishers.

Franco, R. Z., Fallaize, R., Lovegrove, J. A., & Hwang, F. (2016). Popular nutrition-related mobile apps: A feature assessment. *JMIR mHealth and uHealth, 4*(3), 1-12. https://doi.org/10.2196/mhealth.5846

Freeman, A. C., & Szabo, C. P. (2005). Eating disorders in South African males: A review of the clinical presentation of hospitalised patients. *South African Journal of Psychology, 35*(4), 601–622. https://doi.org/10.1177/008124630503500401

GCFGlobal. (n.d.). *Pros and cons of wearable technology.* https://edu.gcfglobal.org/en/wearables/pros-and-cons-of-wearable-technology/1/

Gorrell, S., & Murray, S. B. (2019). Eating disorders in males. *Child and Adolescent Psychiatric Clinics of North America, 28*(4), 641–651. https://doi.org/10.1016/j.chc.2019.05.012

Gottlieb, C. (2014, February 23). Disordered eating or eating disorder: What's the difference? *Psychology Today.* https://www.psychologytoday.com/za/blog/contemporary-psychoanalysis-in-action/201402/disordered-eating-or-eating-disorder-what-s-the

Griffiths, S., Murray, S. B., & Touyz, S. (2014). Extending the masculinity hypothesis: An investigation of gender role conformity, body dissatisfaction, and disordered eating in young heterosexual men. *Psychology of Men & Masculinity*, *16*(1), 108–114. https://doi.org/10.1037/a0035958

Hahn, S. L., Sonneville, K. R., Kaciroti, N., Eisenberg, D., & Bauer, K. W. (2021). Relationships between patterns of technology-based weight-related self-monitoring and eating disorder behaviors among first year university students. *Eating Behaviors*, *42*, 1–8. https://doi.org/10.1016/j.eatbeh.2021.101520

Hefner, V., Dorros, S. M., Jourdain, N., Liu, C., Tortomasi, A., Greene, M. P., Brandom, C., Ellet, M., & Bowles, N. (2016). Mobile exercising and tweeting the pounds away: The use of digital applications and microblogging and their association with disordered eating and compulsive exercise. *Cogent Social Sciences, 2*(1), 1–11. https://doi.org/10.1080/23311886.2016.1176304

Higgins, J. P. (2016). Smartphone applications for patients' health and fitness. *The American Journal of Medicine, 129*(1), 11–19. https://doi.org/10.1016/j.amjmed.2015.05.038

Hoerr, S. L., Bokram, R., Lugo, B., Bivins, T., & Keast, D. R. (2002). Risk for disordered eating relates to both gender and ethnicity for college students. *Journal of the American College of Nutrition, 21*(4), 307–314. https://doi.org/10.1080/07315724.2002.10719228

Honary, M., Bell, B. T., Clinch, S., Wild, S. E., & McNaney, R. (2019). Understanding the role of healthy eating and fitness mobile apps in the formation of maladaptive eating and exercise behaviors in young people. *JMIR mHealth and uHealth, 7*(6), 1-19. https://doi.org/10.2196/14239

Jordaan, E. (2016). Eating and feeding disorders. In A. Burke (Ed.), *Abnormal Psychology: A South African perspective* (2nd ed. revised, pp. 409-446). Oxford University Press Southern Africa.

Kimball, A. (2015, June 1). *The downside of calorie-counting apps and health tracking.* https://www.chatelaine.com/health/fitness/the-downside-of-calorie-counting-apps-and-health-tracking/

KPMG. (2016). *Health wearables, apps & information protection*. https://home.kpmg/za/en/home/insights/2016/06/health-wearables--apps---information-protection.html

Kumar, R. (2011). *Research methodology: A step-by-step guide for beginners* (3rd ed.). SAGE Publications Ltd.

Kunst, A. (2022, February 23). *Which of these types of health apps and smart health devices (connected to the internet) have you used in the past 12 months?* https://www.statista.com/forecasts/832208/usage-of-health-apps-and-smart-health-devices-in-south-africa

Laricchia, F. (2022, June 20a). *Fitness trackers - Statistics & facts.* https://www.statista.com/topics/4393/fitness-and-activity-tracker/#dossierKeyfigures

Laricchia, F. (2022, March 31b). *Global wearable device market share from 3rd quarter 2020 to 3rd quarter 2021, by product category.* https://www.statista.com/statistics/690731/wearables-worldwide-shipments-by-product-category/

Lavender, J. M., & Anderson, D. A. (2009). Contribution of emotion regulation difficulties to disordered eating and body dissatisfaction in college men. *International Journal of Eating Disorders, 34*(4), 352-357. https://doi.org/10.1002/eat.20705

Lavender, J. M., Brown, T. A., & Murray, S. B. (2017). Men, muscles, and eating disorders: An overview of traditional and muscularity-oriented disordered eating. *Current Psychiatry Reports, 19*(32), 1-7. https://doi.org/10.1007/s11920-017-0787-5

Limbers, C. A., Cohen, L. A., & Gray, B. A. (2018). Eating disorders in adolescent and young adult males: Prevalence, diagnosis, and treatment strategies. *Adolescent Health, Medicine and Therapeutics*, *9*, 111–116. https://doi.org/10.2147/ahmt.s147480

Linardon, J., & Messer, M. (2019). My fitness pal usage in men: Associations with eating disorder symptoms and psychosocial impairment. *Eating Behaviors*, *33*, 13-17. https://doi.org/10.1016/j.eatbeh.2019.02.003

Lyons, E. J., Lewis, Z. H., Mayrsohn, B. G., & Rowland, J. L. (2014). Behavior change techniques implemented in electronic lifestyle activity monitors: A systematic content analysis. *Journal of Medical Internet Research, 16*(8), 1-15. https://doi.org/10.2196/jmir.3469

MacNeill, L. P., Best, L. A., & Davis, L. L. (2017). The role of personality in body image dissatisfaction and disordered eating: Discrepancies between men and women. *Journal of Eating Disorders, 5*(44), 1-9. https://doi.org/10.1186/s40337-017-0177-8

Martin, K. E., McGloin, R., & Atkin, D. (2018). Body dissatisfaction, neuroticism, and female sex as predictors of calorie-tracking app use amongst college students. *Journal of American College Health, 66*(7), 608–616. https://doi.org/10.1080/07448481.2018.1431905

Midgley, B. (2018). *The six reasons the fitness industry is booming*. https://www.forbes.com/sites/benmidgley/2018/09/26/the-six-reasons-the-fitness-industry-is-booming/?sh=6ae69f85506d

Mitchison, D., & Mond, J. (2015). Epidemiology of eating disorders, eating disordered behaviour, and body image disturbance in males: A narrative review. *Journal of Eating Disorders*, *3*(20), 1-9. https://doi.org/10.1186/s40337-015-0058-y

Morning Consult. (2018). *National tracking poll #181231 December 13-14, 2018: Crosstabulation results.* https://morningconsult.com/wp-content/uploads/2019/01/181231_crosstabs_CES_MOBILE_Adults_v2_AP.pdf

Morris, P. F., & Szabo, C. P. (2012). Meanings of thinness and dysfunctional eating in black South African females: A qualitative study. *African Journal of Psychiatry*, *16*(5), 338-342. https://doi.org/10.4314/ajpsy.v16i5.45

Murad, Y. (2019, January 8). *Wearable and app users tracking health tech's next step.* https://morningconsult.com/2019/01/08/wearable-and-app-users-tracking-health-techs-next-step/

Murray, S. B., Griffiths, S., & Mond, J. M. (2016). Evolving eating disorder psychopathology: Conceptualising muscularity-oriented disordered eating. *British Journal of Psychiatry, 208*, 414–415. https://doi.org/10.1192/bjp.bp.115.168427

Nagata, J. M., Murray, S. B., Bibbins-Domingo, K., Garber, A. K., Mitchison, D., & Griffiths, S. (2019). Predictors of muscularity-oriented disordered eating behaviors in U.S. young adults: A prospective cohort study. *International Journal of Eating Disorders*, *52*(12), 1380–1388. https://doi.org/10.1002/eat.23094

National Association of Anorexia Nervosa and Associated Disorders (ANAD). (n.d.-a). *Eating disorder statistics.* https://anad.org/get-informed/about-eating-disorders/eating-disorders-statistics/

National Association of Anorexia Nervosa and Associated Disorders (ANAD). (n.d.-b). *Eating disorder types & symptoms*. https://anad.org/get-informed/about-eating-disorders/eating-disorder-types-and-symptoms/

National Eating Disorders Collaboration. (n.d.). *Disordered eating & dieting*. https://nedc.com.au/eating-disorders/eating-disorders-explained/disordered-eating-and-dieting/

Netcare. (2018, October 10). *Understanding eating and weight disorders.* https://www.netcare.co.za/News-Hub/Articles/understanding-eating-and-weight-disorders

Paxton, M. (2020, August 17). *Wearable tech fitness trackers on the rebound.* https://www.spglobal.com/marketintelligence/en/news-insights/blog/wearable-tech-fitness-trackers-on-the-rebound

Plateau, C. R., Bone, S., Lanning, E., & Meyer, C. (2018). Monitoring eating and activity: Links with disordered eating, compulsive exercise, and general wellbeing among young adults. *International Journal of Eating Disorders, 51*(11), 1270–1276. https://doi.org/10.1002/eat.22966

Sanlier, N., Varli, S. N., Macit, M. S., Mortas, H., & Tatar, T. (2017). Evaluation of disordered eating tendencies in young adults. *Eating and Weight Disorders – Studies on Anorexia, Bulimia and Obesity*, *22*(4), 623–631. https://doi.org/10.1007/s40519-017-0430-9

Sarcona, A., Kovacs, L., Wright, J., & Williams, C. (2017). Differences in eating behavior, physical activity, and health-related lifestyle choices between users and nonusers of mobile health apps. *American Journal of Health Education*, *48*(5), 298–305. https://doi.org/10.1080/19325037.2017.1335630

Setia, M. S. (2016). Methodology series module 3: Cross-sectional studies. *Indian Journal of Dermatology, 61*(3), 261–264. https://doi.org/10.4103/0019-5154.182410

Simpson, C. C., & Mazzeo, S. E. (2017). Calorie counting and fitness tracking technology: Associations with eating disorder symptomatology. *Eating Behaviors, 26*, 89-92. http://dx.doi.org/10.1016/j.eatbeh.2017.02.002

Smith, K. E., Mason, T. B., Murray, S. B., Griffiths, S., Leonard, R. C., Wetterneck, C. T., Smith, B. E. R., Farrell, N. R., Riemann, B. C., & Lavender, J. M. (2017). Male clinical norms and sex differences on the Eating Disorder Inventory (EDI) and Eating Disorder Examination Questionnaire (EDE-Q). *International Journal of Eating Disorders, 50*(7), 769-775. https://doi.org/10.1002/eat.22716

Solbrig, L., Jones, R., Kavanagh, D., May, J., Parkin, T., & Andrade, J. (2017). People trying to lose weight dislike calorie counting apps and want motivational support to help them achieve their goals. *Internet Interventions*, *7*, 23–31. https://doi.org/10.1016/j.invent.2016.12.003

Stanford, S. C., & Lemberg, R. (2012a). A clinical comparison of men and women on the Eating Disorder Inventory-3 (EDI-3) and the Eating Disorder Assessment for Men (EDAM). *Eating Disorders, 20*(5), 379-394. https://doi.org/10.1080/10640266.2012.715516

Stanford, S. C., & Lemberg, R. (2012b). Measuring eating disorders in men: Development of the Eating Disorder Assessment for Men (EDAM). *Eating Disorders, 20*(5), 427-436. https://doi.org/10.1080/10640266.2012.715522

Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. *Psychological Bulletin*, *128*(5), 825–848. https://doi.org/10.1037/0033-2909.128.5.825

Tan, T., Kuek, A., Goh, S. E., Lee, E. L., & Kwok, V. (2016). Internet and smartphone application usage in eating disorders: A descriptive study in Singapore. *Asian Journal of Psychiatry, 19,* 50-55. http://dx.doi.org/10.1016/j.ajp.2015.11.007

U.S. Food and Drug Administration. (n.d.). *Digital health innovation action plan*. https://www.fda.gov/media/106331/download

Vailshery, L. S. (2021). *Fitbit Inc. revenue from 2010 to 2019 (in million U.S. dollars)**. https://www.statista.com/statistics/472518/fitbit-revenue/

Verizon. (n.d.). *A timeline: A brief history of Apple watch.* https://www.verizon.com/articles/brief-history-of-apple-watch/

Windasari, N. A., Lin, F-R., & Kato-Lin, Y-C. (2021). Continued use of wearable fitness technology: A value co-creation perspective. *International Journal of Information Management, 57,* 1-15. https://doi.org/10.1016/j.ijinfomgt.2020.102292

Yu, Z., & Tan, M. (2016). Disordered eating behaviors and food addiction among nutrition major college students. *Nutrients, 8*(11), 1–16. https://doi.org/10.3390/nu8110673

SECTION 2: ARTICLE

Men's health- and fitness-related technology use and its associations with disordered eating

Guidelines for authors: *Eating Disorders: The Journal of Treatment and Prevention*

This section will be submitted for possible publication and will therefore be in article format. A summary of the author guidelines for the journal *Eating Disorders: The Journal of Treatment and Prevention* will be provided, which will be followed by the article.

Instruction for Authors

About the Journal

Eating Disorders: The Journal of Treatment and Prevention is a peer-reviewed journal that is respected worldwide. This journal is appropriate for clinicians, researchers, and prevention experts in the field of eating disorders. The specific focus of this journal is publishing high quality, original research articles that facilitate, inform and assess the effectiveness of prevention and treatment methods and interventions.

Manuscript Format

According to the journal guidelines, the structure of the paper should include the following: title page; abstract and keywords; introduction; methods; results; discussion; acknowledgements; declaration of interest statement; references; appendices; table(s) with headings (on individual pages); and figures. The word count for research articles is 6 000 words, which should include the abstracts, tables, references, and tables or figures. The title page should include the full names of all the authors, the institutional affiliations where the study was conducted, and acknowledgements. This is followed by the abstract which should be 200 words and the researcher should identify five to seven keywords. This journal also

requires the researchers to provide three to five clinical implications in bullet form, which should not exceed 85 characters.

References

APA 7th edition (the style of the American Psychological Association) referencing should be followed for any manuscript submitting for possible publication. The journal provided a thirty-seven-page reference guide manual that should be followed when preparing the article references list, as well as in-text citations. This manual was consulted and used when preparing the references for this article.

ARTICLE

Men's health- and fitness-related technology use and its link with disordered eating

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Men's Health- and Fitness-Related Technology Use and its Associations with Disordered Eating

Abstract

With health- and fitness-related technology continuously developing and improving, researchers have become concerned with its association with disordered eating. This study investigated the possible link between using these types of technologies and disordered eating, in a sample of South African males. The final sample consisted of 304 males who were recruited via social media platforms. They were asked to complete an online questionnaire which included questions regarding health- and fitness-related technology use and the items from the *Eating Disorder Assessment for Men (EDAM).* Data were analysed using statistical analysis software (SPSS and JSAP). Most of the participants indicated that they used health- and fitness-related technology (N = 161; 52.96%), with fitness applications (apps) being the most commonly used (N = 151; 49.67%). There was a statistically significant difference in the mean scores for users and non-users of health- and fitness-related technology and the construct body dissatisfaction ($t(289) = 2.356$, $p = .019$), as well as between body dissatisfaction and users and non-users of calorie counting apps ($t(289) = 2.514$, $p = .012$). The results highlighted the possibility that certain strategies, such as using calorie counting apps, can be utilised by males to relieve any anxiety when experiencing body dissatisfaction and disordered eating. Clinical implications and limitations were also discussed.

(197 words)

Keywords: body dissatisfaction, disordered eating, eating behaviours, eating attitudes, fitness-related technology, health-related technology, males, quantitative research

Clinical implications

- Males may utilise possible strategies such as using health- and fitness-related technology, to alleviate feelings of guilt related to disordered eating.
- When considering the factors that have an association with disordered eating, body dissatisfaction should be considered as one of the most prominent.
- In this study, when looking at the link between health- and fitness-related technology and disordered eating in males, calorie counting apps seem to be the most problematic.

Introduction

It has become increasingly clear that the way in which males and females experience and present disordered eating may be different (Griffiths et al., 2014; Lavender et al., 2017; Le et al., 2021; MacNeill et al., 2017; Stanford & Lemberg, 2012a). Most males tend to seek a more muscular physique, whereas females are more focused on attaining the *thin body ideal* (Dakanalis et al., 2015; Gorrell & Murray, 2019; Griffiths et al., 2014). Pressure to attain the *ideal body* as promoted by society and the media (MacNeill et al., 2017), could in some instances result in males displaying symptoms of disordered eating and/or experiencing high levels of body dissatisfaction (Griffiths et al., 2014; Nerini et al., 2016).

Body dissatisfaction refers to the extent to which an individual is concerned with, or is dissatisfied with their overall appearance (Wyssen et al., 2016) and has been identified as a risk factor for developing and maintaining disordered eating behaviour (Dakanalis et al., 2015). Dakanalis and colleagues (2015) state that between 57-80% of young males experience body dissatisfaction. However, when compared to females, they will be less likely to disclose any discomfort with their overall appearance (Calzo et al., 2016). Men who perceive themselves as being too thin or overweight, can be vulnerable to experiencing body dissatisfaction, and partake in risky health- and fitness-related behaviours to attain the *ideal body* (Calzo et al., 2016).

With technology continuously developing and improving, new ways of monitoring and encouraging health-conscious lifestyles are available (Higgins, 2016). Early statistics show that, in the month of January 2022, the most used health- and fitness applications (apps) were downloaded globally approximately 17 million times (Ceci, 2022). This was more than the 16.3 million downloads recorded in January 2020 (Ceci, 2022). Wearable devices such as smartwatches and fitness trackers will be expected to see a global annual increase in shipments, of 11% between 2021 and 2024 (Laricchia, 2022). It was estimated that 37 million

smartwatch shipments were sold worldwide in 2016, and that this will most likely see an increase of more than 253 million devices by 2025 (Laricchia, 2022). As more and more of these devices and apps are being utilised for improving physical fitness and monitoring daily health (Chiu & Cho, 2020), concerns are being raised whether these types of technologies are more harmful than beneficial (Miller, 2015).

According to Miller (2015), health- and fitness-related technology can fuel problematic characteristics associated with disordered eating, such as the desire for rigid control and perfectionism. Individuals that struggle with perfectionistic tendencies are especially at risk for experiencing anxiety or guilt when not meeting specific fitness goals or exceed daily calorie intake (Simpson & Mazzeo, 2017). This, in turn, can result in excessive and rigid dieting and/or physical activity in order to decrease these feelings of guilt (Simpson & Mazzeo, 2017). These are some of the risky behaviours associated with excessive health- and fitness-related technology use. It is for this reason that researchers have become concerned with whether these types of technologies may be associated with body dissatisfaction and disordered eating (Hahn et al., 2021; Linardon & Messer, 2019; Martin et al., 2018; Simpson & Mazzeo, 2017). One of the main limitations indicated by some of these researchers is the fact that their final population sample lacked male representation (Hefner et al., 2016; Honary et al., 2019; Tan et al., 2016), adding to the incorrect notion that body dissatisfaction and disordered eating is a "female issue" (p. 86; Dakanalis et al., 2015).

Males are likely to exhibit "… a particularly maladaptive set of behaviours" (p. 2) in order to achieve the *ideal body* which is characterised as being both lean and muscular (Lavender et al., 2017). These behaviours include fixed and strict dieting and/or exercising routines, as well as in some cases the use of over the counter and/or illicit appearance and performance-enhancing supplements (Lavender et al., 2017), thus, emphasising that males are not immune to disordered eating and body dissatisfaction (Ammann et al., 2017) which may

also be triggered and maintained by using health- and fitness-related technology (Simpson & Mazzeo, 2016).

In order to address the gap in literature, the following research question was answered: *What is the link between the use of health- and fitness-related technology and disordered eating in a sample of South African males?* The aim was to investigate whether there is a statistically significant difference regarding specific behaviours linked with disordered eating in a sample of South African males that use health- and fitness-related technology (users) - more specifically smart watches, calorie counting apps, and/or fitness apps – and those who do not (non-users).

Methods

Procedures and Ethical Aspects

This study was approved in South Africa by the Health Research Ethics Committee (HREC) of the Faculty of Health Sciences of the North-West University (NWU- 00248-21-A1). Participants for this research study were recruited via an advertisement shared on several social media platforms such as Facebook, Instagram, LinkedIn, etc. The advertisement was posted and shared for approximately seven months and participants did not receive any incentives or reimbursements for participating. For confidentiality and anonymity purposes, the link to the online questionnaire was provided with the advertisement and the researcher did not have any direct or indirect contact with the participants.

After giving informed consent, participants were asked to complete the questionnaire online. The questionnaire asked for demographic-related information (e.g. age and sex); specific questions relating to the use of health- and fitness technology (e.g. do you use health- and fitness-related technology?), as well as the 50-item Eating Disorder Assessment for Men

(EDAM) developed by Stanford and Lemberg (2012b). Completing the questionnaire took approximately 30 minutes.

Sampling Method

Non-random, purposive sampling was used for this research study (Etikan et al., 2016). The final sample included both users and non-users of health- and fitness-related technology for comparison purposes. Men between the ages of 18 and 30 years are at higher risk of developing disordered eating (Sanlier et al., 2017) and experiencing body dissatisfaction (Martin et al., 2018) and were therefore the focus of this study. Additionally, marketing companies tend to focus on younger adults when advertising health- and fitness technology (Honary et al., 2019).

Measures

Disordered Eating

The Eating Disorder Assessment for Men (EDAM) is a 50-item self-report questionnaire focused on measuring eating disorders in males (Stanford & Lemberg, 2012b). It includes four subscales: binge eating (12 items), muscle dysmorphia (15 items), body dissatisfaction (12 items), and eating disorder (11 items) (Stanford & Lemberg, 2012b). Each item was rated on a 5-point Likert scale ranging from 0 (never) to 4 (always). The internal reliability for each subscale in this study was: $\alpha = .76$ (binge eating), $\alpha = .79$ (muscle dysmorphia), $\alpha = .76$ (body dissatisfaction), and $\alpha = .78$ (eating disorder). These values were all above the guideline value of at least .70 (Field, 2013) indicating that the resulting factors (subscales) were reliable.

Data Analysis

Data was analysed by using statistical analytic software (SPSS and JSAP). Descriptive statistics was calculated to explore the mean differences between males who used health- and fitness-related technology (users) and those who did not (non-users). This was explored in

terms of their overall EDAM scores, as well as for the four subscales (binge eating, muscle dysmorphia, body dissatisfaction, and eating disorder). Inferential statistics - more specifically independent samples t-tests - were then calculated to assess if there was a statistically significant difference between the mean scores of users and non-users (Pallant, 2016). This will be discussed in the results section below.

Results

The final sample population for this study included 304 males. Descriptive statistics for the demographic-related information can be found in Table 1, whereas Table 2 provides the descriptive statistics for the sample's health- and fitness-related technology use. More participants indicated that they used health- and fitness-related technology (N = 161; 52.96%), with fitness apps (N = 151; 49.67%) being the most prominently used type of technology amongst this sample. When asked how often they use their health- and fitness-related technology 32.24% (N = 98) of the participants indicated 'a few times a day', whereas 21.38 % (N = 65) indicated 'not regularly'.

<INSERT TABLE 1 AND 2 HERE>

An independent samples t-test was conducted to compare the mean EDAM scores for health- and fitness-related technology users and non-users. There was not a statistically significant difference in the mean scores for these two groups ($t(301) = 1.710$, $p = .088$). There was only a statistically significant difference for the subscale body dissatisfaction, between the two groups ($t(289) = 2.356$, $p = .019$); however, it had a small effect size of .277 (Field, 2013). The other three subscales did not show a statistically significant difference between the mean scores for those who used any health- and fitness-related technology and those who did not (see Table 3).

With regards to the type of technology used, there was no statistically significant differences between the mean EDAM scores for fitness watch users and non-users ($t(301)$ =

0.804, $p = .422$). The same was also found for calorie counting apps ($t(301) = 1.837$, $p = .067$) and fitness apps ($t(301) = 1.073$, $p = .284$). However, there was a statistically significant relationship between the mean scores of calorie counting app users and non-users on the subscale of body dissatisfaction ($t(289) = 2.514$, $p = .012$). Further, there was no statistically significant relationship between the mean scores for types of technology and the remaining subscales (see Table 3).

<INSERT TABLE 3 HERE>

Discussion

The use of health- and fitness-related technology has been increasing globally, year after year (Ceci, 2022; UpMeals, 2020). Using these types of technology has been associated with establishing healthy habits, promoting fitness and/or exercise routines, as well as making better choices regarding nutrition and food consumption (UpMeals, 2020). It can help achieve certain health- and fitness goals such as losing weight, building muscle, calorie tracking and much more (UpMeals, 2020). However, it is also possible that in some instances, the risks of using health- and fitness-related technology outweigh the benefits (UpMeals, 2020), especially when an individual displays extreme behaviours of control, which has been identified as a possible trigger for disordered eating (UpMeals, 2020).

This study aimed to investigate whether there is a link between using health- and fitness-related technology and disordered eating in a sample of South African males. The results showed a difference in the mean scores for users and non-users of health- and fitness-related technology and the construct body dissatisfaction, as well as between body dissatisfaction and the use of calorie counting apps.

According to Dakanalis et al. (2014) males who experience higher levels of body dissatisfaction will be more likely to partake in risky eating and weight control practices in order to achieve the *ideal male body*. This includes behaviours such as binge eating, using

laxatives, fasting, and extreme exercising routines (Da Silva et al., 2017). When looking at the results for this study, it is possible that using calorie counting apps can become a regulation strategy, focused on targeting issues with weight and body shape (Dakanalis et al., 2014). Linardon and Messer (2019) conducted a study focusing specifically on an association between the calorie counting app, MyFitnessPal (MFP), and eating disorder symptoms in a sample of males (Linardon & Messer, 2019). In their study, approximately 40% of the sample indicated that MFP, to some extent, contributed to displaying and/or experiencing eating disorder symptoms (Linardon & Messer, 2019). Therefore, it does seem that calorie counting apps may become part of a strategy to relieve possible anxiety and guilt related to body dissatisfaction: more so than any of the other technologies that were included in this study.

Interestingly, the findings of a previous study (see Simpson & Mazzeo, 2017) stands in contrast to this study's results. Simpson and Mazzeo (2017) identified fitness watches and/or devices as a unique indicator of experiencing symptoms of disordered eating in their study, and not calorie-counting apps. They concluded that future research should focus on understanding the association between using calorie counting apps and disordered eating (Simpson & Mazzeo, 2017). Even though it was not possible to provide a clear understanding of the association between these two variables within this study, the researchers were able to identify that a possible link did seem to exist (contradicting the above-mentioned findings), and that this link was more related to body dissatisfaction. Body dissatisfaction has previously been identified as an important aspect when looking at disordered eating amongst the male population (Da Silva et al., 2017).

Maladaptive levels of body dissatisfaction have been described as a consistent risk factor for disordered eating (Ammann et al., 2018; Dakanalis et al., 2014; Dakanalis et al., 2015). Whereas Da Silva et al. (2017) mentioned that body dissatisfaction was also strongly associated with body dysmorphia and the drive for a muscular physique that is associated

with masculinity in males, therefore, showing an association between body dissatisfaction and several other aspects of disordered eating in males.

Males who experience higher levels of body dissatisfaction will most likely be dissatisfied with their overall body shape and size (e.g. the desire for being more muscular) as well as dissatisfaction with specific upper body parts such as their arms and chest area (Ammann et al., 2018; Dakanalis et al., 2015). These males will be more likely to focus on losing weight and increasing their overall muscle mass (McCabe & Ricciardelli, 2004). Touching on another factor measured by the EDAM, namely *muscle dysmorphia* (Stanford & Lemberg, 2012a). This was not something that clearly stood-out in this study; however, it is important to take note of the association between body dissatisfaction and the need for a more muscular body (Griffiths et al., 2014). Having a muscular body has been identified as a way in which males can "communicate traditionally masculine qualities to others" (p. 1; Griffiths et al., 2014). Males who perceive themselves as lacking these qualities can find themselves feeling more pressured to obtain the ideal muscular body, which can result in body dissatisfaction and disordered eating (Griffiths et al., 2014). Still, the number of males struggling with disordered eating may be downplayed and not adequately addressed when it comes to seeking treatment (DSM-5-TR, 2022).

There are two possible explanations for this. Firstly, disordered eating in males is more inclined to be ignored, since males deny or dismiss the presence of any symptoms, usually due to the social stigma underlying this diagnosis (Limbers et al., 2018). Secondly, it could be because not enough attention is given to identifying the appropriate biopsychosocial factors associated with the prevalence of disordered eating in males (Ammann et al., 2018). According to Ammann et al. (2018) these factors include low self-esteem, perfectionistic tendencies, the way in which society portrays the *ideal male body*, as well as social development and psychological adaptation during younger years. Referring to the latter

factor, it has been mentioned that early-maturing males are usually perceived as being more attractive which, in turn, could result in displaying higher levels of body dissatisfaction (Ammann et al., 2018). Bringing us back to the earlier discussion within this section: males who experience higher levels of body dissatisfaction and disordered eating will be more likely to partake in risky practices and weigh control strategies, such as using calorie counting apps, in order to obtain the *ideal male body* (Ammann et al., 2018; Dakanalis et al., 2014). Perfectionistic tendencies have also been cited as resulting in excessive and rigid dieting and/or physical activity with the hopes of reducing feelings of guilt when exceeding calorie intake or not meeting fitness goals (Simpson & Mazzeo, 2017). This, therefore, provides a potential link between certain individual characteristics related to disordered eating in males and use of health- and fitness-related technology.

Clinical implications for this study are related to the fact that body dissatisfaction was the predominant finding amongst this male population when it came to using health- and fitness-related technology. This is something that should be considered when identifying proper treatment strategies for males who seem to display symptoms of disordered eating. It should also be considered when conceptualising a clear description and/or understanding of disordered eating in males. Health care professionals who work specifically with disordered eating, should consider possible regulation strategies that males use to reduce feelings of guilt and anxiety when experiencing higher levels of body dissatisfaction (Dakanalis et al., 2014), such as using health- and fitness-related technology (Simpson & Mazzeo, 2017). The developers of health- and fitness-related technology might also want to consider developing and/or including possible screening tools to help identify males at risk for displaying problematic eating behaviours and attitudes, especially the developers of calorie counting apps.

This study was also not without its limitations. Only South African males between the ages of 18 and 30 years were included, thus making it impossible to generalise these findings to the larger population. Future researchers should consider broadening the inclusion criteria to assess if the results are similar, or if there are any noteworthy differences between these groups. Non-probability, purposive sampling was used as the sampling method, which also makes it difficult to generalise the results. This study used cross-sectional survey design and the topic has been identified as one around which males tend to ignore, deny, or dismiss their symptoms (Limbers et al., 2018). It is therefore possible that the results aren't a true reflection of the extent of disordered eating amongst South African males. Lastly, only independent sample t-tests were used to compare the mean differences between users and non-users of health- and fitness-related technology. Future research should be conducted which includes other statistical tests, such as assessing the possible relationships between the four EDAM factors. We also suggest that future studies focus specifically on including a sample of males at risk for a clinical diagnosis for disordered eating. This way it can be assessed if using health- and fitness-related technology exacerbates disordered eating within a sample already at risk.

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Conflicts of Interest

The authors have no conflict of interest to declare.

References

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.). American Psychiatric Publishing.

Ammann, S., Berchtold, A., Barrense-Dias, Y., Akre, C., & Surís, J. C. (2017). Disordered eating: The young male side. *Behavioral Medicine*, *44*(4), 289–296. https://doi.org/10.1080/08964289.2017.1341383

Calzo, J. P., Horton, N. J., Sonneville, K. R., Swanson, S. A., Crosby, R. D., Micali, N., Eddy, K. T., & Field, A. E. (2016). Male eating disorder symptom patterns and health correlates from 13 to 26 years of age. *Journal of the American Academy of Child & Adolescent Psychiatry, 55*(8), 693–700. https://doi.org/10.1016/j.jaac.2016.05.011

Ceci, L. (2022, February 25). *Growth of leading fitness and workout mobile apps downloads in January 2022*. https://www.statista.com/statistics/1239806/growth-top-fitness-mobile-apps-downloads/

Chiu, W., & Cho, H. (2020). The role of technology readiness in individuals' intention to use health and fitness applications: a comparison between users and non-users. *Asia Pacific Journal of Marketing and Logistics*, *33*(3), 807–825. https://doi.org/10.1108/apjml-09-2019-0534

Dakanalis, A., Timko, C. A., Favagrossa, L., Riva, G., Zanetti, M. A., & Clerici, M. (2014). Why do only a minority of men report severe levels of eating disorder symptomatology, when so many report substantial body dissatisfaction? Examination of exacerbating factors. *Eating Disorders*, *22*(4), 292–305. https://doi.org/10.1080/10640266.2014.898980

Dakanalis, A., Favagrossa, L., Clerici, M., Prunas, A., Colmegna, F., Zanetti, M. A., & Riva, G. (2015). Body dissatisfaction and eating disorder symptomatology: A latent structural equation modeling analysis of moderating variables in 18-to-28-year-old

males. *The Journal of Psychology*, *149*(1), 85–112. https://doi.org/10.1080/00223980.2013.842141

Da Silva, W. R., Marôco, J., Ochner, C. N., & Campos, J. A. D. B. (2017). Male body dissatisfaction scale (MBDS): Proposal for a reduced model. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, *22*(3), 515–525. https://doi.org/10.1007/s40519-017-0420-y

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics, 5,* 1-4. https://doi.org/10.11648/j.ajtas.20160501.11

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). SAGE Publications Ltd.

Gorrell, S., & Murray, S. B. (2019). Eating Disorders in males. *Child and Adolescent Psychiatric Clinics of North America, 28*(4), 641–651. https://doi.org/10.1016/j.chc.2019.05.012

Griffiths, S., Murray, S. B., & Touyz, S. (2014). Extending the masculinity hypothesis: An investigation of gender role conformity, body dissatisfaction, and disordered eating in young heterosexual men. *Psychology of Men & Masculinity*, *16*(1), 108–114. https://doi.org/10.1037/a0035958

Hahn, S. L., Sonneville, K. R., Kaciroti, N., Eisenberg, D., & Bauer, K. W. (2021). Relationships between patterns of technology-based weight-related self-monitoring and eating disorder behaviors among first year university students. *Eating Behaviors*, *42*, 1–8. https://doi.org/10.1016/j.eatbeh.2021.101520

Hefner, V., Dorros, S. M., Jourdain, N., Liu, C., Tortomasi, A., Greene, M. P., Brandom, C., Ellet, M., & Bowles, N. (2016). Mobile exercising and tweeting the pounds away: The use of digital applications and microblogging and their association with disordered

eating and compulsive exercise. *Cogent Social Sciences, 2*(1), 1–11. https://doi.org/10.1080/23311886.2016.1176304

Higgins, J. P. (2016). Smartphone applications for patients' health and fitness. *The American Journal of Medicine, 129*(1), 11–19. https://doi.org/10.1016/j.amjmed.2015.05.038

Honary, M., Bell, B. T., Clinch, S., Wild, S. E., & McNaney, R. (2019). Understanding the role of healthy eating and fitness mobile apps in the formation of maladaptive eating and exercise behaviors in young people. *JMIR Mhealth and Uhealth, 7*(6), 1-19. doi:10.2196/14239.

Laricchia, F. (2022, February 14). *Unit shipment forecast of smart wristwear worldwide 2016-2025.* https://www.statista.com/statistics/878144/worldwide-smart-wristwear-shipments-forecast/

Lavender, J. M., Brown, T. A., & Murray, S. B. (2017). Men, muscles, and eating disorders: An overview of traditional and muscularity-oriented disordered eating. *Current Psychiatry Reports, 19*(32), 1-7. https://doi.org/10.1007/s11920-017-0787-5

Le, T. P., Bradshaw, B. T., Pease, M., & Kuo, L. (2021). An intersectional investigation of Asian American men's muscularity-oriented disordered eating: Associations with gendered racism and masculine norms. *Eating Disorders*, 1–23. https://doi.org/10.1080/10640266.2021.1924925

Limbers, C. A., Cohen, L. A., & Gray, B. A. (2018). Eating disorders in adolescent and young adult males: prevalence, diagnosis, and treatment strategies. *Adolescent Health, Medicine and Therapeutics*, *9*, 111–116. https://doi.org/10.2147/ahmt.s147480

Linardon, J., & Messer, M. (2019). My fitness pal usage in men: Associations with eating disorder symptoms and psychosocial impairment. *Eating Behaviors*, 33, 13-17. https://doi.org/10.1016/j.eatbeh.2019.02.003

MacNeill, L. P., Best, L. A., & Davis, L. L. (2017). The role of personality in body image dissatisfaction and disordered eating: discrepancies between men and women. *Journal of Eating Disorders, 5*(44), 1-9. https://doi.org/10.1186/s40337-017-0177-8

Martin, K. E, McGloin, R., & Atkin, D. (2018). Body dissatisfaction, neuroticism, and female sex as predictors of calorie-tracking app use amongst college students. *Journal of American College Health, 66*(7), 608–616. https://doi.org/10.1080/07448481.2018.1431905

McCabe, M. P., & Ricciardelli, L. A. (2004). Body image dissatisfaction among males across the lifespan. *Journal of Psychosomatic Research*, *56*(6), 675–685. https://doi.org/10.1016/s0022-3999(03)00129-6

Miller, A. M. (2015, January 6). *The dark side of activity trackers.* https://health.usnews.com/health-news/health-wellness/articles/2015/01/06/the-dark-side-of-activity-trackers

Nerini, A., Matera, C., Baroni, D., & Stefanile, C. (2016). Drive for muscularity and sexual orientation: Psychometric properties of the Italian version of the Drive for Muscularity Scale (DMS) in straight and gay men. *Psychology of Men & Masculinity*, *17*(2), 137–146. https://doi.org/10.1037/a0039675

Pallant, J. (2016). *SPSS survival manual* (6th ed.). Open University Press.

Sanlier, N., Varli, S. N., Macit, M. S., Mortas, H., & Tatar, T. (2017). Evaluation of disordered eating tendencies in young adults. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, *22*(4), 623–631. https://doi.org/10.1007/s40519-017-0430-9

Simpson, C. C., & Mazzeo, S. E. (2017). Calorie counting and fitness tracking technology: Associations with eating disorder symptomatology. *Eating Behaviors, 26*, 89-92. http://dx.doi.org/10.1016/j.eatbeh.2017.02.002

Stanford, S. C., & Lemberg, R. (2012a). A clinical comparison of men and women on the Eating Disorder Inventory-3 (EDI-3) and the Eating Disorder Assessment for Men (EDAM). *Eating Disorders, 20*(5), 379-394. https://doi.org/10.1080/10640266.2012.715516

Stanford, S. C., & Lemberg, R. (2012b). Measuring eating disorders in men: Development of the Eating Disorder Assessment for Men (EDAM). *Eating Disorders, 20*(5), 427-436. https://doi.org/10.1080/10640266.2012.715522

Tan, T., Kuek, A., Goh, S. E., Lee, E. L., & Kwok, V. (2016). Internet and smartphone application usage in eating disorders: A descriptive study in Singapore. *Asian Journal of Psychiatry, 19,* 50-55. http://dx.doi.org/10.1016/j.ajp.2015.11.007

UpMeals. (2020, December 6). *Calorie counting apps: Should you use them?* https://upmeals.ca/calorie-counting-apps-should-you-use-them/#:~:text=The%20dark%20side%20of%20calorie%20counting%20This%20may,from%20using%20these%20tools%20can%20trigger%20disordered%20eating

Wyssen, A., Bryjova, J., Meyer, A. H., & Munsch, S. (2016). A model of disturbed eating behavior in men: The role of body dissatisfaction, emotion dysregulation and cognitive distortions. *Psychiatry Research*, *246*, 9–15. https://doi.org/10.1016/j.psychres.2016.09.010

Table 1. Sample demographics

Race	Frequency	Percent
Black	133	43.75
Coloured	13	4.28
White	139	45.72
Indian	19	6.25
Total	304	100
Age		
18-20 years	67	22.04
21-23 years	128	42.11
24-26 years	67	22.04
27-30 years	41	13.49
Total	303	99.68*
Marital status		
Single	206	67.40
In a relationship	77	25.30
Engaged	8	2.60
Married	9	3.00
Prefer not to say	6	1.60
Total	304	100

* *One participant did not indicate their age*

Table 2. Health- and fitness-technology use

		Frequency	Percentage
Do you use health- and fitness-related technology?			
	Yes	161	52.96
	No	143	47.04
Do you use a fitness watch?			
	Yes	114	37.50
	No	190	62.50
Do you use a calorie-counting app?			
	Yes	95	31.25
	No	209	68.75
Do you use a fitness app?			
	Yes	151	49.67
	No	153	50.33
How often do you use health- and fitness technology?			
	Not regularly	65	21.38
	Few times a day	98	32.24
	Few times a week	42	13.82
	Not applicable	99	32.57
How often do you use your fitness watch?			
	Not regularly	39	12.83
	Few times a day	45	14.80
	Few times a week	49	16.12
	Not applicable	171	56.25

How often do you use your calorie counting app?		62	20.40
	Not regularly	42	13.82
	Few times a day	30	9.87
	Few times a week	170	55.92
	Not applicable		
How often do you use your fitness app?			
	Not regularly	62	20.40
	Few times a day	93	30.59
	Few times a week	29	9.54
	Not applicable	120	39.47

Table 3. Summary of the results

	Users	Non-users		
	M (SD)	*M (SD)*	*T (df)*	*p*
Do you use health- and fitness-related technology?				
EDAM Total	60.81 (22.43)	56.28 (23.62)	1.710 (301)	.088
Binge eating	2.00 (1.05)	2.04 (0.96)	0.303 (300)	.762
Muscle dysmorphia	2.06 (1.00)	1.90 (1.00)	1.345 (298)	.180
Body dissatisfaction	2.14 (1.04)	1.86 (0.99)	2.356 (289)	.019
Eating disorder	1.15 (0.45)	1.21 (0.74)	0.725 (265)	.088
Do you use a fitness watch?				
EDAM Total	60.05 (23.09)	57.85 (23.09)	0.804 (301)	.422
Binge eating	1.95 (0.94)	2.06 (1.04)	0.930 (300)	.353
Muscle dysmorphia	2.05 (1.08)	1.94 (0.95)	0.936 (298)	.350
Body dissatisfaction	2.07 (1.03)	1.97 (1.02)	0.806 (289)	.421
Eating disorder	1.20 (0.53)	1.16 (0.64)	0.566 (265)	.572
Do you use a calorie counting app?				
EDAM Total	62.29 (23.87)	57.04 (22.57)	1.837 (301)	.067
Binge eating	2.03 (1.05)	2.01 (0.99)	0.178 (300)	.859
Muscle dysmorphia	2.14 (1.00)	1.91 (1.00)	1.814 (298)	.071
Body dissatisfaction	2.24 (1.18)	1.91 (0.94)	2.514 (289)	.012
Eating disorder	1.17 (0.44)	1.18 (0.66)	0.096 (265)	.923
Do you use a fitness app?				
EDAM Total	60.11 (23.81)	57.26 (22.32)	1.073 (301)	.284

Binge eating	2.01 (1.04)	2.03 (0.97)	0.167 (300)	.867
Muscle dysmorphia	2.05 (1.03)	1.92 (0.98)	1.090 (298)	.277
Body dissatisfaction	2.08 (1.05)	1.95 (1.00)	1.088 (289)	.277
Eating disorder	1.21 (0.70)	1.14 (0.49)	1.013 (265)	.312

SECTION 3: CRITICAL REFLECTION

Introduction

The purpose of this chapter is to reflect on my personal journey through this research process. It focuses specifically on my own personal experiences, beliefs, opinions, and attitudes. Botma et al. (2010) describes research as being "daunting" and "challenging" (p. 33), and most times, a source of unwanted anxiety. However, the need to acquire knowledge and understand human behaviour will mostly likely prevail and we find the need to conduct research within health sciences appealing (Botma et al., 2010). Ironically, when you want to complete your MHSc in Research Psychology (or most master's degrees for that matter), you are required to embark on this journey - no matter how anxious, unprepared, or ignorant you are about conducting research. To be able to reflect on my journey, it is important to go back to the beginning …

The Beginning

In 2020, around November, I was selected for the Masters in Research Psychology Programme at the North-West University, Potchefstroom campus in South Africa. I was quite luck, in that, not long after that, Professor Ruan Spies contacted me and asked if he could be my research supervisor. It was a no-brainer since we had worked together in the past and his field of interest (psychopathology) was in-line with my own. This is where my research journey started: selecting my topic.

I have always had an interest in eating disorders. I felt like they were an under-researched topic, especially amongst various demographic groups once not thought to be affected by this group of disorders. Of course, finding something interesting, does not necessarily mean identifying the research gap and/or the research problem will be easy. Originally, I thought I might go the route of researching eating disorders in the South African female population, but it seemed that more research was needed including males as the

sample population. This was later linked to the idea of using health- and fitness-related technology and its possible associations with disordered eating. This type of study had not been done in South Africa. Hence, my topic: *Males use of health- and fitness-related technology and its link with disordered eating*. I am predominantly a qualitative researcher and felt that the best way for me to develop my quantitative research skills would be by conducting a quantitative study myself. Ironically, the topic presented itself to be more quantitative in nature. This provided me with the opportunity to conduct research focusing on a topic I was interested in, whilst using a research approach I was trying to understand better.

After identifying the research topic, everything went quite smoothly. Early in 2021 my research proposal was completed and before I knew it, we had submitted to both COMPRES and HREC. I found the COMPRES submission easier and less stressful. HREC, on the other hand, was a bit more challenging. After completing the extensive application form and gathering all the required documents (17 to be exact), we were finally able to submit to HREC. This experience included my first ever rebuttal. On 1 September 2021, I received my ethics approval letter, which meant data collection could start. This all formed part of the conceptual phase, which included topic identification, reviewing the literature, creating the research question, and writing the research proposal (Botma et al., 2017).

The Middle

This part is known as the research design phase (Botma et al., 2017). It includes identifying and recruiting participants, as well as data collection. I found the data collection process to be the most challenging and nerve-wrecking of this entire process. Suddenly, I wasn't the one in control of the research process and the completion of this study was dependent on individuals completing the online questionnaire. By the end of 2021, only about a hundred participants had completed the questionnaire. This was a bit of a problem for two reasons: 1) I needed at least 300 participants and 2) I had to start data analysis in May 2022 if

I wanted to submit for examination in time. Early December data collection had reached a point of 'stagnation' and getting males to complete the questionnaire had reached a complete halt. This was one of those experiences that was rooted in ethical decision making (Strydom, 2011). I was faced with a dilemma and had to identify the most appropriate solution (Strydom, 2011) – we decided it was time for an amendment. Around the beginning of March 2022, we submitted an amendment request to HREC which stated that we wanted to include honours students as fieldworkers. All they would have to do was share the study advertisement and a link specific to them, on their own social media platforms. After getting HREC approval the research study continued, and this time at a much faster pace. At the end of April, 304 participants that meet the inclusion criteria had completed the questionnaire, which meant data analysis could start. For the first time in a while, I had control over the process again. This was my first time extracting data and actually creating my code book, identifying and comparing variables, and finally being able to conduct the statistical analysis mentioned in my proposal almost a year back.

The End

I once read a personal essay comparing the write-up of a mini-dissertation to the five stages of grief identified by Kübler-Ross (2009). It starts with denial – denial regarding the fact that you need to finish you research to get your degree. This is followed by denial about how much still needs to be done for you to actually finish the mini-dissertation. Then, anger kicks in. It comes in waves: anger towards yourself for leaving it till the last minute, anger towards your supervisor who is constantly nagging you for that 'first draft', anger when your first draft has more comments and track changes than actual content. Just before you get to feel too sorry for yourself, the bargaining starts. You keep bargaining with yourself that you will sit and do a little bit of work – be it over the weekends, whenever you have five minutes to spare – all so that you don't leave it until a month or two before having to submit for

examination. However, you rarely follow this thoroughly thought-out plan, which kind of leads you to regress to stage two: a little more unproductive anger. Now we reach depression, which in my case equalled a lot of comfort eating (ironic, if you take into consideration my topic). This is a weird time in any masters student's life. You feel sorry for yourself but at the same time realise you have no one else to blame but yourself – and let's be honest, students don't like blaming themselves! After a few days of wallowing, there is usually a moment when you realise all you can do is sit yourself down in front of the computer and do what needs to be done – Hello, acceptance!

All jokes aside, during this time I was a bit overworked - being an intern and all. So actually sitting and writing-up my Chapter 2 was something I really struggled with. Thankfully, Prof Spies had not completely given-up on me, even after several empty promises, which started to all sound the same. Sometimes I think research supervisors deserve medals for the amount of work that goes into a single student and their study. In July 2022, I submitted my notice of submission for November 2022. Nothing like a deadline to get you to sit down and do what needs to be done. With great guidance and about three drafts, we were finally happy with the final product and ready to submit.

Conclusion

When I embarked on this journey I was anxious, unprepared, and even ignorant about conducting research and completing a research study. Now, I am thankful. This has taught me so much about what type of researcher I want to be in the future. I have had the opportunity to learn from my mistakes and identify ways to improve. I have learnt so much from my research supervisor and if I had to do it all over again, I would not change a thing. Of course, I also had a great support system, which I am sure was getting sick of me and my research study. I think the best advice for any student going through this process would be: trust your supervisor - they really know what they are doing; make sure you have a solid proposal to

help guide you throughout this process; make use of your support system and remember to thank them afterwards. It's okay to go through the 'research stages of grief' – just make sure you reach acceptance!

References

Botma, Y., Greeff, M., Mulaudzi, F. M., & Wright, S. C. D. (2010). *Research in health sciences.* Heinemann.

Kübler-Ross, E., & Kessler, D. (2005). *On grief and grieving: Finding the meaning of grief through the five stages of loss*. Simon & Schuster.

Strydom, H. (2011). Ethical aspects of research in the social sciences and human service professions. In A. S. de Vos, H. Strydom, C. B. Fouché, & C. S. L. Delport (Eds.), *Research at grass roots: For the social sciences and human service professions* (4th ed., pp. 113-132). Van Schaik Publishers.

COMPLETE REFERENCE LIST

Akabor, N. (2022, May 17). *Research finds fitness trackers increase physical activity*. https://mg.co.za/sci-tech/2022-05-17-research-finds-fitness-trackers-increase-physical-activity/

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Publishing.

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.). American Psychiatric Publishing.

Ammann, S., Berchtold, A., Barrense-Dias, Y., Akre, C., & Surís, J. C. (2017). Disordered eating: The young male side. *Behavioral Medicine*, *44*(4), 289–296. https://doi.org/10.1080/08964289.2017.1341383

Botma, Y., Greeff, M., Mulaudzi, F. M., & Wright, S. C. D. (2010). *Research in health sciences.* Heinemann.

Calzo, J. P., Horton, N. J., Sonneville, K. R., Swanson, S. A., Crosby, R. D., Micali, N., Eddy, K. T., & Field, A. E. (2016). Male eating disorder symptom patterns and health correlates from 13 to 26 years of age. *Journal of the American Academy of Child & Adolescent Psychiatry, 55*(8), 693–700. https://doi.org/10.1016/j.jaac.2016.05.011

Ceci, L. (2021, July 6). *Health and fitness app downloads worldwide from 1st quarter 2019 to 2nd quarter 2020 (in millions).* https://www.statista.com/statistics/1127248/health-fitness-apps-downloads-worldwide/

Ceci, L. (2022, February 25). *Growth of leading fitness and workout mobile apps downloads in January 2022*. https://www.statista.com/statistics/1239806/growth-top-fitness-mobile-apps-downloads/

Ceci, L. (2022, March 22a). *Health and fitness apps - Statistics & facts.* https://www.statista.com/topics/9204/health-and-fitness-apps/#dossierKeyfigures

Ceci, L. (2022, July 25b). *Leading health and fitness apps in the Google Play Store worldwide in June 2022, by revenue*. https://www.statista.com/statistics/695697/top-android-health-apps-in-google-play-by-revenue/

Chapman, J., & Woodman, T. (2015). Disordered eating in male athletes: A meta-analysis. *Journal of Sports Sciences, 34*(2), 101–109. https://doi.org/10.1080/02640414.2015.1040824

Chiu, W., & Cho, H. (2020). The role of technology readiness in individuals' intention to use health and fitness applications: A comparison between users and non-users. *Asia Pacific Journal of Marketing and Logistics*, *33*(3), 807–825. https://doi.org/10.1108/apjml-09-2019-0534

Comstock, J. (2015, May 11). *Eight years of fitbit news leading up to its planned IPO.* https://www.mobihealthnews.com/43423/eight-years-of-fitbit-news-leading-up-to-its-planned-ipo

Dakanalis, A., & Riva, G. (2013). Current considerations for eating and body-related disorders among men. In L. B. Sams & J. A. Keels (Eds.), *Handbook on body image: Gender differences, sociocultural influences and health implications* (pp. 195-216). Nova Publishers, Incorporated.

Dakanalis, A., Timko, C. A., Favagrossa, L., Riva, G., Zanetti, M. A., & Clerici, M. (2014). Why do only a minority of men report severe levels of eating disorder symptomatology, when so many report substantial body dissatisfaction? Examination of exacerbating factors. *Eating Disorders*, *22*(4), 292–305. https://doi.org/10.1080/10640266.2014.898980

Dakanalis, A., Favagrossa, L., Clerici, M., Prunas, A., Colmegna, F., Zanetti, M. A., & Riva, G. (2015). Body dissatisfaction and eating disorder symptomatology: A latent structural equation modeling analysis of moderating variables in 18-to-28-year-old

males. *The Journal of Psychology*, *149*(1), 85–112. https://doi.org/10.1080/00223980.2013.842141

Darcy, A. M., & Lin, I. H. (2012). Are we asking the right questions? A review of assessment of males with eating disorders. *Eating Disorders, 20*, 416-426. https://doi.org/10.1080/10640266.2012.715521

Da Silva, W. R., Marôco, J., Ochner, C. N., & Campos, J. A. D. B. (2017). Male body dissatisfaction scale (MBDS): Proposal for a reduced model. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, *22*(3), 515–525. https://doi.org/10.1007/s40519-017-0420-y

Delport, C. S. L., & de Vos, A. S. (2011). Professional research and professional practice. In A. S. de Vos, H. Strydom, C. B. Fouché, & C. S. L. Delport (Eds.), *Research at grass roots: For the social sciences and human service professions* (4th ed., pp. 45-60). Van Schaik Publishers.

Eikey, E. V., & Reddy, M. C. (2017). "It's definitely been a journey": A qualitative study on how women with eating disorders use weight loss apps. *Conference on Human Factors in Computing Systems, 2017*, 642-654. http://dx.doi.org/10.1145/3025453.3025591

Eikey, E. V., Reddy, M. C., Booth, K. M., Kvasny, L., Blair, J. L., Li, V., & Poole, E. S. (2017). Desire to be underweight: Exploratory study on a weight loss app community and user perceptions of the impact on disordered eating behaviors. *JMIR mHealth and uHealth, 5*(10), 1-11. https://doi.org/10.2196/mhealth.6683

Eisenberg, D., Nicklett, E. J., Roeder, K., & Kirz, N. E. (2011). Eating disorder symptoms among college students: Prevalence, persistence, correlates, and treatment seeking. *Journal of American College Health, 59*(8), 700–707. https://doi.org/10.1080/07448481.2010.546461

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics, 5,* 1-4. https://doi.org/10.11648/j.ajtas.20160501.11

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175-191. https://doi.org/10.3758/bf03193146

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). SAGE Publications Ltd.

Fitbit. (n.d.). *Charge 4*. https://www.fitbit.com/global/us/products/trackers/charge4

Fouché, C. B., Delport, C. S. L., & de Vos, A. S. (2011). Quantitative research designs. In A. S. de Vos, H. Strydom, C. B. Fouché, & C. S. L. Delport (Eds.), *Research at grass roots: For the social sciences and human service professions* (4th ed., pp. 142-158). Van Schaik Publishers.

Franco, R. Z., Fallaize, R., Lovegrove, J. A., & Hwang, F. (2016). Popular nutrition-related mobile apps: A feature assessment. *JMIR mHealth and uHealth, 4*(3), 1-12. https://doi.org/10.2196/mhealth.5846

Freeman, A. C., & Szabo, C. P. (2005). Eating disorders in South African males: A review of the clinical presentation of hospitalised patients. *South African Journal of Psychology, 35*(4), 601–622. https://doi.org/10.1177/008124630503500401

GCFGlobal. (n.d.). *Pros and cons of wearable technology.* https://edu.gcfglobal.org/en/wearables/pros-and-cons-of-wearable-technology/1/

Gorrell, S., & Murray, S. B. (2019). Eating disorders in males. *Child and Adolescent Psychiatric Clinics of North America, 28*(4), 641–651. https://doi.org/10.1016/j.chc.2019.05.012

Gottlieb, C. (2014, February 23). Disordered eating or eating disorder: What's the difference? *Psychology Today.* https://www.psychologytoday.com/za/blog/contemporary-psychoanalysis-in-action/201402/disordered-eating-or-eating-disorder-what-s-the

Griffiths, S., Murray, S. B., & Touyz, S. (2014). Extending the masculinity hypothesis: An investigation of gender role conformity, body dissatisfaction, and disordered eating in young heterosexual men. *Psychology of Men & Masculinity*, *16*(1), 108–114. https://doi.org/10.1037/a0035958

Hahn, S. L., Sonneville, K. R., Kaciroti, N., Eisenberg, D., & Bauer, K. W. (2021). Relationships between patterns of technology-based weight-related self-monitoring and eating disorder behaviors among first year university students. *Eating Behaviors*, *42*, 1–8. https://doi.org/10.1016/j.eatbeh.2021.101520

Hefner, V., Dorros, S. M., Jourdain, N., Liu, C., Tortomasi, A., Greene, M. P., Brandom, C., Ellet, M., & Bowles, N. (2016). Mobile exercising and tweeting the pounds away: The use of digital applications and microblogging and their association with disordered eating and compulsive exercise. *Cogent Social Sciences, 2*(1), 1–11. https://doi.org/10.1080/23311886.2016.1176304

Higgins, J. P. (2016). Smartphone applications for patients' health and fitness. *The American Journal of Medicine, 129*(1), 11–19. https://doi.org/10.1016/j.amjmed.2015.05.038

Hoerr, S. L., Bokram, R., Lugo, B., Bivins, T., & Keast, D. R. (2002). Risk for disordered eating relates to both gender and ethnicity for college students. *Journal of the American College of Nutrition, 21*(4), 307–314. https://doi.org/10.1080/07315724.2002.10719228

Honary, M., Bell, B. T., Clinch, S., Wild, S. E., & McNaney, R. (2019). Understanding the role of healthy eating and fitness mobile apps in the formation of maladaptive eating

and exercise behaviors in young people. *JMIR mHealth and uHealth, 7*(6), 1-19. https://doi.org/10.2196/14239

Jordaan, E. (2016). Eating and feeding disorders. In A. Burke (Ed.), *Abnormal Psychology: A South African perspective* (2nd ed. revised, pp. 409-446). Oxford University Press Southern Africa.

Kimball, A. (2015, June 1). *The downside of calorie-counting apps and health tracking.* https://www.chatelaine.com/health/fitness/the-downside-of-calorie-counting-apps-and-health-tracking/

KPMG. (2016). *Health wearables, apps & information protection*. https://home.kpmg/za/en/home/insights/2016/06/health-wearables--apps---information-protection.html

Kübler-Ross, E., & Kessler, D. (2005). *On grief and grieving: Finding the meaning of grief through the five stages of loss*. Simon & Schuster.

Kumar, R. (2011). *Research methodology: A step-by-step guide for beginners* (3rd ed.). SAGE Publications Ltd.

Kunst, A. (2022, February 23). *Which of these types of health apps and smart health devices (connected to the internet) have you used in the past 12 months?* https://www.statista.com/forecasts/832208/usage-of-health-apps-and-smart-health-devices-in-south-africa

Laricchia, F. (2022, February 14). *Unit shipment forecast of smart wristwear worldwide 2016-2025.* https://www.statista.com/statistics/878144/worldwide-smart-wristwear-shipments-forecast/

Laricchia, F. (2022, June 20a). *Fitness trackers - Statistics & facts.* https://www.statista.com/topics/4393/fitness-and-activity-tracker/#dossierKeyfigures

Laricchia, F. (2022, March 31b). *Global wearable device market share from 3rd quarter 2020 to 3rd quarter 2021, by product category.* https://www.statista.com/statistics/690731/wearables-worldwide-shipments-by-product-category/

Lavender, J. M., & Anderson, D. A. (2009). Contribution of emotion regulation difficulties to disordered eating and body dissatisfaction in college men. *International Journal of Eating Disorders, 34*(4), 352-357. https://doi.org/10.1002/eat.20705

Lavender, J. M., Brown, T. A., & Murray, S. B. (2017). Men, muscles, and eating disorders: An overview of traditional and muscularity-oriented disordered eating. *Current Psychiatry Reports, 19*(32), 1-7. https://doi.org/10.1007/s11920-017-0787-5

Le, T. P., Bradshaw, B. T., Pease, M., & Kuo, L. (2021). An intersectional investigation of Asian American men's muscularity-oriented disordered eating: Associations with gendered racism and masculine norms. *Eating Disorders*, 1–23. https://doi.org/10.1080/10640266.2021.1924925

Limbers, C. A., Cohen, L. A., & Gray, B. A. (2018). Eating disorders in adolescent and young adult males: Prevalence, diagnosis, and treatment strategies. *Adolescent Health, Medicine and Therapeutics*, *9*, 111–116. https://doi.org/10.2147/ahmt.s147480

Linardon, J., & Messer, M. (2019). My fitness pal usage in men: Associations with eating disorder symptoms and psychosocial impairment. *Eating Behaviors*, *33*, 13-17. https://doi.org/10.1016/j.eatbeh.2019.02.003

Lyons, E. J., Lewis, Z. H., Mayrsohn, B. G., & Rowland, J. L. (2014). Behavior change techniques implemented in electronic lifestyle activity monitors: A systematic content analysis. *Journal of Medical Internet Research, 16*(8), 1-15. https://doi.org/10.2196/jmir.3469

MacNeill, L. P., Best, L. A., & Davis, L. L. (2017). The role of personality in body image dissatisfaction and disordered eating: Discrepancies between men and women. *Journal of Eating Disorders, 5*(44), 1-9. https://doi.org/10.1186/s40337-017-0177-8

Martin, K. E., McGloin, R., & Atkin, D. (2018). Body dissatisfaction, neuroticism, and female sex as predictors of calorie-tracking app use amongst college students. *Journal of American College Health, 66*(7), 608–616. https://doi.org/10.1080/07448481.2018.1431905

McCabe, M. P., & Ricciardelli, L. A. (2004). Body image dissatisfaction among males across the lifespan. *Journal of Psychosomatic Research*, *56*(6), 675–685. https://doi.org/10.1016/s0022-3999(03)00129-6

Midgley, B. (2018). *The six reasons the fitness industry is booming*. https://www.forbes.com/sites/benmidgley/2018/09/26/the-six-reasons-the-fitness-industry-is-booming/?sh=6ae69f85506d

Miller, A. M. (2015, January 6). *The dark side of activity trackers.* https://health.usnews.com/health-news/health-wellness/articles/2015/01/06/the-dark-side-of-activity-trackers

Mitchison, D., & Mond, J. (2015). Epidemiology of eating disorders, eating disordered behaviour, and body image disturbance in males: A narrative review. *Journal of Eating Disorders*, *3*(20), 1-9. https://doi.org/10.1186/s40337-015-0058-y

Morning Consult. (2018). *National tracking poll #181231 December 13-14, 2018: Crosstabulation results.* https://morningconsult.com/wp-content/uploads/2019/01/181231_crosstabs_CES_MOBILE_Adults_v2_AP.pdf

Morris, P. F., & Szabo, C. P. (2012). Meanings of thinness and dysfunctional eating in black South African females: A qualitative study. *African Journal of Psychiatry*, *16*(5), 338-342. https://doi.org/10.4314/ajpsy.v16i5.45

Murad, Y. (2019, January 8). *Wearable and app users tracking health tech's next step.* https://morningconsult.com/2019/01/08/wearable-and-app-users-tracking-health-techs-next-step/

Murray, S. B., Griffiths, S., & Mond, J. M. (2016). Evolving eating disorder psychopathology: Conceptualising muscularity-oriented disordered eating. *British Journal of Psychiatry, 208*, 414–415. https://doi.org/10.1192/bjp.bp.115.168427

Nagata, J. M., Murray, S. B., Bibbins-Domingo, K., Garber, A. K., Mitchison, D., & Griffiths, S. (2019). Predictors of muscularity-oriented disordered eating behaviors in U.S. young adults: A prospective cohort study. *International Journal of Eating Disorders*, *52*(12), 1380–1388. https://doi.org/10.1002/eat.23094

National Association of Anorexia Nervosa and Associated Disorders (ANAD). (n.d.-a). *Eating disorder statistics.* https://anad.org/get-informed/about-eating-disorders/eating-disorders-statistics/

National Association of Anorexia Nervosa and Associated Disorders (ANAD). (n.d.-b). *Eating disorder types & symptoms*. https://anad.org/get-informed/about-eating-disorders/eating-disorder-types-and-symptoms/

National Eating Disorders Collaboration. (n.d.). *Disordered eating & dieting*. https://nedc.com.au/eating-disorders/eating-disorders-explained/disordered-eating-and-dieting/

Nerini, A., Matera, C., Baroni, D., & Stefanile, C. (2016). Drive for muscularity and sexual orientation: Psychometric properties of the Italian version of the Drive for Muscularity Scale (DMS) in straight and gay men. *Psychology of Men & Masculinity*, *17*(2), 137–146. https://doi.org/10.1037/a0039675

Netcare. (2018, October 10). *Understanding eating and weight disorders.* https://www.netcare.co.za/News-Hub/Articles/understanding-eating-and-weight-disorders

Pallant, J. (2016). *SPSS survival manual* (6th ed.). Open University Press.

Paxton, M. (2020, August 17). *Wearable tech fitness trackers on the rebound.* https://www.spglobal.com/marketintelligence/en/news-insights/blog/wearable-tech-fitness-trackers-on-the-rebound

Plateau, C. R., Bone, S., Lanning, E., & Meyer, C. (2018). Monitoring eating and activity: Links with disordered eating, compulsive exercise, and general wellbeing among young adults. *International Journal of Eating Disorders, 51*(11), 1270–1276. https://doi.org/10.1002/eat.22966

Sanlier, N., Varli, S. N., Macit, M. S., Mortas, H., & Tatar, T. (2017). Evaluation of disordered eating tendencies in young adults. *Eating and Weight Disorders – Studies on Anorexia, Bulimia and Obesity*, *22*(4), 623–631. https://doi.org/10.1007/s40519-017-0430-9

Sarcona, A., Kovacs, L., Wright, J., & Williams, C. (2017). Differences in eating behavior, physical activity, and health-related lifestyle choices between users and nonusers of mobile health apps. *American Journal of Health Education*, *48*(5), 298–305. https://doi.org/10.1080/19325037.2017.1335630

Setia, M. S. (2016). Methodology series module 3: Cross-sectional studies. *Indian Journal of Dermatology, 61*(3), 261–264. https://doi.org/10.4103/0019-5154.182410

Simpson, C. C., & Mazzeo, S. E. (2017). Calorie counting and fitness tracking technology: Associations with eating disorder symptomatology. *Eating Behaviors, 26*, 89-92. http://dx.doi.org/10.1016/j.eatbeh.2017.02.002

Smith, K. E., Mason, T. B., Murray, S. B., Griffiths, S., Leonard, R. C., Wetterneck, C. T., Smith, B. E. R., Farrell, N. R., Riemann, B. C., & Lavender, J. M. (2017). Male clinical norms and sex differences on the Eating Disorder Inventory (EDI) and Eating Disorder Examination Questionnaire (EDE-Q). *International Journal of Eating Disorders, 50*(7), 769-775. https://doi.org/10.1002/eat.22716

Solbrig, L., Jones, R., Kavanagh, D., May, J., Parkin, T., & Andrade, J. (2017). People trying to lose weight dislike calorie counting apps and want motivational support to help them achieve their goals. *Internet Interventions*, *7*, 23–31. https://doi.org/10.1016/j.invent.2016.12.003

Stanford, S. C., & Lemberg, R. (2012a). A clinical comparison of men and women on the Eating Disorder Inventory-3 (EDI-3) and the Eating Disorder Assessment for Men (EDAM). *Eating Disorders, 20*(5), 379-394. https://doi.org/10.1080/10640266.2012.715516

Stanford, S. C., & Lemberg, R. (2012b). Measuring eating disorders in men: Development of the Eating Disorder Assessment for Men (EDAM). *Eating Disorders, 20*(5), 427-436. https://doi.org/10.1080/10640266.2012.715522

Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. *Psychological Bulletin*, *128*(5), 825–848. https://doi.org/10.1037/0033-2909.128.5.825

Strydom, H. (2011). Ethical aspects of research in the social sciences and human service professions. In A. S. de Vos, H. Strydom, C. B. Fouché, & C. S. L. Delport (Eds.), *Research at grass roots: For the social sciences and human service professions* (4th ed., pp. 113-132). Van Schaik Publishers.

Tan, T., Kuek, A., Goh, S. E., Lee, E. L., & Kwok, V. (2016). Internet and smartphone application usage in eating disorders: A descriptive study in Singapore. *Asian Journal of Psychiatry, 19,* 50-55. http://dx.doi.org/10.1016/j.ajp.2015.11.007

UpMeals. (2020, December 6). *Calorie counting apps: Should you use them?* https://upmeals.ca/calorie-counting-apps-should-you-use-them/#:~:text=The%20dark%20side%20of%20calorie%20counting%20This%20may,from%20using%20these%20tools%20can%20trigger%20disordered%20eating

U.S. Food and Drug Administration. (n.d.). *Digital health innovation action plan*. https://www.fda.gov/media/106331/download

Vailshery, L. S. (2021). *Fitbit Inc. revenue from 2010 to 2019 (in million U.S. dollars)**. https://www.statista.com/statistics/472518/fitbit-revenue/

Verizon. (n.d.). *A timeline: A brief history of Apple watch.* https://www.verizon.com/articles/brief-history-of-apple-watch/

Windasari, N. A., Lin, F-R., & Kato-Lin, Y-C. (2021). Continued use of wearable fitness technology: A value co-creation perspective. *International Journal of Information Management, 57,* 1-15. https://doi.org/10.1016/j.ijinfomgt.2020.102292

Wyssen, A., Bryjova, J., Meyer, A. H., & Munsch, S. (2016). A model of disturbed eating behavior in men: The role of body dissatisfaction, emotion dysregulation and cognitive distortions. *Psychiatry Research*, *246*, 9–15. https://doi.org/10.1016/j.psychres.2016.09.010

Yu, Z., & Tan, M. (2016). Disordered eating behaviors and food addiction among nutrition major college students. *Nutrients, 8*(11), 1–16. https://doi.org/10.3390/nu8110673

APPENDIX A

NWU®

Scientific Committee Approval for a Research Application

Research using human participants, health or health-related studies

Scientific Committee Information			
Name of the scientific committee	COMPRES	**Discipline(s)**	MA/MSc Research Psychology
Research Entity	COMPRES	**Contact Person for the committee**	Chanté Klopper
Faculty	Health Sciences	**E-mail address for the committee contact person**	Chante.Klopper@nwu.ac.za

Study & Scientific Review Information				
Title of the study:	Men's health and fitness-related technology use and its association with disordered eating.			
Researcher/Study Supervisor Initials, Name and Surname:	Dr Ruan Spies		**NWU Number:**	12835471
Student Initials, Name & Surname:	Jessica Daniel		**NWU Number:**	26159600
Other Researchers involved in the study *(Initials, Names and Surnames)*:	None indicated.			
Potential risk level for human participants:	No risk	☐	**Motivate:** Click here to motivate the risk level	
	Minimal risk	☐		
	Medium risk	☒		
	High risk	☐		
Potential risk level for children and incapacitated adults:	No risk	☒	**Motivate:** Click here to motivate the risk level	
	No more than minimal risk of harm	☐		
	Greater than minimal risk with the prospect of direct benefit	☐		
	Greater than minimal risk with no direct benefit	☐		
Recommendation for the REC:	Review by the research ethics committee required	☒	**Motivate:** The proposed study would directly impact human participants.	

APPENDIX B

Private Bag X1290, Potchefstroom
South Africa 2520

Tel: 086 016 9698
Web: http://www.nwu.ac.za/

North-West University Health Research Ethics Committee (NWU-HREC)

Tel: 018 299-1206
Email: Ethics-HRECApply@nwu.ac.za (for human studies)

31 August 2021

ETHICS APPROVAL LETTER OF STUDY

Based on approval by the North-West University Health Research Ethics Committee (NWU-HREC) on 31/08/2021, the NWU-HREC hereby approves your study as indicated below. This implies that the NWU-HREC grants its permission that, provided the general conditions specified below are met and pending any other authorisation that may be necessary, the study may be initiated, using the ethics number below.

Study title: Men's health and fitness-related technology use and its link with disordered eating
Principal Investigator/Study Supervisor/Researcher: Dr R Spies
Student: J Daniel - 26159600

Ethics number: N W U - 0 0 2 4 8 - 2 1 - A 1

Institution Study Number Year Status

Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation

Application Type: Single study
Commencement date: 31/08/2021
Expiry date: 31/08/2022

Risk: **Medium**

Approval of the study is provided for a year, after which continuation of the study is dependent on receipt and review of a six-monthly monitoring report and the concomitant issuing of a letter of continuation. Monitoring reports are due at the end of February and August annually until completion of the study.

General conditions:

While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, the following general terms and conditions will apply:

- *The principal investigator/study supervisor/researcher must report in the prescribed format to the NWU-HREC:*
  - *six-monthly on the monitoring of the study, whereby a letter of continuation will be provided annually, and upon completion of the study; and*
  - *without any delay in case of any adverse event or incident (or any matter that interrupts sound ethical principles) during the course of the study.*
- *The approval applies strictly to the proposal as stipulated in the application form. Should any amendments to the proposal be deemed necessary during the course of the study, the principal investigator/study supervisor/researcher must apply for approval of these amendments at the NWU-HREC, prior to implementation. Should there be any deviations from the study proposal without the necessary approval of such amendments, the ethics approval is immediately and automatically forfeited.*
- *Annually a number of studies may be randomly selected for active monitoring.*
- *The date of approval indicates the first date that the study may be started.*
- *In the interest of ethical responsibility, the NWU-HREC reserves the right to:*
  - *request access to any information or data at any time during the course or after completion of the study;*
  - *to ask further questions, seek additional information, require further modification or monitor the conduct of your research or the informed consent process;*

APPENDIX C

EDITING CERTIFICATE

This certificate confirms that the manuscript listed below has been professionally proof read for grammar, spelling, phrasing, punctuation and sentence structure; as well as contributions to intent of meaning. No alterations were made to intrinsic content. The acceptance of proposed edits was at all times under the control of the author. A copy of the document with editing mark-ups can be made available to the institution on request, with the written permission of the author.

The author has been supplied with both PDF and Word files. No responsibility is taken by the Editor for insertions, deletions or amendments made after receipt by the author.

Manuscript title:	**Men's health- and fitness-related technology use and its link with disordered eating**
Author:	**Jessica Daniel**
Date of issue:	**12 November 2022**

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