THE DEVELOPMENT, IMPLEMENTATION, AND EVALUATION OF AN INDUSTRY SPECIFIC NUTRITION-EDUCATION PLATFORM IN PROFESSIONAL HORSERACING

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Abstract

Professional horseracing is a weight-making sport whereby the jockey athlete is required to 'make weight' to compete. Cultural practice promotes use of weight making approaches that have a negative effect on health. Despite the emergence of an evidence-based jockey diet that facilitates health and performance, dangerous weight-making behaviours are widely maintained. Jockey nutrition education has been cited as lacking and in need of development. Through a mixed-methods paradigm, and use of behaviour change theory, specifically the Capability Opportunity Motivation – Behaviour (COM-B) model and Behaviour Change Wheel (BCW) this thesis aimed to develop, implement, and evaluate the impact of an industry-specific nutrition education platform to help reduce the reliance on hazardous weight management. Study 1 interviewed jockeys athletes (n=10) and their support network of trainers (n=3), agents (n=2), coaches (n=4), and racecourse clerks (n=7) to establish the perceptions of the industry on jockey weight-making and nutrition and why archaic methods were still used. Via six-stage thematic analysis findings indicated several external factors influenced dietary and weight-making practices, with racehorse trainer pressure and poor food provision at racecourses key themes. A systemic lack of nutrition education was the key finding with recommendations to improve the nutrition knowledge and skills of jockeys.

Study 2 employed 'co-creation' as a method of collaboratively designing an education platform for the horseracing industry. Co-creation workshops involving jockeys (n=6), and athlete support personnel (n=12) comprising medics, nutritionists, physiologists, retired jockeys, jockey coaches, and board secretaries were followed by group interviews that spawned and captured ideas. Workshops and group interviews were conducted in three separate groups of six participants (two ASP groups, one jockey group). Themes generated

from group interviews were subsequently mapped across to the COM-B and BCW to provide a theoretical underpinning. From this, an industry-specific education platform was developed.

Study 3 sought to pilot the developed education platform and test its effectiveness and industry suitability. Two groups of seven licensing jockeys were recruited. The control group received the existing education provision whilst the intervention group received the new education. Both groups completed nutrition knowledge questionnaires, food recall diaries and EAT-26 inventories pre and 10-weeks post licensing course to measure changes in nutrition knowledge and eating behaviours. The intervention group improved nutrition knowledge scores by 11.7%±5.5 versus 3.6%±4.5 for the control group. EAT-26 scores and fat intake did not differ significantly across both groups. Intake for total protein and carbohydrate improved moderately in control participants with significant improvements measured in intervention group aligning itself more towards recommended intake for this group. Independent t-tests indicate potential statistical significance in intervention group improvements for nutrition knowledge, and carbohydrate, and protein intake however variance in upper and lower confidence intervals identify need for greater participant numbers in an industry-led trial to draw stronger conclusions. The present thesis provides a proof of concept that the piloted co-developed industry-specific nutrition education platform has the potential to improve the nutrition knowledge and eating behaviours of jockey athletes. Future work should focus on industry implementation of the co-developed platform and longitudinal data collection to assess both short and long term efficacy on a large participant group. Barriers other than jockey education still remain and contribute to archaic weight-making practices such as the influence and control of trainers. Future work should focus on these groups to further compliment the research led on jockeys.

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List of Abbreviations

Abbreviation	Full Title / Meaning
BCW	Behaviour Change Wheel: A tool to assist in the development of behavour change interventions based on COM-B
BHA	British Horseracing Authority: The National Governing Body of UK based horseracing.
BRUMS	Brunel Mood Scale: A questionnaire that gives an indication of an individuals mood profile.
COM-B	Capabaility Opportunity Movivation – Behaviour Model: A behaviour change theory spawned by Susan Michie *et al.*
DEXA	Dual Energy X-ray Absorptiometry: A scan that assesses bone health and also gives an indication of body compostion.
DLW	Doubly Labelled Water: The Gold Standard method of obtaining energy expenditure of an individual.
EA	Energy Availability: The amount of energy (calories) from the diet availble for the body to function when phsycial activity is discounted.
EAT-26 or EAT-40	Eating Attitudes Test: A 26 or 40 question inventory designed to indicate disordered eating and risk of eating disorders.
GNKQ	General Nutrition Knowledge Questionnaire: Widely recognised as the primary NKQ. Often used as is, or amedned to suit speficic population.
IJF	Injured Jockeys Fund: A charity that provides rehabiliiation and social support to both fit and injured, current and retired jockeys.
ISLAGIATT	It Seemed Like A Good Idea At The Time: Used to describe education and behviour change interventions lacking sound reasoning by Martin Eccles
JETS	Jockey Education and Training Scheme: An organisation that funds education and (re)training of jockeys in prepration for a career beyond race riding.
LJMU	Liverpool John Moores Univeristy: A higher-education and research institute in the North-West of England. The UK's leading research and sports science support group for jockeys.
NKQ	Nutrition Knowledge Questionnaire: General term given to questionnaires used in research or practice to assess nutrition knowledge.
PJA	Professional Jockeys Association: The representative body of professional (including Apprentice and Conditional) jockeys in the UK.
USG	Urine Specific Gravity: A method to assess the hydration status of an indivudal using a small urine sample.

Glossary of Terms

Term	Meaning
Apprentice Jockey	A flat jockey with less than 95 race wins. Once a flat jockey wins 95 races, he/she is considered a full professional flat jockey.
Conditional Jockey	A jump jockey with less than 75 race wins. Once a jump jockey wins 75 races, he/she is considered a full profesisonal jump jockey.
Claim or Claiming Weight	A 'claim' is a weight allowance given to apprentice and conditional jockeys, meaning they can ride lighter than the specified weight. Apprentice jockeys can claim a weight allowance of 7lbs until they have 20 wins, 5lbs until 50 wins, and 3lbs until 95 wins. A Conditional jockey can claim a weight allowance of 7lbs until they have 20 wins, 5lbs until 40 wins and 3lbs until 75 wins.
Canter	A term used to describe a crusing speed of a horse. Not a full sprint (or gallop).
Push or Pushing	The explosive and anaerobic movements of a jockey in the final stages of a race, where they 'push' their horses forwards using their body to encourage forward momentum and speed.
Flip or Flipping	Self-induced vomitting to facilitate acute weight loss
Clerk of the Course or Racecourse Clerk	Term given to the person in charge of racecourses day to day (non racing) and accountable for race day operations. Sometimes twinned with a Chief Executive title of a racecourse or group of courses.
Trainer or Racehorse Trainer	A licensed individual who trains horses (usually owned by 3rd parties) to take part in professional racing.
Agent or Jockey Agent	An individual who books rides for jockeys. Acts as a middle-person between trainers and jockeys.
Equiciser	A piece of training equipement used to practice technique, riding position and use of the whip. Can also be used as a position-specific cardiovascualr exercise. Effectively like an exercise bike for cyclists, but for jockeys on a horse.

List of Publications

Published outcomes of PhD Research

Martin, D. Wilson, G.W., Morton, J.P., Close, G.L. and Murphy, R.C. (2017). The horseracing industry's perception of nutrition and weightmaking in professional jockeys. *Qualitative Research in Sport, Exercise and Health*, 9(5), 568-582.

Martin, D. Wilson, G.W., Morton, J.P., Close, G.L. and Murphy, R.C. (2017). Race-Day Catering in Professional Horseracing: Does Current Provision Facilitate Weight Management and Riding Performance?. *EC Nutrition*, 12, 03-17.

In Preparation or Under Review for Publication from PhD Research

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Martin, D. Wilson, G.W., Morton, J.P., Close, G.L. and Murphy, R.C. (*in preparation).* The Implementation of a Nutrition Behaviour Change Intervention Grounded in COM-B and Behaviour Change Wheel Theory in a Professional Weight-Making Sport: A Pilot Study

Published. Associated with but indirect to PhD Research

Wilson, G.W.*,* Martin, D., Morton, J.P. and Close, G.L. (2018). Male Flat Jockeys Do Not Display Deteriorations in Bone Density or Resting Metabolic Rate in Accordance With Race Riding Experience: Implications for RED-S. *International Journal of Sports Nutrition and Exercise Metabolism,* 28(4), 1-18

Martin, D. (2017). A nutritionist and an educator in professional horseracing: using reflection to create 'My process'. *Reflective Practice*, *18*(5), 589-599.

Langan-Evans, C., Crighton, B., Kasper, A., Martin, D., and Wilson, G. (2017). Current practices in weight making sport, *The Sport and Exercise Scientist*, 54, 8-9

List of Dissemination

Event	**Location**	**Description**
International Conference for the Health, Safety and Welfare of Jockeys (ICHSWJ)	Meydan Racecourse, Dubai, UAE	A four-day conference hosting 15 major horseracing nations. Findings from Study One were disseminated over two presentations and how the research was influencing practice in UK industry.
International Conference on Qualitative Research in Sport and Exercise	University of British Columbia, Vancouver, Canada	A three-day international conference focusing on qualitative methods in sport and exercise research. Presented data from Studies One and Two.
International Sport and Exercise Nutirtion Confernece	Newcastle Univeristy, UK.	The premier three-day international conference for sport and exercise nutrition research. Was given the first ever opportunity to present 'qualitative' research data at the confernce.

Europoean College Sports Science Conference	Metopolois Ruhr, Essen, Germany	Four-day International Conference covering all aspects of Sport and Exercise Science Research. Disseminated findings from Study One.
Jockey Coaching Seminar	Leicester City FC, UK	A one-day coaching seminar to all UKCC qualified jockey coaches in UK on provision of nutrition support to UK jockeys, findings from research and proposed actions for industry.
BHA Jockey Seminars	Newmarket, Newbury, & York Racecourses	One day semianrs delivered to all licensed/profesisonal jockeys in the UK. Presentations summarised research done to date and potential 'real world' impact / benefit for jockeys.
HH Sheikh Mansour Bin Zayed Al Nahyan World Arabian Horseracing Festival	Waldorf Asotria Hotel, Rome, Italy	Three-day international conference attended by all stakeholders from horseraicng industry to discuss development of sport in all areas. Our area related to safe weight management and promoting behavour change in jockeys.
York & Newbury – Clerks and Caterers	Newbury & York Racecourses	One day seminars to racecourses CEO's (Clerks) and Catering Manager's on development and rollout of new catering guidelines, informed by outcomes of research through the present PhD.

Chapter 1

Introduction and Literature Review

Introduction

Horseracing is a dyadic sport where a combination of a human and an equine athlete compete in unison within races. The human athlete is commonly referred to as a 'jockey' and is believed to descend from a 17th century term for a person who used to deliver mail on horseback (Wilson, 2014). Although not considered a mass participation sport with less than one percent of the UK population regularly engaging in any form of equestrian sport (Sport England, 2016), it is however the second most attended live sport in the UK behind football (Lees, 2014). Its popularity extends far beyond the home nations with most foreign countries having a Racing Authority and many UK based jockeys now compete internationally. The UK is unique in that competitive racing is available all year round due to the availability of both Flat and National Hunt racing whereby all other nations only operate a Flat season. Flat is considered the summer sport and runs (within the UK) from the first weekend in April and culminates in October, where National Hunt racing commences in October and those jockeys compete through the winter months to April. The advent of the All Weather Championships in 2013 however (flat racing through winter on an all-weather/dirt track rather than turf that can be raced on in any weather condition) made Flat racing available 12-months of the year.

Full professional jockeys are considered self-employed therefore only earn money when they race, collecting their 'riding fee'. They are also entitled to a proportion of any prize money the horse wins in that race, usually 9% if first place and 6-7% if 'placed' (usually up to fourth depending on how many horses are in the race). In mid-week races these are often moderate amounts within the hundreds of pounds, whereas high profile weekend races can offer thousands or tens-of-thousands in some instances as a jockeys share. Whilst this appears lucrative, the relative number of jockeys who progress to compete in such high profile races

is relatively small. The introduction of all-weather racing therefore offers more racing over the calendar year for jockeys to earn a better living, and more opportunity for young jockeys to become established (Wilson *et al.,* 2014). With this increased competitive schedule however, also comes the inevitable necessity to achieve riding weights more often.

Although jockeys are the main human athlete, a second key stakeholder within racing is the racehorse trainer who is responsible for the keep, training, and welfare of the racing horses, in addition to being the tactician who will decide and inform the jockey how to run the race and is often accountable for the success or failure of a horse's racing performance. A loose comparison to this role is akin to a football manager who will manage training through the week, choose the starting squad, and subsequently relay the tactical approach to the team ahead of the game. In a similar way, the trainer will manage training of the horse (not the jockey), however will select which jockey they would prefer to ride (which is done through the jockey's agent), and communicate the tactical approach they would like the jockey to follow prior to the race. Unlike football however where competition is only likely to occur once or twice per week, jockeys may race up to seven times in one day at the same race meeting, each race on a different horse, at different weights, and often for multiple trainers.

Whilst the sport appears to be thriving, now offering a year-round provision for fans to spectate and for jockeys to earn more of a living from, it also increases the pressure on jockeys to achieve the racing weights. Multiple studies since the turn of the millennia have established how jockeys manage their weight on a daily basis and the potential ill-effects on health, wellbeing, and performance (Cotugna *et al.,* 2011; Dolan *et al.,* 2011, 2012; Greene *et al.,* 2013; Leydon and Wall, 2002; Moore *et al.,* 2002; Wilson, 2012, 2013, 2014, 2015). With

hazardous practices being considered widespread previous research has called for an improvement in the education for jockeys with regards to nutrition and weight-management as a strategy to reduce the incidence and severity of rapid weight loss (Caulfield and Karageorghis, 2008; Cotugna *et al.,* 2011; Wilson *et al.,* 2014). This thesis aims to address these recommendations by evaluating the reasons behind the adherence to archaic weigh-making practices, and subsequently goes on to develop a new education platform specifically for the racing industry and jockeys and ultimately pilot it within a UK licensing school and measure its effectiveness.

Structure of the Thesis

Chapter One builds on this introduction and reviews the literature surrounding physiological and energy demands of racing, the factors affecting weight management, current methods to manage weight, and their potential impact on health and riding performance. It goes on to discuss education development and behaviour change, and concludes with a section discussing the methodological approach of the thesis before the overall aims and objectives. Chapters two, three, and four report each of the individual studies that make up the original research element of this body of work. Prior to each chapter is a study map for the reader to track the aims, objectives, and outcomes / key findings from each study and hopefully provides a coherent framework that can be followed. Within each chapter is an introduction, methods, results, and discussion section. Chapter five brings the three studies together for a general discussion and affirms the main findings. It concludes by making recommendations for the both the industry, in terms of policy and practice as well as areas to continue research in the advancement of knowledge in this area.

Literature Review

This section will introduce the prominent issues that surround professional horseracing and its jockey athletes, and specifically around weight-making and the factors that effect it. The overall aim of this thesis is to develop an industry-specific nutrition education platform, done so through gaining the perceptions and experiences of many key stakeholders in the sport. Given the direction of the research, this literature review therefore explores relevant areas relating to previous, and current weight management or 'weight making' strategies and their impact on physical health, mental wellbeing, and athletic performance. The review then explores influencing factors and where education may contribute to the knowledge acquisition and behaviours of professional jockeys. Consideration is also given to literature surrounding behaviour change theory. To conclude the section, methodological and paradigmatic positions are addressed, discussing how the present thesis and its individual studies are embedded in an overarching paradigm.

Weight-Making in Professional Horseracing

Several sports acknowledge that body weight and/or body composition are the primary variables for performance (Ackland *et al*., 2012). Anthropometrically, some athletes are genetically suited to the requirements of their respective sports (Sungdot-Borgen *et al.,* 2013) allowing them to sustain a healthy approach to weight management. Many high performance and elite level athletes however struggle to maintain a conventional relationship with food in their attempt to conform to the "ideal" body their sport requires (Sundgot-Borgen and Garthe, 2011). Weight-category sports usually require the athlete to adhere to a maximum weight threshold so as not to have an unfair or dangerous body mass advantage over competitors (Burke and Cox, 2009; Chaabene *et al.,* 2015). Horseracing adheres to this

principle where riding weights are determined in a) consideration of horse welfare (young and immature horses will carry lighter riding weights), and b) in handicap races dominant horses will carry heavier weights and lesser rated horses will carry a lighter load, to theoretically create a more competitive race.

Professional jockeys are unique weight-making athletes on the basis they are required to "make weight" daily in comparison to their counterparts in other weight making sports who often have weeks or months to meet a specified or desired weight or composition (Wilson *et al.,* 2014). With no designated off-season in horse racing and the advent of all-weather racing tracks, this requisite can endure up to six or seven days per week, 10-12 months of the year in comparison to boxers who may only fight once every 4-6 months (Dolan *et al.,* 2011a). Furthermore, unlike combat sports where athletes 'weigh-in' prior to competition only, allowing (sometimes >24hours) re-hydration and re-fuelling to take place before exertion (Slater *et al.,* 2007; Morton *et al.,* 2010, Langan-Evans *et al.,* 2017), jockeys are not afforded the privilege. Jockeys routinely compete within minutes of having riding weights verified by officials, and are subsequently re-weighed upon completion of the race and required to score within 1kg of the primary reading or face disciplinary sanctions including disqualification, fines, or race bans (Wilson *et al.,* 2014). This model often means jockeys proceed to compete in a state of dehydration and/or low energy (Langan-Evans *et al.,* 2017). A further disadvantage when compared to other weight sensitive sports is the specified competition weight is not a naked weight. In horseracing the competition weight is inclusive of all competitive attire consisting of their silks (racing jersey), breeches (trousers), boots, helmet, body protector, saddle, and horsecloth (Wilson *et al.,* 2014). This requirement logically suggests that as a result, actual body weight is lower than specified in order to accommodate

a margin for said equipment (Voss, 2017). A typical 'day in the life' of a professional jockey is illustrated in Figure 1.

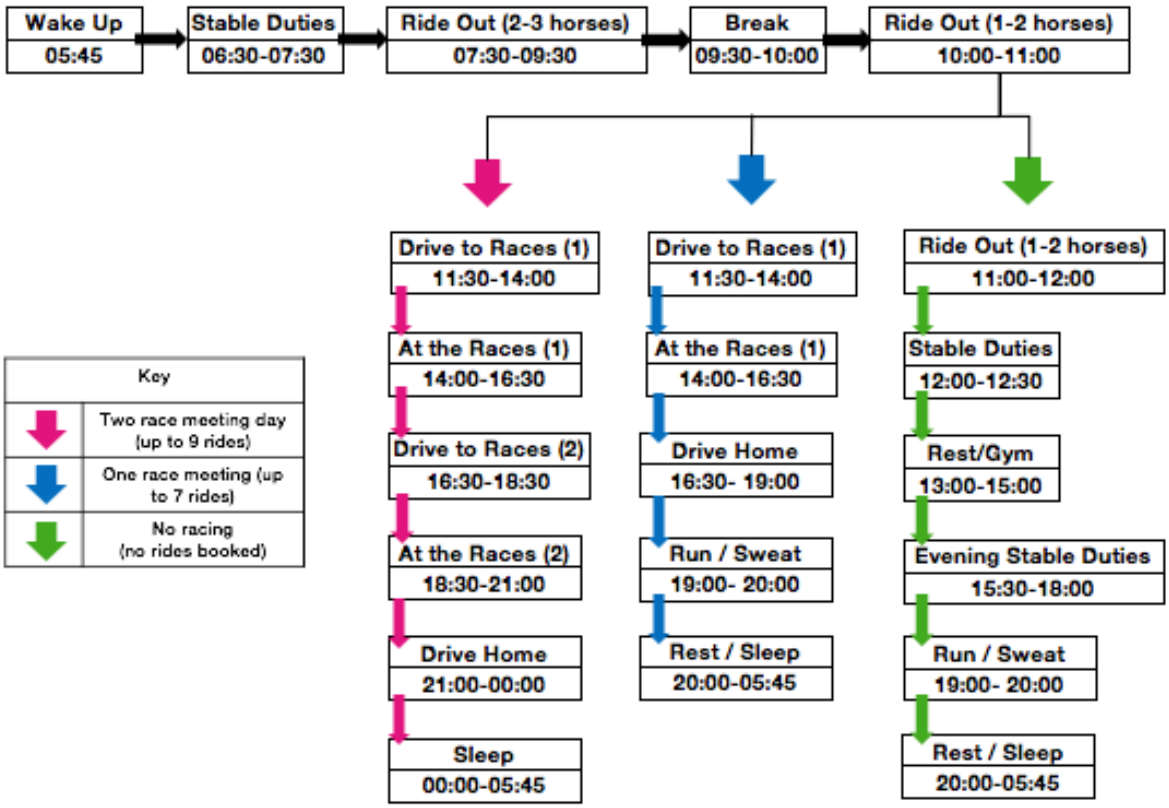

Figure 1. A Typical Daily Routine of a Professional Jockey

Horseracing is generally categorised into one of two codes within the industry; Flat or National Hunt (more commonly referred to as Jump). Both Flat and National Hunt divisions operate a minimum and maximum riding weight range (Wilson *et al.,* 2012) ranging from 50.8 - 63.5kg for Flat and 62.0 – 76.0kg for National Hunt under UK rules. The minimum weights within these ranges which many jockeys are required to meet, are amongst the lightest in the world when compared with other leading horseracing nations (Table 1), creating a further challenge for UK based professional jockeys in an already physically demanding sport. This view is amplified further when the anthropometry of the modern day jockey is considered.

UK flat jockeys are considered the heaviest and loftiest jockeys in the world compared to other leading nations (Table 2).

Table 1 - Minimum riding weights for flat jockeys in leading horse racing nations

Country	Minimum Riding Weight (kg)	Comments
Australia	54.0	Increased by 1kg in 2012
France	51.0	
Hong Kong	51.0	
Ireland	52.6	Combined increase of 2kg in 2006 and 2012
New Zealand	53.0	
UAE	52.0	
UK	50.8	Increased from 49.9kg in 2013
USA	53.5	Increased from 49.9kg in 2016

Table 2 – Mean (and SD) of flat jockey height, weight, and BMI based on nationality

Study (year)	No. of Jockeys	Country	Mean Weight (kg)	Mean Height (m)	Mean BMI
Moore (2002)	91	Australia	53.0 (0.40)	1.59 (0.18)	20 (0.2)
Warrington (2009)	17	Ireland	53.0 (4.10)	1.60 (0.01)	20 (1.3)
Leydon (2002)	8	New Zealand	53.0 (2.40)	1.62 (0.44)	20 (1.5)
Wilson (2013)	19	UK	56.0 (2.90)	1.67 (0.53)	20 (1.4)
Cotugna (2011)	20	USA	51.0 (1.50)	1.58 (0.51)	20 (1.0)
Wilson (2015)	14	UK	60.1 (4.60)	1.67 (0.08)	-
Jackson (2017)	116	UK (licensing)	52.3 (2.50)	162 (0.06)	-
Wilson (2018)	31	UK	56.3 (2.50)	168 (0.50)	-

Rookie professional jockeys within the industry are referred to as 'apprentices' (Flat racing) or 'conditionals' (National Hunt). Due to their relative inexperience these riders are permitted further reductions in bodyweight, commonly referred to as "claiming weight". These further allowances range from 1.4kg to 4.5kg (Wilson *et al.,* 2013a) and gradually decrease when milestones are reached in relation to number of races won until no allowance is granted.

These weight allowances exist as an incentive to racehorse trainers to allow young riders to race on their horses (rather than an older professional without the claim allowance), with a lighter weight likely to increase the running speed of the horse (Wilson *et al.,* 2014). Whilst this is beneficial in giving young riders necessary and essential experience, it is potentially contradictory as these jockeys are then required to meet even more demanding riding weights. A recent study on young jockeys during their licensing program identified the mean weight of 116 flat licensees was 52.3kg (Jackson *et al.,* 2017) however these jockeys could be called on to ride as low as 47kg with their claiming allowance. It has been suggested in literature that the minimum racing weights are both archaic and outdated (Caulfield and Karageorghis, 2008), and are based primarily on the somatotype of the initial jockeys in the 17th century (Wilson *et al.,* 2014) and not in consideration of the present man who is believed to be on average 6cm taller (Steckel, 2009). Similarly, statistics from racing academies in Ireland report that the weight of young jockeys had increased by 37% over thirty years (Warrington *et al.,* 2009), however during this period there has only been a moderate 6% increase in minimum riding weights.

Physiological and Nutritional / Energy Demands of Professional Horseracing

The energy demands of professional jockeys have only been scarcely researched due to the logistical and technical challenges associated with obtaining reliable and valid measures of energy expenditure during bouts of work (e.g. during actual horse riding). Only two studies have attempted to quantify total energy expenditure of professional jockeys. The inaugural study utilised a laboratory calibrated Actiheart heartrate monitor that eight professional jockeys were instructed to wear for 24-hours, estimating a daily energy expenditure of 2691(±356) kcals (Wilson *et al.,* 2013a). A follow-up study from the same research group later

utilised the gold-standard method of doubly-labelled water (DLW) to assess total energy expenditure over a two week period, reporting daily average expenditure of 2567(±478) kcals (Wilson *et al*., 2018a). Energy expenditure is reported as modest in comparison to other professional athletic populations and age-matched non-athletes indicating that widely referenced general sports-nutrition recommendations (Burke *et al.,* 2011) are perhaps invalid for jockeys. Individual variability within jockeys exists due to deliberate bouts of additional exercise engaged in by some, and not the time spent riding either in training or race-riding scenarios. This is likely to be due to the low energy cost of riding. At present the use of portable gas analysis equipment or heart rate monitors on jockeys whilst riding a live horse is banned under health and safety grounds in UK (Wilson *et al.,* 2018a) therefore previous attempts of establishing energy expenditure during race-riding has been limited to lab-based simulation trials using a mechanical horse. Over a two-mile simulated race taking approximately 4-minutes to complete, jockeys expended a moderate 43(±7) kcals (Wilson *et al.,* 2013). A subsequent study on Irish jockeys produced comparable data with an average expenditure of 22(±5) kcals over a simulated race of just under 1-mile (Cullen *et al.,* 2015). Through consultation with senior medical advisors, this Irish study also permitted the use of heartrate monitors during three competitive races on eight apprentice jockeys. Results indicated almost exact mean and peak heartrates during competitive race-riding when compared to their individual lab-based V02 max test results suggesting the simulated trials may provide a reasonable estimate of energy expenditure. Similar findings were more recently reported in elite standard Hong Kong based jockeys (O'Reilly *et al.,* 2017).

Current Nutrition Intakes of Professional Jockeys

Previous studies that have examined the dietary intakes of jockeys (inclusive of male and female, flat and jump) report inadequate energy intakes (Dolan *et al.,* 2011b; Leydon and Wall, 2002; Waldron-Lynch *et al.,* 2010; Wilson *et al.,* 2012a; Wilson *et al.,* 2015). Self-reporting of dietary intake has been the predominant method of data collection. Although weighed food diaries are considered the gold standard for measuring energy intake (Bingham, 1987) this was not, and likely could not be a feature of recent jockey research given their hectic daily schedule (Wilson *et al.,* 2012). Using food diaries, reported average calorie intakes of professional jockeys of 1803±564kcals (flat 1669±436; jump 2013±707) (Dolan *et al.,* 2011a) are approximately 1.2 times their resting metabolic rate (RMR). Within this, macronutrient breakdown was estimated to be 3.7±1.3g.kg.bw carbohydrate and 1.3±0.5g.kg.bw protein. Similarly in a New Zealand study, jockeys self-reported intakes of 1624±155kcals (female, n=14) and 1480±208kcals (male, n=6) with carbohydrate intakes of ~3.5g.kg.bw and protein ~1g.kg.bw collectively (Leydon and Wall, 2002). Waldron-Lynch *et al.* (2010) surmised daily energy intakes of 1760±283kcals across 27 male professional jockeys (flat, n=17; jump, n=10) via food diary analysis. Failing to provide relative macronutrient intakes in grams per kilogram of bodyweight, figures detailing carbohydrate intake attributed for 42.9±8.5% of total energy intake with protein contributing for 16.2±3.7% correspond with the previous two studies suggesting uniformity. In two more recent studies by the group of Wilson *et al.*, in the first research paper investigating energy demands of race-riding they reported carbohydrate intakes of 3.4g.kg.bw and protein of 1g.kg.bw (Wilson *et al.,* 2013a), whilst using a 24-hour recall interview they reported similar intakes of 3.1g.kg.bw carbohydrate and 0.9g.kg.bw protein in 10 male jockeys (Wilson *et al.,* 2015). It appears that across all studies, jockeys reported low energy intake values when compared to the measured

daily total energy expenditure data of 2500-2700kcals from Wilson *et al.* (2013a) using heartrate monitors and their most recent study using DLW (Wilson *et al.,* 2018a). If all these values are to be believed, it poses a paradox in that jockeys struggle to maintain a competitive racing weight despite regularly being in a state of energy deficit, close to RMR. In two intervention studies, the first a case study (Wilson *et al.* 2012) followed by a more comprehensive intervention trial (Wilson *et al.,* 2015), jockeys were prescribed a daily calorie allowance equivalent to measured RMR with a high protein (~2.5g.kg.bw), low 'healthy' fat (~0.8-1g.kg.bw) and low-moderate carbohydrate composition (remainder of kcal allowance, usually ~2.5-3.5g.kg.bw). When adhered to, the case study reported a total weight loss of 7.7kg (5.4kg fat, 2.3kg FFM) over nine-weeks with improved absolute and relative strength and aerobic performance scores (Wilson *et al.,* 2012). Over six-weeks in the group trial, jockeys lost an average of 2kg total weight, sparing lean tissue and in similar style to the case-study reported improvements in strength and VO2max scores (Wilson *et al.,* 2015). The results of these two studies are in stark contrast to the previous assumption that jockeys who maintained an energy intake equivalent to RMR still struggle to maintain weight.

Most energy consumed by jockeys has reported to be in the form of high glycaemic-index carbohydrate foods (Cotugna *et al.,* 2010; Dolan *et al.,* 2011b; Wilson *et al.,* 2012) which is directly associated with weight gain via stored liver and muscle glycogen and water molecules (McCardle *et al.,* 2010), and energy storage via fat tissue (Jenkins *et al.,* 1989) when compared to low glycaemic-index foods. Food recall amongst jockeys indicated low micronutrient intakes, failing to meet recommended daily allowances for most essential vitamins and mineral groups associated with cellular function and repair (Dolan *et al.,* 2011b; Leydon and Wall. 2002). Perhaps more importantly given the increased risk of fracture in racing (Filby *et al.,* 2012), micronutrients associated with optimal bone health, calcium and vitamin D were

considered grossly deficient (Greene *et al.,* 2013; Waldron-Lynch *et al.,* 2010) with intakes around 14-18% of the recommended for vitamin D and 61-68% for calcium. Before any conclusions are drawn however, it should be noted that accurate micronutrient profiling can only be assessed via biochemical blood analysis (Fallon, 2008) due the effect pedo-climatic factors may have on fruit's nutritional composition (Failla *et al.,* 1996). Blood analysis of vitamin D via serum 25(OH)D concentrations in previous jockey studies however indicated a very high prevalence (72%) of inadequate concentrations (30-50nmol.l) with 11% severely deficient (<12.5nmol.l) (Wilson *et al.,* 2013b).

It is likely that underestimation of intake via self-reported food diaries, commonly believed to be up to 50% out (Burke and Deakin, 2010) is responsible for the lack of accuracy, particular surrounding macronutrient intake. Since these studies, the novel use of photographing smartphone apps such as Snap'n'Send has provided a potentially more accurate and less laborious method of recording food intake independently and remotely (Costello *et al.,* 2017) however has still yet to be trialled in jockeys and may not be as effective in this population as in team sports where it was trialled. The evident lack of understanding amongst jockey athletes on the energy profile of foods is likely a key contributor to their struggle to make weight daily and so regularly resort to acute weight loss strategies in order to achieve the necessary riding weights.

Current Weight Making Strategies in Professional Horseracing

Up to 70% of elite level athletes who compete in weight-sensitive sports resort to 'disordered eating' to reduce bodyweight in the lead up to competition (Oppliger *et al.,* 1996; Torstveit and Sudgot-Borgen, 2005) with higher rates of adverse practices in sports where the specific emphasis is low bodyweight (Sundgot-Borgen and Larsen, 1993; Rosendahl *et al.,* 2009; Holm-

Denoma *et al.,* 2009) such as horseracing. Several investigations into the methods employed specifically by jockeys to make weight exist (Cotugna *et al.,* 2011; Dolan *et al.,* 2011; Leydon and Wall, 2002; Moore *et al.,* 2002; Wilson *et al.,* 2012, 2013). Prolonged periods of starvation and withholding fluid intake is common (Cotugna *et al.,* 2011; Dolan *et al.,* 2011a) to prevent weight gain. Skipping meals and restricting food intake to one or two small sitting per day on a daily basis was reported in 33% of 116 jockeys (Moore *et al.,* 2002) with 44% reporting this practice on multiple days per week but not every day. This phenomenon exists in both flat and jump jockeys where 60% of both codes they regularly resort to food restriction and fasting, consuming only a maximum of two meals per day (Wilson *et al.,* 2013a). Despite the advent of the intervention studies by Wilson *et al.* (2012 and 2015) where jockeys consumed smaller amounts more regularly and lost up to 8kg, dehydration and starvation are still the most commonplace method.

To facilitate the practice of fasting, studies indicate smoking cigarettes as a common method to assist in appetite suppression (Dolan *et al.,* 2011b; Greene *et al.,* 2013; Moore *et al.,* 2002). Smoking restrains appetite due to the modulation of hypothalamic neurotransmitters when nicotine is entered into the body (Miyata *et al.,* 1999; Jo *et al.,* 2002). Half of all jockeys studied (Leydon and Wall, 2002) and 40% of all male and female jockeys (Moore *et al.,* 2002) indicated they were smokers, stating the habit acted as a tool to facilitate appetite suppression rather than one of desire or enjoyment. The habit permeates both genders of apprentice riders, with 40% confirming their status as smokers (Greene *et al.,* 2013), and 38% of both flat and jump jockeys indicated its use in their weight management strategy (Dolan *et al.,* 2011b). When compared to the general public, it appears jockeys are significantly more likely to take up smoking (Wilson *et al.,* 2014), a concerning statement considering the wealth of knowledge now recognised in smoking's contribution to lower life expectancy.

Acute and rapid dehydration strategies to make weight is reported in multiple studies using a myriad of techniques including use of saunas, hot salt baths, sweat suits, laxatives, diuretics, and self-induced vomiting (Dolan *et al.,* 2011a). Jockeys routinely drop 2-3% of total body weight in the final hours preceding competition (Cotugna *et al.,* 2011) via water loss whilst more severe weight cuts have reported 7% of body weight losses over a 24h period (Wilson *et al.,* 2013a). Although these figures are self-reported and open to cynicism, studies investigating the hydration status of jockeys through urine specific gravity (USG) analysis potentially substantiate these figures. Dehydration via USG analysis can be classified as a score >1.020g.ml for athletic populations (Casa *et al.,* 2000). Average USG scores for flat jockeys of 1.022g.ml at rest (i.e. not during training, competition, or making weight for competition) indicate jockeys could be chronically dehydrated and not restricted to the periods around racing (Warrington *et al.,* 2009). Jump jockeys were reported to have slight dehydration (1.012g.ml) during the same study with the difference most likely due to the more liberal riding weights for jump racing allowing for less restrictive day-to-day practices versus flat jockeys. An alternative study measured USG of nine jockeys prior to and subsequently after a voluntary 4% decrease in bodyweight sweat. Mean USG increased from an already elevated 1.019g.ml to 1.028g.ml (Dolan *et al.,* 2013). This literature highlights specifically that jockeys enter competition in a state of severe dehydration unlike comparative weight-making sports where dehydration is only necessary for the weight verification. Understandably, it has been asserted that acute dehydration practices pose significant health risks to jockeys as well as their ability to perform optimally (Caulfield and Karageorgis, 2008; Warrington *et al.,* 2009), and is suggested to be a contributor to a number of falls and injuries by jockeys losing consciousness mid-race (Rueda *et al.,* 2010).

Despite being banned in horseracing worldwide in 1999, diuretics still appear to play a role in weight making practices by jockeys (Dolan *et al.,* 2011; Leydon and Wall, 2002; Moore *et al.,* 2002). Prior to their prohibition it was estimated 60% of UK jockeys routinely used diuretics as a weight-making aid (King and Mezey, 1987), whilst 77% of South African based jockeys confirmed their use (Labadarios *et al.,* 1993). Current figures indicate their use throughout the professional ranks since the introduction of a ban has deterred their use. Only 4% of 91 jockeys admitted their use as a contemporary strategy (Moore *et al.,* 2002), and only a single participant from an Irish cohort reported using them (Dolan *et al.* 2011a). Similar to diuretics, laxatives were outcast globally in 1999 as a weight-loss aid in racing and a comparable decrease in use to diuretics is evident. Prior to their ban practices were as high as 70% (King and Mezey, 1987) however post-millennium usage was reported at 16% of 116 jockeys (Moore *et al.,* 2002), with only one jockey each reporting their use in work by Dolan *et al.* (2012a) and Wilson *et al.* (2013a). Whether the ban is the contributing factor to the reported decrease in diuretic and laxative use is impossible to conclude. Given the taboo that surrounds the use of banned substances it is reasonable to assume that their use may be greater than reported due to the reluctance of participants to admit to engaging in banned practices and fear of being subsequently reported, an act that could put their career at jeopardy.

Forced, or self-induced vomiting is a practice more commonly referred to within the industry as 'flipping' (Caulfield and Karageorghis, 2008). This practice involves regurgitating recently eaten foods to reduce bodyweight. Whilst the act is symptomatic of clinical eating disorders such as bulimia nervosa (Kaye *et al.,* 2004) it is generally not considered a clinical illness amongst athletes as is a 'tool' to facilitate immediate weight loss for competition, rather than impulses being driven by issues associated with body image (Wilson *et al.,* 2014). Flipping

amongst professional jockeys has been a consistent feature in the literature from initial studies (King and Mezey, 1987) through to present day reading (Dolan *et al.,* 2011b; Greene *et al.,* 2013; Moore *et al.,* 2002). Flipping could be acknowledged as the least favourable option as incidence rates are comparatively low against sweating modalities. Flipping was reported as a method by ~10% of 91 Australian jockeys (Moore *et al.,*2002) and 14% in a study of 21 Irish riders (Dolan *et al.,* 2011b). The initial research only indicated 10% of jockeys engaged in flipping (King and Mezey, 1987) indicating a consistently low use-rate. One cause for concern however is the findings of a study on apprentice jockeys which suggested 60% had engaged in flipping in tandem with other acute weight loss strategies (Greene *et al.,* 2013). Whilst this is only a single study and there is the possibility of a population bias, these findings need to be considered and addressed. Poor education on the dangers of such practices may be a contributing factor alongside the concept that archaic practices are passed down from senior jockeys to newly licensed riders (Moore *et al.,* 2002).

Impact of Weight-Making on Physical and Physiological Health

Dehydration, hormonal disturbances and poor bone health are all reported in jockey-specific literature as a consequence of acute weight-making strategies (Caulfield and Karageorghis, 2008; Dolan *et al.,* 2011b; Waldron-Lynch *et al.,* 2010; Warrington *et al.,* Wilson *et al.,* 2014). Osteopenia was identified via dual-energy x-ray absorptiometry (DEXA) analysis of the whole body, hip, and lumbar spine in both male and female flat jockey groups (Leydon and Wall, 2002). Using criteria specified by Blake and Fogelman (2007), 40% of male and 46% of female jockeys were graded as osteopenic. Osteopenia was reported at levels of 53% (flat) and 10% (jump) respectively after the same three diagnostic scans in a later Irish study (Warrington *et al.,* 2009). In this work site specific osteopenia was also observed at the hip (41% flat; 20%

jump). Perhaps most concerning was a 12% incidence of flat jockeys who presented with T-scores of -2.5, an indication of osteoporosis - a condition more commonly associated with older and elderly populations (Kanis *et al.,* 2001) rather than a mean age sample of 27year old professional athletes. More recent work assessing the bone health of jockeys indicates levels of low bone mineral density may be prevalent across the age spectrum of jockeys. In a study of 31 jockeys (17 apprentices v 14 senior jockeys) matched for weight, Z-scores at the lumbar spine (-1.3 ± 1.4 v -1.5 ± 1) and hip (-0.9 ± 1.1 v -0.8 ± 0.7) indicated site specific osteopenia in both populations (Wilson *et al.,* 2018b). An investigation into the bone health of newly licensed jockeys indicated 42% of 79 male apprentices presented with osteopenia at the hip, 34% with osteopenia at the femoral neck, and 76% with osteopenia at the lumbar spine. Scores indicating osteoporosis of the lumbar spine was 29% (Jackson *et al.,* 2017). Despite a greater weight allowance for conditional jockeys (apprentice jump jockeys) Z-scores indicating lumbar spine osteopenia (52%) and osteoporosis (13%), and osteoporotic hips (10%) were evident. Low bone mineral density scores in female apprentice jockeys was significantly lower than their male counterparts. These contemporary results pose the current question of whether weight-making practices in adolescent years has a severe deleterious effect on bone health, or whether jockeys as a population due to their smaller stature have naturally slighter bones than the general population and therefore new relative norms need to be established. Either way, with a body of athletes who are already exposed to a greater risk of fracture due to the nature of the sport, and where high-speed falls routinely occur both in training and competition (Turner *et al.,* 2002), strategies to improve bone health are needed. Up until the discovery of this most contemporary literature in young jockeys, the unchallenged paradigm (and one still maintained my many) was the belief that poor bone health amongst jockeys was as a result of adverse dietary behaviours in the pursuit

of weight loss. This view may in part explain why flat jockeys appear to be consistently worse-effected given their need to achieve more stringent riding weights than jump riders, and consistently reported lower daily energy intakes to make weight (Dolan *et al.,* 2011b; Waldron-Lynch *et al.,* 2010; Wilson *et al.,* 2013). With this is mind, low energy availability has been associated with poor bone health (Mountjoy *et al.,* 2014, 2018). It is purported that an energy availability >30kcal.kg of lean mass results in impaired physiological functioning of body systems (Loucks *et al.,* 2011). Specific to bone health, bone mineralisation and rates of bone protein synthesis decrease in addition to disrupted key hormone function responsible for bone mineral regulation (Loucks, 2004). A dichotomy exists however, if jockeys were to maintain the recommended 45kcal.kg.lm as recommended for healthy energy availability (Loucks *et al.,* 2011), it is likely jockeys would require a dietary intake exceeding 3000kcals and cause weight gain (Wilson *et al.,* 2014). It is therefore recommended to spare chronic bone degradation, to implement an osteogenic stimulus in the form of resistance and weight-bearing exercise (Guadalupe-Grau *et al.,* 2009; Wilson *et al.,* 2018b), and consider nutrition strategies including supplementation to augment calcium and vitamin D intakes (Greene *et al.,* 2013). Vitamin D is of significance given its role in facilitating calcium uptake to bone and a correlation existed in a jockey study where participants with lower vitamin D intakes had higher levels of bone resorption indicator NTX-1 versus jockeys who were considered having adequate vitamin D intake (Waldron-Lynch *et al.,* 2010). Similarly, using tandem mass spectrometry on a cohort of 37 jockeys to assess for 25(OH)D, 76% were considered as having inadequate concentrations. Abnormal levels of CTX-1, and indicator of bone resorption was also present in eight of the jockeys (Wilson *et al.,* 2013).

Much emphasis in previous jockey research is placed on bone health despite their being a strong body of literature on the effect of low energy availability and disordered eating on

physiological and organ health (Melin *et al.,* 2014; Mountjoy *et al.,* 2018). Studies where blood markers to assess for organ damage or inefficiencies in jockeys have been conducted yielded no significant irregularities despite a high prevalence of disordered eating and archaic weight making tactics (Wilson *et al.,* 2013; Waldron-Lynch *et al.,* 2010). In addition, there was no indicated differences in blood and urine results between flat and jump jockeys despite the more intense nature of weight making reported in flat jockeys. Although the outcomes of research to date indicates only damage to bone health, there have been no longitudinal studies to investigate the sustained effect of the jockeys lifestyle on health. One previous study investigated the health of retired jockeys however was limited in its scope to body composition and thyroid function (Cullen *et al.,* 2015b) rather than organ health. The literature field would benefit from a long-term study into organ health of jockeys.

Impact of Weight-Making on Psychological Health

Previous jockey work has attempted to establish the impact of weight-making on psychological wellbeing via questionnaire-based tests. A psychometric test to enable practitioners to identify abnormal eating habits and atypical bodyweight concerns was devised in the 1970's and labelled the Eating Attitudes Test (shortened to EAT-26 test due to its 26-question length) (Garner *et al.*, 1982; Garner and Garfinkel, 1979). In its first published use on a jockey population, King and Mezey (1987) reported eating habits consistent with clinical eating disorder patients however with the observation that 'fear of fatness' and 'body dysmorphia' did not apply to jockeys. This is likely due to many jockeys using disordered eating as nothing more than a tool to achieve a necessary competitive weight for no longer than the duration of the race. On a group of 20 jockeys, 20% indicated disordered eating (Leydon and Wall, 2002) whilst 15% of 41 jockeys assessed were classified as 'at risk' (a score

of 20 or greater) of developing a clinical eating disorder in a later study (Caulfield and Karageorghis, 2008). Perhaps unsurprisingly results differed significantly between jockeys who were regularly required to make weight versus jockeys who had stable riding weights and were not required to lose significant sums often. In its most recent use, three out of ten jockeys were considered 'at risk' (Wilson *et al.,* 2015) when measured using the EAT-26 scale with a six-week dietary intervention decreasing average score from 14.8 (±9.6) to 11.0 (±5.6), however not considered statistically significant. This indicates that dietary prescription alone may not be enough to facilitate sustained eating behavior change.

A second common psychological test used within jockey literature is the Brunel Mood Score test (BRUMS). This inventory assesses six mood parameters; anger, confusion, depression, fatigue, tension and vigour (Terry *et al.,* 1999). Used in tandem with the EAT-26 test, the BRUMS was used to assess the psychological impact of weight-making and conducted immediately after a weight-loss period and prior to a race (Caulfield and Karageorghis, 2008). Vigour, the metric for positive mood state was significantly supressed, whilst elevated scores were reported for anger, confusion, depression, fatigue and tension. Similar results were reported in 33 jockeys with the five negative mood markers elevated with vigour supressed (Wilson *et al.,* 2012b). In a case-study project where a single jump jockey followed a nine-week dietary prescription intervention using the optimal diet described earlier in this chapter, BRUMS scores pre and post transformed from elevated negative mood scores and supressed vigour, to normal levels of negative scores and an elevated score for vigour (Wilson *et al.,* 2012a). Although only an n=1 study, this was the first to exhibit that optimal dietary intake for jockeys may not only facilitate physical health, but also play a beneficial role in mental wellbeing. With evidence of negative mood states potentially inhibiting athletic performance (Lane *et al.,* 2001; Morgan, 1988), and magnified in scale in sports of short duration involving

open skills (Beedie *et al.,* 2000) of which horseracing can be considered, the extreme weight-making strategies associated with professional jockeys may be causing detriment to riding performance as well as physical and psychological health.

Impact of Weight-Making on Riding Performance

Literature surrounding the direct association between weight-making and riding performance specifically in jockey populations is scarce given the real world challenges of recruitment and inducing dehydration in a safe and ethical manner. In an Irish study, nine jockeys were requested to lose 4% bodyweight over 48-hours as they would normally do for competition after concluding baseline testing on an incremental cycle ergometer test. Jockeys reported a combination of food and fluid restriction in addition to dehydration via saunas, baths, and exercising in sweat suits. Acute weight loss of 4% bodyweight resulted in reduced aerobic capacity and significantly less total workload and increased time to exhaustion ($p=0.01$) in comparison to baseline (Dolan *et al.,* 2013). In the same study, cognitive function by way of reaction time and decision making, tested using a computer programme was not significantly affected. In line with the work of Hitchens *et al.* (2011), they suggest although not performed on a horse in the study, rapid weight loss impairs riding performance and could increase the risk of falls. A more methodologically valid investigation attempted to simulate race riding conditions using a mechanical horse 2-mile race protocol subsequent to a 2% body weight cut via treadmill running in a sweat suit (Wilson *et al.* 2013b) in addition to maximal upper and lower body strength tests. During the race jockeys were asked to 'canter' for the first 2400m before engaging in maximal intensity 'pushing' for the remainder as typical of a real race of this distance. Aerobic power along with upper and lower body strength was significantly poorer, however non-significant differences were observed in decision making. A major

limitation of both these studies is a) neither were performed in real conditions, and b) 2-4% bodyweight cuts is commonplace in this population. Whilst these studies identify acute losses of this magnitude decrease athletic performance, conclusions shouldn't be drawn that acute weight loss in jockeys don't impair cognitive function as ethical clearance makes it difficult to test real-world conditions of more severe, yet common, losses in weight.

Factors Influencing Weight-Making Practices

Archaic weight making practices still dominate despite the presence and disemmination of literature clearly identifying alternatives to rapid weight loss through diet and exercise (Wilson *et al.,* 2012a, 2015; Professional Jockeys Association (PJA), 2012). The reasons for this may be multifactorial and this section aims to introduce the complex of factors that contribute. Both intrinsic (e.g. beliefs and ideologies of the jockey) and extrinsic factors (e.g. peers and the structure of racing) are discussed, whilst providing an insight into a jockeys lifestyle and workload. Intrinsic factors include concepts such as lack of nutrition knowledge, a lack of belief that an evidence-informed approach may be more effective than traditional methods, that novel approaches are too restrictive, or that they believe the horse is the genuine performer and the method of weight management is unlikely to influence the horses performance. Extrinsic factors involve a potential power dynamic between racehorse trainers and the long working hours making optimal nutrition difficult, persuasion or poor guidance from senior peers, lack of availability of approved support groups, pre-determined low/light riding weights, and poor food provision at racecourses.

Different athlete groups place varying degrees of emphasis on nutrition based on its perceived importance on performance (Pelly *et al.,* 2006). It is common in equine sports for

the horse to be focussed on more as the performer than the rider (Douglas *et al.,* 2012). If jockeys don't believe traditional weight-making methods will affect the outcome of races, and rather it is decided by the ability of the horse, some jockeys may not take performance nutrition as serious as other athletic groups. Whilst this can be seen as an intrinsic (albeit perhaps misinformed) motive for poor dietary practices, a range of external influences may contribute. In a study conducted on 35 Australian apprentice jockeys, themes relating to a power dynamic whereby racehorse trainers decide what weights and horses young jockeys shall ride exist (Landolt *et al.,* 2017) which may passively lead to jockeys requiring to lose weight at short notice. The structure of racing itself in part precipitates this by allowing trainers to 'declare' or enter horses for races at just two days' notice which has been cited in the media as a key contributor to rapid weight loss, and in particular self-induced vomiting (Voss, 2017). The time and physical demands of the industry perhaps also play a role in adherence to healthy nutrition strategies, with some jockeys describing 60-70 hour working weeks over 6-7 days (Landolt *et al.,* 2017). Although not described in previous research, these factors may directly cause jockeys to opt for strategies that require less time and physical effort to achieve competitive weights. An alternative factor in jockeys deciding to maintain cultural practices may lay in the insular nature of the sport, with 63% of 115 jockeys reporting they seek dietary and weight-management advice from current or retired jockeys as their first choice over nutrition professionals (Moore *et al.,* 2002). Statistics such as these indicate that despite the research and education available, the voice from senior jockeys who have displayed mastery of weight making over many years may be more impactful despite advocating detrimental practices. This notion is not necessarily surprising, previous research in team-sports has indicated that young athletes may imitate nutritional habits of peers (Birkenhead and Slater, 2015; Smart *et al.,* 2001). In contrast, other research has indicated

that greater nutrition knowledge in young athletes leads to better engagement with both training and nutrition than those with less knowledge (Croll *et al.,* 2006). Given the unremitting racing calendar (362 days per year), jockeys spend a significant period of their lives at racecourses. For many due to the long driving commitments (Landolt *et al.,* 2017), food provided at racetracks is often their main opportunity to eat. With no direct input into provision, this could be considered another daily external influence on food choice. Hunger is recognised as the primary determinant of food choice (Lowe and Butryn, 2007) with greater feelings of hunger correlating with more unhealthy food choices. Considering the regular and prolonged bouts of starvation jockeys currently undertaken to maintain weight, it would be sensible to provide foods that are not overly calorie dense to prevent gauging and a rebound in weight however jockeys have previously indicated a high level of availability of high fat, energy dense foods (Harley, 2015). Sport-specific catering in other sports is common and tightly regulated by nutrition professionals who design menus collaboratively with chefs/caterers to ensure optimal provision based on the needs and demands of the sport (Pelly *et al.,* 2009, 2014). Considering the frequency and duration of time jockeys spend at courses, racecourse food provision is a logical line of enquiry for research and industry practitioners. It is clear to see that as described by Sobal and Bisogni (2009) in the context of athletes making correct and optimal food selection choices, that jockeys face a range of extrinsic factors that influence nutrition behaviour. The behaviours and practices of peers, the culture and structure of the sport, and the influence of the support network all contribute (Long *et al.,* 2011; Ono *et al.,* 2012). A visual representation specific to jockeys is depicted in Figure 2.

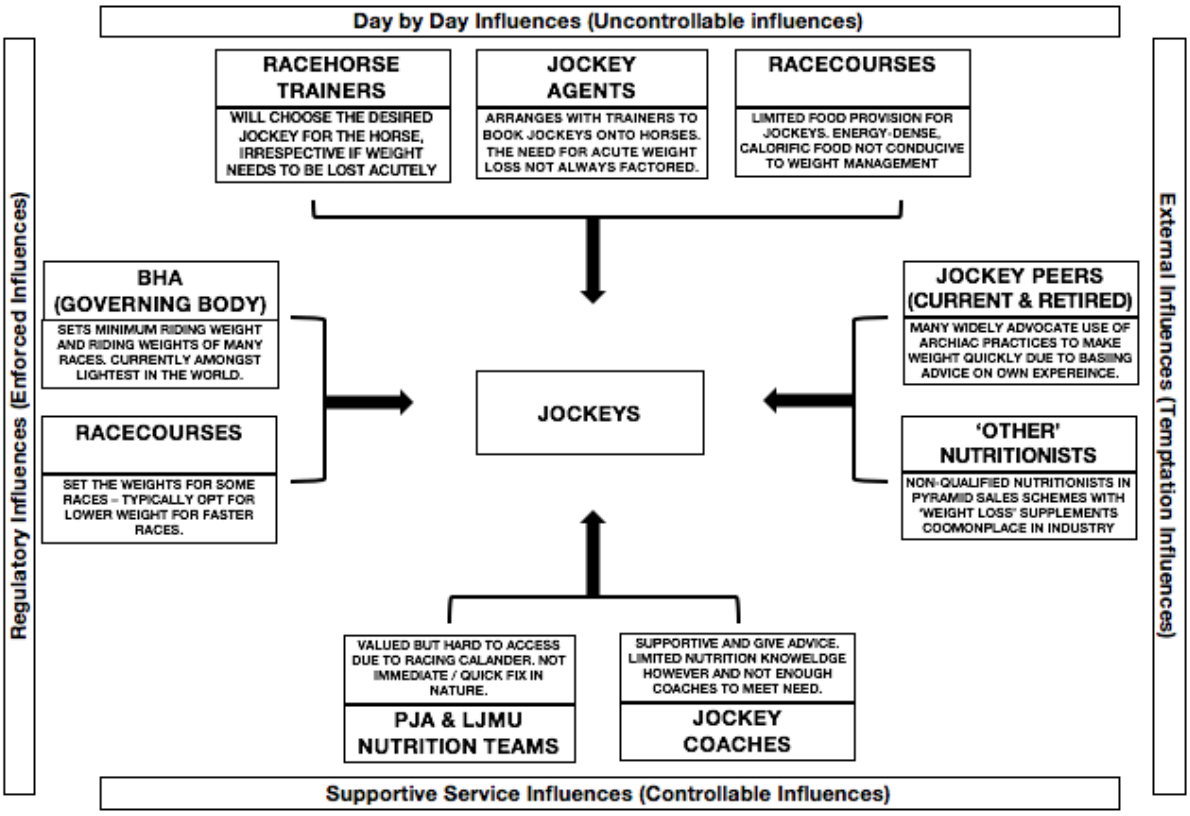

Figure 2. Influence from Stakeholders that may Influence Weight-Making Practices

Regulatory or 'enforced' influences may describe the rigid and non-negotiable factors that may contribute to adverse weight management and can only be changed by central bodies such as the sport's governing body, the BHA (British Horseracing Authority). The BHA sets and upholds legislation for minimum riding weights, and the riding weights for most races and horses. Many races in the UK operate a 'handicap' system by where the designated weight for each horse within these races is determined based upon each horses own previous racing performances. This 'handicapping' system is maintained by the BHA with the designated weights being final. The weights for certain non-handicap races (where all horses race with the same weight) are not under the jurisdiction of the BHA and fall to the racecourse to decide the weight.

Day by day influences or 'uncontrollable influences' may describe external influences that occur on a daily basis in the life of a jockey, and whilst are not mandatory from a regulation perspective, are mostly out of the control of the jockey. Once a weight has been specified by the BHA or a Racecourse and has become regulation, Racehorse Trainers may choose a jockey who is heavier than the specific weight as is a preferred technical rider. Under these circumstances the jockey would then be required to lose the excess weight or reject the ride altogether. With fear of being overlooked for future rides and gaining a reputation for not being able to make certain weights, it is generally an unwritten rule amongst jockeys to not decline rides regardless of weights. Acting as a buffer between trainers and jockeys, exists Jockey Agents who books rides for their jockey clients and ideally only books rides with weights that they have agreed between them is suitable. In the interest of securing work for their clients, these agreed weights are often overlooked. Finally, food provision at racecourses is out of the control of jockeys and may be presented with energy-dense foods not conducive to weight management or riding performance.

External or 'temptation' influences describe the availability of quick-fix or magic bullet solutions to weight management problems. Jockey peers often advocate methods that 'worked for them' in securing a rapid loss of weight usually through water loss. There is also a constant availability of unqualified out-of-industry weight-loss support services, often based around weight-loss supplements that lack an efficacious evidence-base and may increase the risk of an anti-doping violation (PJA, 2018).

Amongst the many influences that appear to make the task of optimizing nutrition and maintaining weight a challenge, there are supportive and 'controllable' influences. Industry endorsed nutrition support is available through the PJA Nutrition Team and LJMU (Liverpool

John Moores University) and can provide individual dietary advice for jockeys. Jockeys coaches are similarly supportive and provide advice and signposting where necessary for jockeys. Several avenues of support are available for jockeys to support weight management through access to coaches and professional sports nutritionists, with coverage of success in both industry specific and general mass media (JETS, 2017; Whitaker, 2017, 2018).

Organisational Culture and Occupational Working Conditions

An additional factor that likely features in the influencing of jockeys dietary behaviours and weight-making practices is the deeper culture of the sport. In relative terms, it could be argued that culturally speaking, very little has changed within professional horseracing since the interwar period (Huggins, 2010). Where some rules have been adapted to conform with contemporary health and safety (e.g. the mandatory use of body protectors), or integrity legislation (e.g. betting rules), the organisational structure and working culture has remained somewhat constant. Historically, and only up until 1993, professional horseracing has been governed by The Jockey Club who projected a masculine and authoritative figure over the sport, heavily represented by the social elite and male upper classes and military (Huggins, 2010). In contrast, many jockeys are typically of working class roots. Despite the BHA assuming the sports governance form 1993, the working culture of modern day professional horseracing still mirrors to the greater extent to that of the 20th century (Hill, 2002) with jockeys, stable staff and the betting public sharing a sense of social identity at the coal-face of the industry whilst the wealthier classes and social elite still typically enforce the ownership of horses, breeding, and training (Huggins, 2010). This dynamic of social power could in part contribute to the continued adherence of poor weight management as identified in Figure 2 whereby if a person who is considered to be in an elevated position not just organisationally

but also in terms of class requests for a low weight to be achieved, the perceived lower-class employee (i.e. a jockey) may feel compelled to conform. Rigid hierarchical cultures such as the ones that may exist within racing yards may facilitate labour exploitation and excessive works loads as described by Landolt *et al.* (2017) with jockeys carrying the heaviest burden being at the bottom of said hierarchy. This deep-rooted cultural dynamic in addition to the relentless nature of working conditions and hours, job insecurity, and a constant risk of catastrophic injury for relatively little monetary 'reward' could be considered a perfect storm for chronic occupational stress (Blix *et al.,* 2013; Landolt *et al.,* 2017). Occupational stress is experienced when one is in a constant state of unrest, in an everchanging, volatile and challenging work environment (Siegrist, 2001), all facets typical of a jockeys working life. Whilst the present thesis is focused on developing a strategy and intervention for nutrition education and behaviours it should be noted that there is a sparcity in psychology-based research amongst jockeys.

Behaviour Change Theory and the COM-B Model

Recognising that basic education or advice via media campaigns alone may not alone nullify the described influencing factors, nor deter individuals from poor nutrition or lifestyle choices, a growing body of work focuses on 'behaviour change interventions' (Alexander *et al.,* 2014; Costello *et al.,* 2018; Curtis *et al.,* 2015). Behaviour change interventions are defined as a coordinated set of activities designed to change behaviour (Michie *et al.,* 2011), where education or media campaigns may be one of several multiple 'activities'. Numerous behaviour change theories exist on which to model interventions. These theories share overlapping, yet differently named constructs within them (Michie *et al.,* 2014). With limited guidance on how to choose the applicable theory to the context of would-be interventions,

many designed interventions are often created without a theoretical underpinning at all which contributes to ineffectiveness or failure (Michie *et al.,* 2011; Eccles *et al.,* 2012). Previous interventions have been described by the acronym ISLAGIATT (it seemed like a good idea at the time) (Eccles *et al.,* 2012), highlighting the non-systematic approach to intervention design. The use of theory in the development of behavioural interventions is recommended by the UK Medical Research Council (MRC) (Craig *et al.,* 2008). In doing so, interventions are more likely to be successful and allows a more valid model of evaluation (Barker *et al.,* 2015). Electing a relevant and valid theory to the context of the project is a challenge for researchers or intervention designers given the large number of theories available to use, or to simply opt for a 'common' or 'favourite' theory with a small number particularly being identified as dominating intervention research (Painter *et al.,* 2008). In a review article eighty-two theories of behaviour and behaviour change were identified over 276 articles (Davis *et al.,* 2014) however only four theories accounted for 174 (63%) of them. A well-established theory, and one that featured in 92 published articles within the referenced review article is the Transtheoretical Model of Change (Prochanska and Velicer, 1997), however despite its use has been widely criticised on multiple fronts including its rigidity in creating non-fluid stages and a lack of support the automatic and impulsiveness of human nature to relapse (West, 2005; Cahill *et al.,* 2010). Other commonly used theories include Theory of Planned Behaviour (Ajzen, 1991) and Information-Motivation-Behavioural-Skills Model (Fisher and Fisher, 1992). In an alternative systematic review, nineteen behaviour change frameworks were identified (Michie *et al.,* 2011), and in similar conclusion identified each had its own shortfalls. To overcome this, there were calls for a 'supra-theory model' that is applicable across contexts (Barker *et al.,* 2015). Michie *et al.* (2011) spawned the 'COM-B model' (based on the nineteen existing identified frameworks), a model intended to be

comprehensive, parsimonious and applicable to all behaviours (Jackson *et al.*, 2014). They proposed that for an individual to engage in a desired behaviour (in the context of jockeys, using diet and exercise appropriately to make weight safely over rapid weight loss techniques), people need the capability (C), the opportunity (O) and be motivated (M) to perform the behaviour (B). Each facet of the model is further broken down into two sections and illustrated simply in Figure 3.

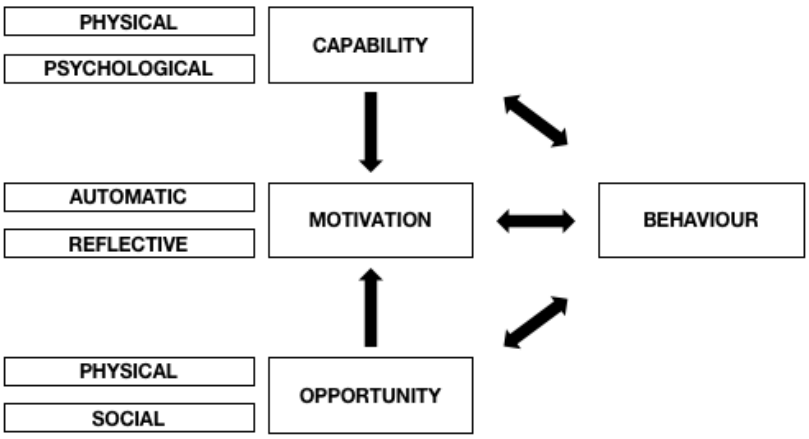

Figure 3. The COM-B Model of Behaviour *(adapted from Michie et al., 2011)*

Capability is being both physically (i.e. having the technical skills such as cooking) and psychologically (i.e. having fundamental knowledge of what to do) able to perform the behaviour. Opportunity relates to the physical (i.e. having the necessary access to required equipment) and social opportunities (i.e. the culture and/or environment around you facilitates and promotes) to perform the behaviour. Finally, motivation is delineated by automatic (i.e. controlling impulses to relapse) and reflective (i.e. goals and intentional thought out decision making) processes (Michie *et al.,* 2011; 2014). Building on the COM-B model, the researchers placed it at the hub of a larger theoretical behaviour system termed the Behaviour Change Wheel (BCW), a tool designed to help develop effective behaviour

change interventions (Michie *et al.,* 2011; 2014) illustrated in Figure 4. The BCW allows researchers and developers to logically identify one or more of nine 'intervention functions' and seven 'policies' that could elicit behavioural changes if implemented. Intervention functions include; Education, Persuasion, Incentivisation, Coercion, Training, Enablement, Modelling, Environmental Restructuring, and Restrictions.

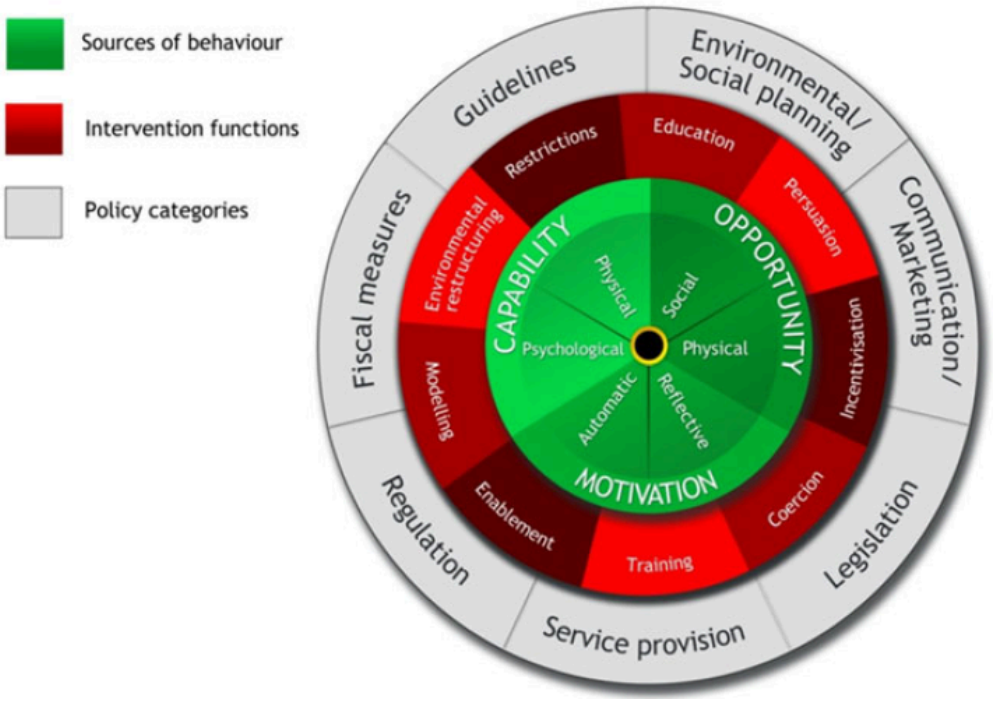

Figure 4. The Behaviour Change Wheel (BCW)

The seven policies include; Legislation, Service Provision, Regulation, Fiscal Measures, Restrictions, Environmental / Social Planning, and Communication / Marketing. Definitions and examples of the interventions and policies are provided in Table 3. Once developers have identified which of the interventions and policies best suit their context and can be feasibly applied, the concluding stage is to step outside of the BCW and consider industry-specific factors such as preferred modes of delivery based on the population (Barker *et al.,* 2015).

This systematic process of combining theory and design aligns with the aforementioned advice of the MRC (Campbell *et al.,* 2000).

The development of a theory-informed intervention using the COM-B and BCW is typically applied in a three-stage format as per guidance from the authors who pioneered the model (Michie *et al.,* 2011). Phase one typically requires the intervention designer to 'understand the behaviour' in terms of what the behaviour is, who is causing the problem behaviour, and identify what needs to change. In the context of racing and the problems associated with weight management this refers to the behaviours surrounding abstaining from food and fluid and engaging in rapid weight loss practices. Phase two after understanding the problem begins to 'build the intervention' (Atkins and Michie, 2015). Here, the intervention designer will start to identify functions (i.e. one or more of the nine described in Table 3) that may work in the context of the behaviour and the individuals (i.e. jockeys and stakeholders and as well as starting to identify potential policy categories relevant for the industry (i.e. racing). Phase three involves the intervention designer to start identifying specific content to populate the functions with (e.g. if a media campaign has been decided, what content specifically will appear on the posters, adverts etc.) and the mode of delivery and implementation. Application of the COM-B model and the BCW in its entirety has been done successfully in a number of healthcare contexts including healthy eating for children (Alexander *et al.,* 2014), adherence to medication (Jackson *et al.,* 2014), compliance amongst new hearing-aid users (Barker *et al.,* 2015), and attendance at NHS stop-smoking services (Fulton *et al.,* 2016). Despite its success in general public health interventions, use of the model in in professional sport is limited. A recent case-study on a professional rugby academy athlete documenting how the BCW was used to create a nutrition intervention (Costello *et al.,* 2018) appears to be the only documented application. Use of the BCW is yet to be used

in a wider context within professional sport however given its success in public health scenarios and application in an athlete case-study, the BCW could be used to frame an intervention to address the challenges faced by professional jockeys. In the context and structure of the present thesis which will be explained further within this opening chapter, phase one of an intervention design (understanding the behaviour) will be addressed through Study 1 which seeks to address the necessary questions of *why* the current behaviours are maintained and *who* facilitates them. Phases two and three are addressed during Study 2 which seeks to systematically design and develop an intervention ready for implementation through identifying and deciding on intervention functions, policy categories and content to include. This could be achieved through the development of a series of new functions (such as new methods of education, training, and enablement), and see these embodied within new industry policies or by making amendments to existing regulations and guidelines.

Nutrition-Education Interventions in Sport

Educating athletes is a fundamental part of sports nutrition (Birkenhead and Slater, 2015). This may provide them with the 'capability' to see both the detrimental effects to health and performance of sub-optimal practices, and the benefits of consistent preferred habits. Similarly, education could help athletes have a greater awareness of the factors that influence and contribute to their food choices and develop strategies to avoid them.

Previous nutritional education interventions in other sports have indicated positive results in terms of improved knowledge and performance outcomes. Over twelve, ninety-minute education sessions, collegiate baseball athletes increased nutrition knowledge whilst also exhibiting improved body composition (Cholewa et al., 2015), whilst an eight-week education

intervention significantly improved knowledge and energy intake to meet energy demands in a professional rugby academy (Tester et al., 2012).

Table 3 – Definitions of BCW Interventions and Policies (*adopted from Michie et al., 2011)*

Intervention	Definition	Example
Education	Increasing knowledge or understanding	Providing information to promote diet versus dehydration and starvation to make weight
Persuasion	Using communication to induce positive or negative feelings to stimulate action	Using images and/or success stories of how diet is better than rapid weight loss, or negative images/consequences of rapid weight loss.
Incentivisation	Create expectation of reward	Recognition / reward for practicing desired behaviours
Coercion	Creating expectation of punishment or cost	Employ a levy on the use of saunas at racetracks
Training	Imparting skills	Food / meal preparation skills to lose weight via low-carbohydrate diet
Restriction	Using rules to reduce the opportunity to engage in target behaviour to be changed (or vice-versa)	Removing saunas from the weighing room at racecourses
Environmental Restructuring	Change the physical or social context	Provide performance chefs that provide foods conducive to weight management at racecourses
Modelling	Providing an example for people to aspire to or imitate	Employing jockey-role models to imitate
Enablement	Increasing means / reducing barriers to increase capability or opportunity	A nutrition 'roadshow' that visits the training yards up and down the UK
Policies		
Communication/ Marketing	Using print, electronic, or broadcast media	Conducting mass media campaigns
Guidelines	Creating documents that recommend or mandate practice	Producing and disseminating protocols to stakeholders
Fiscal	Increasing or reducing the financial cost	Increasing duty / deductions from earnings
Regulation	Establishing rules or principles of behaviour or practice	Establishing agreements with stakeholders on minimum standards of provision to facilitate health and weight management
Legislation	Making or changing laws	Prohibiting certain practices (by jockey or stakeholder)
Service Provision	Delivering a service	Establishing support services in the workplace / industry
Environmental / Social Planning	Controlling the physical or social environment	Better-informed planning of new industry buildings etc. from key decision makers

An alternative model utilising a series of one-to-one sessions to educate female volleyball athletes over sixteen weeks similarly improved nutritional knowledge and practice (Valliant et al., 2012), and the use of media via three thirty-minute DVD education sessions was reported to improve knowledge and self-efficacy amongst ballet dancers (Doyle-Lucas and Davy, 2011). Insight into the content of these mini-curricula within the respective manuscripts was withheld, as was their delivery style other than generic statements such as 'one to one' or 'group sessions'. Despite evidence of success in these aforementioned education platforms , a consistent model or framework could not be identified. In this sense educational platforms appeared to be developed in an ad-hoc manner.

Time devoted to nutrition education platforms is to ultimately try and improve the behaviours of a person, with the assumption that greater knowledge will lead to improved nutritional behaviours (Parmenter and Wardle, 1999). Despite the reported adherence to more optimal diets post-education, two large-scale systematic reviews assessing the effectiveness of nutrition education strategies including athletic populations on dietary behaviours concluded only a weak link exists between the two (Heaney *et al.,* 2011; Spronk *et al.,* 2014). It has been previously reported that despite knowledge of nutrition, athletes don't always apply this (Walsh *et al.,* 2011) and will put their own beliefs surrounding what effects optimal performance ahead of scripted best nutrition practices (Harrison *et al.,* 1991). Considering the many traditional and cultural beliefs surrounding the effect of food on weight, and the implications of acute weight loss on health and performance, this notion rings true in horseracing. Both systematic review articles in addition to a review paper on factors influencing food choices of athletes (Birkenhead and Slater, 2015) conclude that based on loose methodologies of previous work that the impact of knowledge alone on eating behaviours remains equivocal, and future work should seek to create a more robust approach

to investigating the efficacy of any platform. The education interventions described within these review articles are all conducted in isolation, without the coordinated approach of multiple 'intervention functions', void of behavioural theory underpinning, and lacked recognition of the needed 'opportunity' to perform better dietary behaviours as advised by Michie *et al.,* (2011). These are likely contributors to their collective lack of impact and limited the development of the research field. The trialled education models also lacked input from the athletic population in intervention design, and were instead designed by researchers despite interventions with collaborative input being more likely to have better rates of adherence (Barker *et al.,* 2015).

Nutrition education within horseracing specifically is considered to be lacking (Caulfield and Karageorghis, 2008; Wilson *et al.,* 2014). At present jockeys receive one afternoon of nutrition education during their two-week licensing course in a seminar format. For the purpose of context, in order to ride professionally, jockeys are required to obtain a riding license. Aspiring flat jockeys will pursue an apprentice license whilst a young jump jockey will work towards a conditional license. The licensing process requires young riders to attend a two-week licensing course at one of only two racing schools in the U.K. During the two weeks, licensees will complete a series of modules to educate them on the varying responsibilities of being a professional jockey, including but not limited to; official BHA rules of riding, media training, financial advice, and veterinary education. One other module is nutrition and usually takes place on one of the afternoons. Beyond that, whilst still considered either and apprentice or conditional jockey, they will receive a single 45-minute seminar per year on nutrition. Upon successfully 'riding out' their claim (95 wins for a flat/apprentice jockey or 75 wins for a jump/conditional) and being considered experienced and full professional jockeys, mandatory education seizes. Voluntary access to education

material is available online via the PJA website, and industry-funded sports science support from Liverpool John Moores university.

Co-creation of Education and Curricula

With previous education interventions appearing to be designed in arbitrary manners and yielding arbitrary results, maintaining this approach in future projects may be short-sighted. This may be especially so in horseracing given the irregular structure of the sport in comparison to other sports, and where competition takes place 362 days of the year and the variability in the daily routines of professional jockeys (Wilson *et al.,*2012). With this in mind, a process to create an education platform conducive to the needs and requirements of the athletes and the sport (or club) needs to be considered – in this case, jockeys and the wider horseracing industry.

Co-creation of curricula is a novel concept used within schools and Higher Education institutes to help inform the development of curriculum (Bovill, 2014). This approach advocates the use of ideas and knowledge from learners to provide information and diverse perspectives to subsequently produce a curriculum that better fulfils their needs (McCulloch, 2009). Previous successful co-creation projects have involved focus-groups and workshops where students and teaching staff have helped to develop a syllabus through idea generation and concept development (Bovill *et al*., 2009; Jensen & Bennett, 2016; Murphy *et al*., 2017). One study reports a three case-study anthology where co-creation was used in the development of curriculum across three contrasting subject areas, in three different countries and educational institutes; one in the UK, one in Ireland, and one in the USA (Bovill, 2014). Each case-study describes the input from the student through either focus groups or allowing them to decide the content and delivery style through being present at planning meetings. In

the UK case-study, four second-year geography students were employed to co-design along with two academic staff, the first-year of the programme for the new cohort based on their own experiences that year. In the USA case-study they employed eight learners, four current, and four graduated to help co-develop the content, delivery style, and assessment modes. Cross-case themes described initial hesitations from curriculum leaders in putting a significant amount of trust in the student and as a result lived with uncomfortable levels of perceived risk as the education and grades of the cohorts receiving the newly co-developed curriculum were at stake. Upon conclusion however, the concept of co-creation was described by some as transformatory and upon reflection felt students brought concepts to the table that were novel and realistic in delivery, and given it was pitched as a genuine opportunity to influence the curriculum, and not simply an exercise, students took the responsibility seriously.

In the context of product (not curriculum) design, companies such as IKEA utilise co-creation in ways such as inviting customers to contribute to the design, development, and functionality of a potential new product or piece of furniture that the company are considering bringing to market. Rather than one design person predicting the needs of the masses and requiring to amend it later, they involve the end user at the concept development phase so the product is better informed from the start (Koniorczyk, 2015). Whether co-developing a product or a curriculum, input via these forums helps project leaders or researchers to develop an understanding of the world through the eyes of the end user, developing an 'empathetic understanding' of what is important to them (Dougherty, 1992) and helps build a greater awareness of the social and cultural contexts that define their experiences. Based on the social and cultural challenges associated with weight-making amongst professional jockeys, the development of any nutrition education intervention (stand-alone or as part of a multi-faceted behaviour change intervention) may best be served

if designed in collaboration with the industry members. The concept of co-creation has rarely been used in professional sport to develop an education platform for its athletes, making it a highly novel concept. This approach also satisfies the notion that blindly developing new intervention functions without fully exploring the problems or barriers as to why previous interventions have failed, will likely result in another project with limited success (Atkins and Michie, 2015).

Assessing Impact of Education Interventions –Nutrition Knowledge Questionnaires (NKQs)

Judging the effectiveness of an education intervention requires a reliable (internal and external) and valid (construct and convergent) assessment tool (Kliemann *et al.,* 2016), that can determine if knowledge has increased as the result of an intervention. Despite acknowledging earlier in this chapter that education alone may not effect behaviour, it is currently the predominant method used to measure success and behaviour. Two systematic reviews that investigate the relationship between nutrition knowledge and dietary behaviour conform to the view that greater knowledge doesn't correlate to improved behaviour (Heaney *et al.,* 2011; Spronk *et al.,* 2014). Both studies however conclude that a key factor in this trend emerging is down to weak methodologies within individual studies, and a lack of consistency across the area when it comes to determining and assessing nutrition knowledge. Both research groups conclude that validated tools to assess knowledge need to be used throughout such research, and not intermittently as was reported to be the case. Several validated assessment tools have been developed and collectively these tools are referred to as nutrition knowledge questionnaires (NKQs). The most widely used NKQ in research and practice is the General Nutrition Knowledge Questionnaire (GNKQ) (Parmenter and Wardle, 1999), a tool originally developed and validated for the UK adult population. Given its

effectiveness, it has been modified to accommodate cultural differences in foods and validated for use in other countries including Turkey (Alsaffar, 2012), Australia (Hendrie *et al.,* 2008), and Portugal (Ferro-Lebres *et al.,* 2014). Given the necessity to assess nutrition knowledge in professional sport, it has also been modified to reliably assess the general nutrition knowledge of elite athletes (Spendlove *et al.,* 2012). Since the original GNKQ was devised, advances in nutrition and dietetic knowledge have created a greater understanding of the link between diet and health, and as such general nutrition guidelines have changed since the original's inception (Willett and Stampfer, 2013). As a result, the GNKQ has recently undergone a revision taking contemporary nutrition knowledge into account (Kliemann *et al.,* 2016) and is now termed the Revised General Nutrition Knowledge Questionnaire (GNKQ-R). Where the GNKQ-R aims to assess a rounded knowledge of nutrition over 88 questions, other created NQK's have been developed with the focus of understanding energy content, rather than nutrient function (Motelli *et al.,* 2016) in an attempt to understand the incidence of weight gain. The 'Practical Knowledge About Meal Calories' (PKM-11) scale is a valid and reliable Rasch-based instrument that involves an eleven question inventory asking the user to choose from multiple choices what they believe to contain either the most or least calorific content. Although initially removed from an athletic population when designed, given the struggles professional jockeys (and other weight-making athletes) face, questions relating to knowledge surrounding the calorie content of food in an applied sense seems a logical inclusion when assessing understanding, an area the GNKQ-R arguably lacks in comparison (Spronk *et al.,* 2014). In an effort to make NKQ's directly applicable to professional sportspeople and not use modified versions of existing ones, there have been recent attempts to develop NKQ's specifically for athletes (Furber *et al.,* 2017; Trakman *et al.,* 2017). Furber *et al.,* (2017) devised the Nutrition Knowledge Questionnaire for Athletes (NKQA), providing

a psychometrically validated and reliable assessment tool of general and sports nutrition knowledge. Containing 145 parts over 85 questions (some questions contain multiple questions within them), it is longer than previous NQK's however addresses concerns over superficial coverage of either general or sports nutrition in previous studies (Zinn *et al.,* 2005). Questionnaire length can impact the compliance of participants (Galesic and Bosnjak, 2009) however meta-analyses of 25 studies demonstrates a weak correlation between questionnaire length and poor compliance (Rolstad *et al.,* 2011). Perhaps its biggest limitation in its use for the jockey population is that it was specifically designed for track and field athletes and as such many questions are sport-specific. The authors do however advise the tool lends itself to subtle modifications to make questions relevant to other sports through relevant word changes. The second recently devised NKQ for athletes is termed the Nutrition for Sport Knowledge Questionnaire (NKSQ) (Trakman *et al.,* 2017). Shorter in length to the NQKA, the NKSQ is an 89-point tool (44 questions) however is at present the only sport NSQ to be validated using the more robust Rasch analysis protocol.

Each independently devised NQK bears its own clear strengths and limitation. Where some lack depth in sports nutrition they offer a comprehensive insight to the understanding of general nutrition for health, and where some are applied in nature they are simply too superficial to ascertain a rounded knowledge assessment. A technique used in some research has taken the 'best bits' to develop an assessment tool made up of two or more previously validated NKQ's. Researching the food knowledge of elite Australian athletes, Devlin and Belski (2015) measured knowledge using a combination of two NKQ's, the GNKQ to assess general health nutrition knowledge, and the modified version for elite athletes (Spendlove *et al.,* 2012). In addition, the researchers added 12 of their own unique questions and made subtle amendments to accommodate Australian language and food culture to increase its

usability for participants. In a study attempting to evaluate the efficacy of an intervention in female collegiate athletes, a bespoke NKQ was devised using the GNKQ as a basis and taking specific questions from other unspecified NKQs to suit the research question (Abood *et al.,* 2004). Any future assessment tool in the unique sport of racing may lend itself to an amalgamation of two or more NQK's given both the health and sport-specific challenges faced.

Assessing Impact of Education Interventions – EAT-26

Researchers are aware of the notion that eating behaviour is more complex than nutrition knowledge alone (Heaney *et al.,* 2011; Spronk *et al.,* 2014). In addition to knowledge, individuals need to have a positive attitude towards food, and be motivated to carry out optimal dietary behaviour (Atkins and Michie, 2015). Measurement of attitude towards foods involves completing an Eating Attitudes Test (EAT). The original test (EAT-40) was a forty point inventory (Garner and Garfinkel, 1979) and later created a shorter 26-point version (EAT-26) (Garner *et al.,* 1982), created to measure behaviour and attitudes towards foods in both clinical and non-clinical populations. Both versions are widely used in research providing a valid and reliable standardised measure of symptoms and concerns characteristic of eating disorders. The EAT-26 has been used in previous studies with jockeys (Caulfield and Karageorhis, 2008; Leydon and Wall, 2002; Wilson *et al.,* 2015) to screen for the presence of potential eating disorders. These inventories alone do not provide a diagnosis of eating disorders however scores of equal or greater than twenty are advised to be referred for clinical assessment by a qualified and registered mental health professional. In the case of assessing the impact of education or behavior change interventions, the EAT-26 scale could provide a useful insight to the change in behaviours or attitudes towards foods post-

intervention. Given its previous uses in jockey research, it allows comparisons to be drawn in data.

Current Nutrition Education and Support in Horseracing

To date, there is a paucity of research addressing the education and nutrition support needs, and potential interventions of professional jockeys. Previous work has discussed and established their nutritional needs for health and performance (Wilson *et al.,* 2015), however despite the success of dietary prescription interventions, attitudes and behaviours towards food measured via EAT-26 remained unchanged (14.8 ± 9.6 vs. 11.0 ± 5.6). This may be due to a lack of autonomy development during the intervention. Instead, participants were supplied with their food from a meal preparation company every day for six weeks. Whilst this method upheld the internal validity of the research, it failed to develop the participants physical (cooking skills) and psychological (knowledge) capabilities, as referred to by Michie *et al.* (2011) as necessary to effect behaviour change. As previously discussed, current industry nutrition education is limited to one afternoon during a jockeys licensing course, then one 45-minute seminar per year up until 95 or 75 race wins are achieved for flat and jump jockeys respectively. Although the aim here is to develop capability, perhaps the quantity and delivery methods of current education is lacking.

Similarly, despite their being access to support via the Professional Jockeys Association dedicated nutrition team, and industry-funded nutrition support at Liverpool John Moores University, the research investigating methods employed to manage weight indicates that archaic practices, particularly voluntary dehydration, are still the most common. It could be seen that this is the industry's attempt at creating 'opportunity', however in consideration of

the congested racing fixtures calendar and the hectic hours described (Lindolt *et al.,* 2017), this support may be difficult to reach by many. More research in this area is crucial if we are to develop an understanding of how jockeys are to be best educated, and develop realistic and sustainable opportunities to access support and embed best practices into their daily lives as professional athletes.

Framing the Research: Research Paradigms and Methodologies

Having outlined the theoretical and conceptual issues that run through the thesis, it is now relevant to discuss the paradigmatic underpinning of the research. In this sense, the following section is delivered in two sections; the first introduces top level paradigms of qualitative and quantitative research and the notion of mixed-methods enquiry and pragmatism. The second explains the methodological approaches of Action Research and how the present body of research is embodied by its principles.

Qualitative, Quantitative and Mixed-Methods Research

Both qualitative and quantitative researchers believe they know something that is worth sharing with the research community (Becker, 1986), however there is no unanimously agreed definition of either approach (Sparkes and Smith, 2014). A fundamental difference between the two is how the researcher philosophically approaches research. Qualitative research stresses the 'intimate relationship between researcher and topic, and the situational constraints that shape enquiry', versus the 'emphasis of measurement and analysis of causal relationships between variables, not processes' (Denzin and Lincoln, 1994). Both qualitative and quantitative research are often defined by what they aren't (rather than what they are), and as such are placed in opposition to each other in discussion, creating a dichotomy similar

to art vs science, hard vs soft, numbers vs words; qualitative vs quantitative (Sparkes and Smith 2014). Despite this, Martin (2011) recognises areas of legitimate difference between the two that need to be considered and understood. Doing this provides a platform for discussion for what each approach has to offer to the other when considering research in the field of Sport and Exercise Science.

Traditional approaches to research in Sport and Exercise Sciences and Sports Nutrition have operated within positivist doctrines (Sparkes, 1998) and relied upon experimental methodology to document causal relationships and its associated levels of reliability and validity (Hardy *et al.,* 1996), namely quantitative research. Positivists assume behaviours can be objectively measured and analysed in a way displayed in previously discussed research (Dolan *et al.,* 2011; Wilson *et al.,* 2015) where behaviours relating to weight-management and eating were quantified. Qualitative research however aims to capture content that is not quantifiable and reducible to numbers, but more so the opinions and experiences of the investigated group (e.g. Lindolt *et al.,* 2017). The need to understand underlying experiences, feelings and opinions to answer the 'why's' related to phenomena is now greatly acknowledged and consequently qualitative research is taking on an increased significance within sport and exercise science research (Gratton and Jones, 2004). Like quantitative research, Denzin and Lincoln (2005) emphasis there is no 'one way' to conduct qualitative enquiry, and is referred to as an 'umbrella term' (Walsh and Koelsch, 2012) to describe a field that "consists of clusters of methods with features in common that overlap in some respect with other clusters, while at the same time, some methods have no obvious features in common with other methods" (Madgill and Gough, 2009). Establishing a preferred qualitative approach can be led by the nature of the research and the means of what data needs to be collected, or instead by the preference of the researcher. Either way, Sparkes and Smith

(2015) assert that one is not necessarily any better than the others and each has its own values. The present thesis, particularly within Study One of Chapter Two will involve studying to a greater degree the 'jockey athletes', who they are and what motivates them to make weight in often dangerous circumstances. The study of people or a subpopulation may lend itself to traditions such as ethnography, described as the art and science of describing a human group, its behaviours, material productions, and beliefs (Angrosino, 2007). Whilst this approach typically lends itself to prolonged and sustained engagement with the participants and often needing to be embedded within the subculture to gain a true depth of understanding (O'Reilly, 2012), it is potentially one-dimensional in the sense that all data, as rich as it may be, is from one source. Similarly, life-history or bibliographical approaches may unearth data over a shorter period of time that explain actions and contribute to building a narrative (Atkinson, 1998) but relies on the participants memory and willingness to share. To try and build a picture around a group of people (for example, jockeys) that involves the opinions and perceptions of others also, approaches such as grounded theory may be more applicable in its systematic yet flexible approach to data collection and analysis where theories are grounded in the data (such as interviews) themselves (Charmaz, 2006).

Mixed-methods research, referred to also as the 'third methodological movement' (Teddlie and Tashakkori, 2011), offers a third approach spawned through *pragmatic* justification that argues that the two main approaches are compatible and can be productively used in conjunction with one another (Howe, 1988; Tashakkori and Teddlie, 1998). A 'composition-definition', based on nineteen other definitions from field experts characterises mixed-methods research as a type of research where a researcher can combine elements of qualitative and quantitative approaches (data collection, analysis and inference

techniques) for the broad purposes of breadth and depth of understanding (Johnson *et al.,* 2007). The notion of 'methodological eclecticism' has been used in previous work (Hammersley, 1996; Yanchar and Williams, 2006) that describes the combination of quantitative and qualitative methods is beneficial on the grounds that each method can cancel out the respective weakness of the other. The concept not only means researchers are able to combine methods, but in a manner that best serves the notion of answering the research question. Tashakkori and Teddlie (2008) refer to this as 'design quality' and is included in their criteria framework for assessing mixed-methods research quality. 'Paradigm pluralism' is a similar concept characteristic of mixed-methods research, allowing researchers to use multiple paradigms to serve as the underlying philosophy (Tashakkori and Teddlie, 2008). This approach of combining methods does not however mean 'anything goes' (Denscombe, 2008, p.274), but rather adopting a *pragmatic* approach to the research. Pragmatism or researching through a pragmatic paradigm has been identified within the mixed-methods research literature as the most appropriate paradigm for conducting mixed methods research (Howe, 1988; Tashakkori and Teddlie, 1998; Teddlie and Tashakkori, 2009), described as the mechanism for balancing both positivist and constructivist research. Pragmatists believe that from an epistemological perspective at some stage during the research it will take an objective approach (for example by not interacting with subjects), while at other stages it will be necessary to take a more subjective approach by interacting with research subjects to construct realities (Teddlie and Tashakkori, 2009). Conducting research through a pragmatic paradigm allows the researcher to be flexible and opt to choose the best approaches to answer the research question. Naturally with this approach multiple realities will be derived through the use of both qualitative and quantitative research methods (Rorty, 1999). Given the nature of the present thesis' enquiry, pragmatism appears

the obvious paradigm through which to conduct the research. As the closing sections to this opening chapter will go on to tell, the necessity to adopt both positivist and constructivist approaches is clear. Taking a pragmatic approach, the most suitable methods will be used at different periods through the body of work to elicit the best possible results to address the research questions and fulfil the research objectives, and be bound by the constraints of one traditional paradigm alone. Studies one and two will draw on qualitative methods to directly engage with research participants to construct a landscape reality of the problems professional jockey currently face, and develop an intervention through collaborative engagement. Study three will seek to employ quantitative approaches to measure the effectiveness of an intervention. This is illustrated in Figure 5.

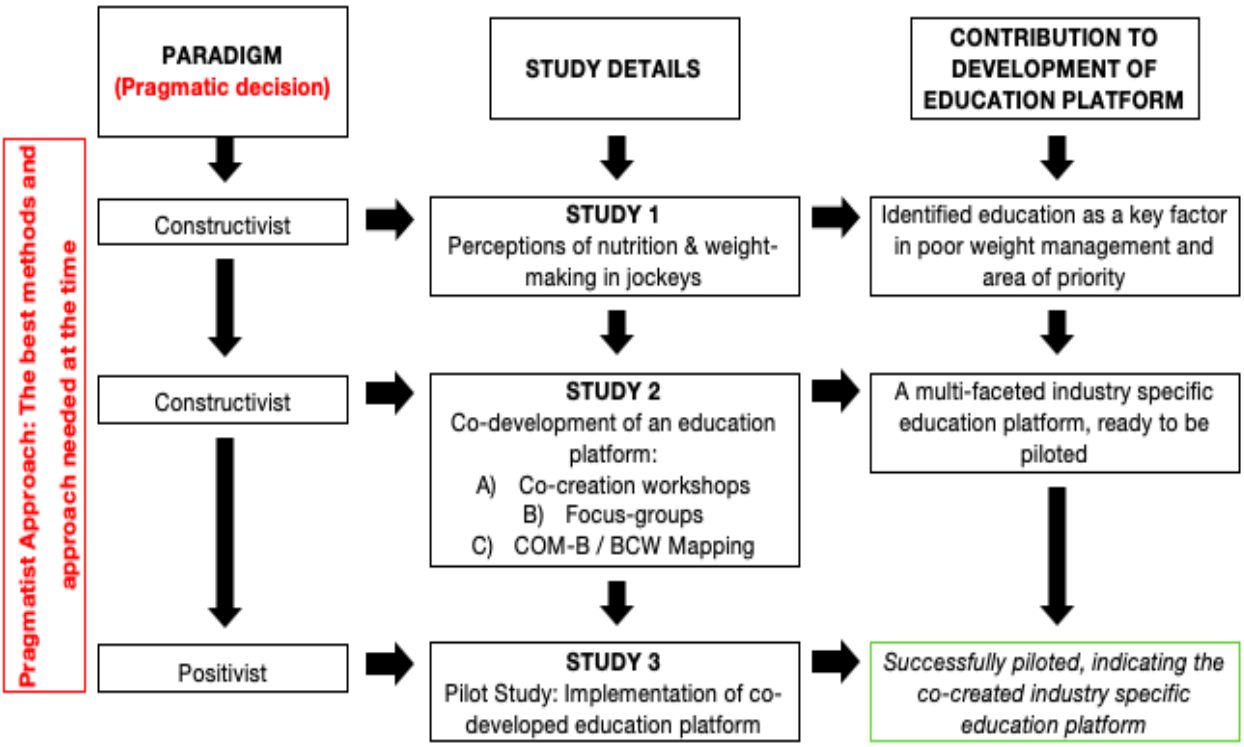

Figure 5 – The pragmatic development of the intervention throughout the progress of the thesis *(adapted from Littlewood, 2005).*

Action Research

Defining *what* Action Research is at a fundamental level is an incredibly challenging concept. Sparkes (1991) indicated there is little shared understanding of an operational description of action research and applied action research protocols are unlikely to be defined in a precise way. It has been defined as a research paradigm (Akdere, 2003; Longstreet, 1982), a research framework (Hopkins, 1993), a methodology (O'Brien, 2001), an inquiry process (Reason and Bradbury, 2001), and a systematic approach to investigation (Stringer, 2014). Tripp (2005) felt it impossible to be limited to a single defining term. For the purpose of this thesis, Action Research will be referred to as a Methodology; the vehicle for conducting the research under a mixed methods paradigm (see Figure 6). The extended definitions given by Reason and Bradbury (2001) and Stringer (2001) describe what would be considered 'methodologies' by Clough and Nutbrown (2012), adding to the conclusive view of O'Brien (2001). Action research is characteristically collaborative in design, providing a connected group of individuals to take systemic action to resolve a specific problem. In the case of the present thesis, the problem refers to the continued and widespread use of archaic weight-making practices amongst jockeys, impacting their physical and psychological wellbeing. Previous documented use of Action Research in the context of Sport and Exercise Science and developing and trialing complex interventions to applied problems exist and provide some rationale for its use here. Evans *et al.* (2000) shared the development of a multi-modal injury rehabilitation strategy with professional rugby players using a mixed-methods approach including goal setting and semi-structured interviewing concluding that adopting the approach of using a practitioner-researcher (i.e. the same person), or having a close relationship between practitioners and researchers per se to combine practice and research to develop applied solution may work better than to separate entities alone.

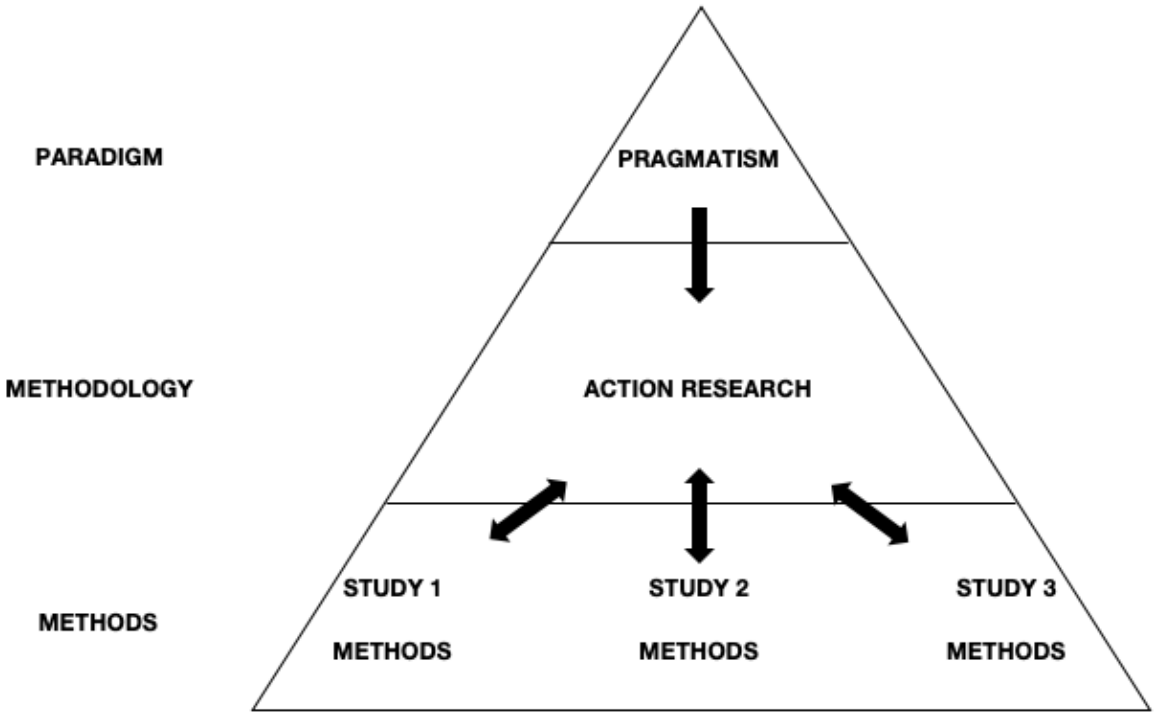

Figure 6. Research Framework of Thesis

Various models of action research exist on which to ground a project or body of research within. Despite each having their own unique aspects, all models fundamentally adhere to action research's traditional characteristics of being collaborative in nature, with a practical focus and dynamic process that produces a plan of action (Creswell, 2012). These ultimately serve the purpose of action research which is to improve practice and/or service provision and not necessarily generate knowledge acquisition as per conventional research (Elliot, 1991). What is generally considered the original model of action research follows a 'plan, act, observe, reflect' cycle (Lewin, 1946) which is self-explanatory in nature. This single cycle then evolves into continuous action-reflection cycles whereby once periods of observation, reflection and evaluation had taken place (in cycle one), an amended plan was developed and a more informed action was implemented to be observed. This model inspired the development of Kemmis and McTaggart (1988) model of action research which similarly use the four same steps of planning, acting, observing, and reflecting. This amended model

suggests that revised planning should not occur subsequent to the first cycle however should be an integrated part of action and reflection to ensure rigour. A more recent model Whitehead and McNiff (2006) suggested a five step approach of 'observe, reflect, act, evaluate, and modify' before then moving on in an 'improved direction'. What is clear to see is that although multiple models of action research exist on which to ground work in, or use as framework to guide research, they are similar and perhaps merely reflect the various ways in which the same set of activities are being described. A common feature they all apply is the cyclical approach of observing, reflecting and enacting a new plan in one order or another. Stringer (2014) offers the analogy of their being 'many ways to bake a cake' eluding to the fact that although the methods may be slightly different, the ingredients and process aren't radically dissimilar otherwise you wouldn't end up with a cake at the end. Similarly, if the actions or steps described in each of the models weren't present then you may not be producing trustworthy or valid action research.

For the purpose of this thesis, the action research approach will follow a 'Look, Think, Act' routine (Stringer, 2014) depicted in Figure 6. This three-stage approach is a simple yet powerful framework. It enables the traditions of action research whilst effectively capturing and enabling the processes of longer-winded models (e.g. Lewin, 1946; Whitehead and McNiff, 2006) in a more concise way. In relation to the research problem, the 'look' phase involves gathering initial relevant data to describe the situation, where the 'think' phase refers to the analysis and theorizing of the gathered information to make sense and determine the underpinning reasons for the problem. This process relates directly to Study 1 (Chapter 2) of this thesis. The 'act' phase concerns planning, implementing, and evaluating a defined course of action (or intervention). These make up the content of Study 2 (Chapter 3)

and three (Chapter 4). In addition to the collaborative nature of this mode of research, a second central premise is that it investigates the problem of a specific group or community versus whole-world enquiry (Denzin and Lincoln, 1994). Their assumption therefore is that all stakeholders who are affected by the problem under study should be engaged in the process of investigation. Through sharing diverse knowledge and experiences, stakeholders themselves can collaboratively develop solutions to the research problem, with the lead researcher the facilitator in research design and methods (Stringer, 2014). In the context for professional horseracing, stakeholders would include the jockey athletes, and the support network that sits around them and either directly or indirectly influence their daily lives and/or career. Engaging in this model of research allows groups that are potentially in conflict to discuss viable, sustainable and mutually agreeable solutions that may be of higher value due to evoking a sense of investment and ownership (Guba and Lincoln, 1989).

For the purpose of this thesis, the action research approach will follow a 'Look, Think, Act' routine (Stringer, 2014) depicted in Figure 7. This three-stage approach is a simple yet powerful framework. It enables the traditions of action research whilst effectively capturing and enabling the processes of longer-winded models (e.g. Lewin, 1946; Whitehead and McNiff, 2006) in a more concise way. In relation to the research problem, the 'look' phase involves gathering initial relevant data to describe the situation, where the 'think' phase refers to the analysis and theorizing of the gathered information to make sense and determine the underpinning reasons for the problem. This process relates directly to Study 1 (Chapter 2) of this thesis. The 'act' phase concerns planning, implementing, and evaluating a defined course of action (or intervention). These make up the content of Study 2 (Chapter 3) and three (Chapter 4). In addition to the collaborative nature of this mode of research, a second central premise is that it investigates the problem of a specific group or community

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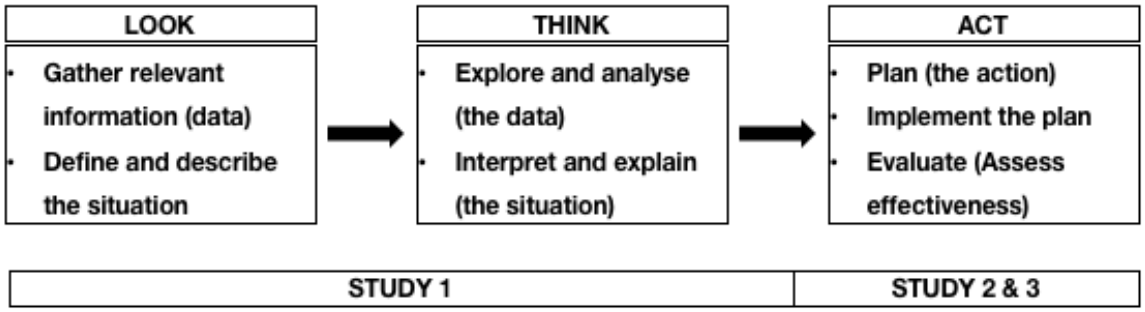


Figure 67. The 'Look, Act, Think' Model of Action Research *(adapted from Stringer, 2014)*

Unlike some positivist research where the aim is to simply provide an answer to a question, or act as a preliminary study to open up new avenues of research, the intended outcome of action research is change (Reason and Bradbury, 2006; Stringer, 2014). These changes may be to practices, policies or regulation within the applied setting, devised and derived from the outcomes of the research process. This concurs with the view of Greenwood and Levin (2006) of generating knowledge to design action with the stakeholders. The 'action outcomes' from the current research (presented within the appendices) hopefully demonstrate to the reader a first-hand example of the impact of action research.

Reflections on the Research Journey: Biographical Position

Reflective accounts of practitioners' personal growth and/or autobiographical accounts of their roles as practitioners, researchers, or both, has gained credibility in recent times. (Collins *et al.,* 2013; Lindsay *et al.,* 2007; Morton *et al.,* 2014; Littlewood *et al.* 2014). Throughout the thesis at the end of each chapter the narrative will switch briefly from a third-person narrative, to allow the reader (you) to visit the philosophical and biographical location of the researcher (me). This initial first-person account introduces my position at the start of the research process.

Coming into this role as a PhD researcher carrying experiences from education as a lecturer of five years within Further Education and Higher Education within Further Education settings (i.e. Foundation Degrees and 'Top-Up' degrees), and as a performance nutritionist specifically within horseracing, although happy and eager to commence, I also felt conflicted. On one hand given the brief of potentially developing an education platform for jockeys I had the fortune of experience in both overlapping sectors, yet on the other hand I worried if I was too close and if my own bias as a practitioner (or now researcher) would compromise my approach, and wondered if I needed to somehow take a step back. One part of this process involved my writing a reflective piece of work (like this one) that I later decided to share with the practitioner-researcher community and published in Reflective Practice (Martin, 2017). This piece took stock and reflected on my journey through being an educator in Further Education whilst being a performance nutritionist in professional horseracing, and how I felt the skill set from each role could complement each other both in practice and in my embarkment on a three-year PhD journey. Writing this article in addition to candid conversations with critical friends who have held similar positions I concluded the my position

as a researcher-practitioner as a strength that would benefit the body of work rather than hinder it. My understanding of the industry, the ability to communicate in 'their' language, and my understanding of nutrition and education/pedagogy was overall a good thing and I am most likely better placed with them than if I had none, or only one of these insights. Since these musings in early 2016 the notion of 'Practitioner-Researcher' has been much talked about within performance sport and discussed as potentially the best way to produce the highest quality research that answers the real research questions in performance sport (Jones, 2018; Close, 2019). It was during these early moments of initial doubt and subsequent reflections that I realised being a Practitioner-Researcher was an actual "thing", and I wasn't breaking any rules or compromising any research traditions in maintaining both roles and using the respective advantages of each position. I grasped that if done correctly, my roles as both practitioner and researcher could ultimately produce a more ecologically valid body of work.

Aims and Objectives of this Thesis

The review above has identified a need to develop the nutrition knowledge and capabilities of jockey athletes given the risk to health of pursuing outdated practices, and the multitude of challenges and influences that they face in the real world of professional horseracing. Furthermore, it highlighted that the development of any future education platform should be done so with consideration and in an informed manner.

The aim of the present thesis therefore is to systematically develop an industry-specific nutrition-education platform, and subsequently implement and evaluate its efficacy in

preparation for use in industry. In order to achieve this aim, the following objectives will be addressed:

1. Investigate current industry perceptions on jockeys as professional athletes and their current weight-making methods
2. Establish the key factors that influence current weight-management approaches and if improved nutrition education is required or would be impactful
3. Use multiple industry stakeholders to spawn new concepts and co-develop a nutrition-education platform for the industry, determining key content and delivery
4. Utilise a recongised behaviour change model to map co-developed ideas onto, to create specific and applied intervention functions
5. Pilot the co-developed nutrition-education platform and evaluate its efficacy in terms of improving nutrition knowledge and dietary behaviour relative to being a professional jockey athlete.

Chapter 2

Study 1: The horseracing industry's perception of nutritional and weight-making practices of professional jockeys

STUDY MAP

STUDY AND AIMS	OBJECTIVES
STUDY 1 Explore the perspectives of key stakeholders within the horseracing industry on their perception of nutritional and weight making practices of professional jockeys	1. Determine dietary practices of jockeys and their perceptions of the factors that influence nutritional decisions and behaviour 2. Establish perceptions regarding the identity of jockeys as professional athletes 3. Identify the perception of jockeys and current weight-making strategies by other industry professionals (agents, trainers, coaches, racecourse clerks) 4. Determine the perceptions of existing food provision at race-courses
STUDY 2 Develop an industry-specific nutrition-education platform for professional jockeys	1. Use co-creation methods to obtain the conceptual thoughts and ideas from a range of stakeholders within the racing industry on the content and design of a nutrition education platform for professional jockeys 2. Identify potential barriers to the successful development and implementation of a nutrition education platform 3. Map concepts to a behaviour change theory model to ground in behaviour change science and construct interventions. 4. Design an industry and context specific nutrition education platform for jockeys
STUDY 3 Implement and pilot the developed education platform direct into the horseracing industry	1. Pilot the developed education platform for one licensing cohort allowing new feature to be piloted and experienced 2. Preliminarily evaluate the effect of the new platform on nutrition knowledge via a NKQ 3. Preliminarily evaluate the effect of the new platform on dietary behaviour via EAT-26 and 24-hour recall analysis

Introduction

This initial study aimed to produce a detailed landscape of the horseracing industry, specifying its current position with regards to the archaic weight-making practices of its professional jockey athletes. As previously discussed during Chapter 1 a myriad of archaic weight-making modalities are practiced, usually centred around acute bouts of dehydration, prolonged periods of starvation, or fluid purging through the use of diuretics, laxatives and self-induced vomiting (Dolan *et al.,* 2011; Cotugna *et al.,* 2012). Although effective in achieving competitive riding weights, a body of work highlights the dangers to physical, physiological, and psychological health of severe and prolonged energy deficiency (Mountjoy *et al.* 2018) as well as athletic and riding performance (Wilson *et al.,* 2013a).

At present, no previous attempts have been made to investigate the cultural assumptions of the horseracing industry and why, despite the growing base of empirical evidence showing safe and optimal practices (Wilson *et al.,* 2012, 2015), the outdated and compromising methods are still widely maintained. To address this paucity in the literature, research is required that explores on an industry-wide basis, the ideologies of its stakeholders. Given the scope of the proposal, qualitative approaches were adopted to gain a depth of understanding into the reasoning or philosophies behind nutritional malpractices. As such, the outcomes of this research should contribute to our understanding of the influences, barriers and processes that facilitate archaic weight-making and provide a platform on where to focus strategies for change.

The aim of the present study was to explore the perspectives of key stakeholders within the horseracing industry on their perception of nutritional and weight making practices of professional jockeys.

In order to achieve the aim, the following objectives were addressed:

1. Determine dietary practices of jockeys and their perceptions of the factors that influence nutritional decisions and behaviour
2. Establish perceptions regarding the identity of jockeys as professional athletes
3. Identify the perception of jockeys and current weight-making strategies by other industry professionals (agents, trainers, coaches, racecourse clerks)
4. Determine the perceptions of existing food provision at race-courses

To answer the research question, the present study is divided in to, and presented in two sections. The first section examines the perceptions of jockeys and other industry stakeholders on the factors that influence the dietary behaviours of jockeys, and the opinions surrounding the notion of jockeys being professional athletes. This satisfies objectives one to three. The second section builds upon the findings, and focuses more on the food provision at the 59 UK racecourses. It examines the industry's perception of the catering standards, a necessary avenue of additional exploration given the 363 day per year competitive calendar currently in operation. This addresses objective four. The discussion section concluding this chapter brings both parts back together and delivers an overall synthesis of the findings.

Study 1, Part I:

Methods

Participants

To gain depth and insight into the industry's perception, stakeholders from multiple facets of the sport were invited to contribute. This approach, comparable to previous qualitative exploration in professional sport (Cook *et al.,* 2014), was favoured in order to capture a

complete subcultural picture. Participants were familiar with jockeys and had regular direct interaction with them in a variety of capacities including Clerks of Courses (n=7 (5 male, 2 female)), Jockey Coaches (n=4 (3 male, 1 female)), Racehorse Trainers (n=3 (1 male, 2 female)), Jockey Agents (n=2 (1 male, 1 female)), and Jockeys themselves (n=10 (8 male, 2 female)). Ethical approval was granted by Liverpool John Moores University to invite licensed and registered industry professionals to contribute in line with inclusion criteria. Jockey participants were required to hold a minimum of an apprentice or conditional racing license meaning they were qualified to race in U.K. professional races. Jockeys were contacted via an open letter in their monthly industry publication followed by snowballing sampling from initial respondents. Maximum data sampling was employed to ensure complete representation of the jockey fraternity (Polkinghorne, 2005), including apprentice and conditionals through to experienced senior jockeys. Other industry professionals were contacted and invited through gatekeepers (general secretaries, chief executive officers) of their respective bodies via an email containing details of the study and participant information details. Racehorse Trainers were required to hold a U.K. trainer's license and be affiliated with the National Trainers Federation, Jockey Coaches were required to hold their L2 UKCC coaching award and be recognised as one if the BHA's listed coaches, similarly Jockey Agents were required to be listed as an approved agent. Racecourse Clerks were required to be a sitting Clerk for at least one U.K. professional racing venue. Respondents were vastly experienced with industry involvement ranging from three to in excess of thirty years.

Data Collection

Semi-structured interviews were undertaken with all participants. An 'open-ended' (Gall *et al.,* 2003) format was adopted presenting all questions in a conversational and informal

manner to develop rapport, and to allow maximal voluntary contribution and detail (Lincoln and Guba, 1985). Subsequent 'probing' occurred (Gratton and Jones, 2004) via naturally occurring follow-up questions which facilitated further depth in responses (Turner, 2010). This format of enquiry allowed participants the liberty to express their experiences and opinions with minimal constraints and to self-navigate towards areas they felt significant (Braun and Clarke, 2013). The interview was centred on seeking the perceptions and thoughts of current weight-making practices in jockeys, how they identify jockeys in relation to other elite weight-making sportspeople. Questions were devised with the outcomes of previous literature in mind (Dolan *et al.,* 2011; Greene *et al.,* 2013; Wilson *et al.,* 2012; Wilson *et al.,* 2013; Wilson *et al.,* 2015) as well as the research group's own ideas in capturing the necessary responses to achieve the study aims.

Interviews were conducted in a variety of locations. All participants were invited for interview to the university however in the interest of availability were also offered to be conducted at local racecourses, industry injury-rehab centres, and jockey schools. All interviews were conducted face-to-face, were recorded using a dictaphone and subsequently transcribed verbatim. Average interview length was 39 minutes. The interviewer was acquainted with the horseracing subculture being an industry performance nutritionist for the previous two years. This was deemed advantageous due to his fluency in their jargon and informal terminology (Abramson and Modzelewski, 2011; Cook *et al.,* 2014). Similarly, being recognised as an 'insider' would elicit more truthful answers and minimise the 'interaction' effects of a researcher perceived as outside the industry (Burawoy, 1998).

Data Analysis

All transcripts were uploaded to software package NVivo10 (QSR International Ltd., 2012) to facilitate the analysis process by managing and organising data. A six-stage process of

thematic analysis (Braun and Clarke, 2006) was adopted. *Immersion* of the data was achieved through multiple readings of the transcripts allowing the researcher to become engrossed in its content. A systematic line-by-line process of *initial coding* took place on each of the transcripts with the researcher identifying any relevant content. Once coding was complete, these were arranged in order to *identify themes* by where a 'common thread' (Sparkes and Smith, 2014) ran through the data. Themes were consequently *reviewed*, developing identifiable frameworks where some individual codes were transferred to other themes and other data was decided to be removed from analysis. Before *writing the report* on the outcomes of data analysis, each of the themes were *named* or *defined* to clearly give the reader a sense of each one. This process took place for each of the five participant groups' data.

Quality Standards

In order to maintain a quality investigative and analytical process the present study adhered to the guidelines constructed by Smith *et al.,* (2014) which draw on criteria of previous qualitative theorists (Lielich *et al.,* 1998; Richardson, 2000; Sparkes, 2002; Holman-Jones, 2005; Sparkes and Smith, 2009; Tracy, 2010; Barone and Eisner, 2012; Smith and Caddick, 2012).

Substantive Contribution and *Width* were achieved through the interviewing of elite standard jockeys and their associated support network in one of the leading professional sports industries. The multiple interpretation of their data as laid out in the results allow the reader to cast judgement as to its quality. The decision to use a range of participants similarly enabled a *dialogue of debate and negotiation* to occur through enticing meaningful opinions

from a range of people, albeit not directly with each other. *Coherence* and *Aesthetic Merit* are endeavoured via a transparent process of thematic analysis and subsequent development of themes. This process allowed the creation of a coherent story expressing the views of contrasting stakeholders within horseracing and how these blended together to create a single panoramic perspective. *Transparency* was maintained throughout by the experienced supervisory members of the research group who remained distanced from the 'hands on' element of the study. Acting as a 'critical friend' (Stenhouse, 1975) they consistently questioned the processes of data collection, handling, and interpretation as well as providing a theoretical sounding board (Sparkes and Smith, 2014). In similar vein, the undertaking of a pilot interview with an ex-jockey and trainer in essence permitted the 'refinement and development of the research instrument' (Creswell, 2013), providing the work with a level of *rich rigour.* Referring back to the interviewees via member checking upon transcription and interpretation of themes similarly helped achieve a good standard of *trustworthiness* of the data. Alternative to seeking external modes of validation, the lead researcher consistently upheld a level of self-reflexivity and critical thinking throughout the duration of the study, contemplating his own views and ideologies to evidence *sincerity* in the process.

The relevance, timing and significance of this topic in context of the horseracing industry and outcomes of previous quantitative enquiry (Dolan *et al.,* 2011, 2012; Wilson *et al.,* 2012, 2013, 2014, 2015) makes the present research a *worthy topic.* Furthermore, it could be considered *incisive* in that it is the first of its kind to explore beyond the superficial happenings of day-to-day racing, and attempts to investigate the explicit views of traditionally covert industry members who may be contributory to the adverse practices of jockeys. Readers affiliated with horseracing may feel a level of *resonance* and re-evaluate their outlook on current practices following the reading of, and reflection upon the data illustrated within

the results and discussion sections of this paper. In doing so, the paper has potential to *engage embodiment for change* amongst its readers. Whether they do or not is down to how they interpret the data and how their own experiences have shaped their current position.

Results

Within this section, themes that were generated through the data synthesis process are outlined using verbatim quotes to highlight the participants' narrative. The section is split into two sub-categories a) the perception and attitudes of jockeys, and b) of the perception and attitudes of the support network (i.e. clerks, trainer, agents, coaches).

The Perception and Attitudes of Jockeys

Three general dimensions were developed in relation to jockeys' perception of their identity and industry nutrition. These dimensions are 1) Cultural weight-making practices adopted by jockeys, 2) Individual Influences on Eating Practices, and 3) Social Influences on Eating Practices. Dimension one gives insight to the practices of 'how' jockeys make weight, whilst dimensions two and three highlight 'why' they engage in such regimens, drawing on both intrinsic and extrinsic factors that influences nutritional and weight-making practices. Higher order themes within these dimensions are indicated by the use of italic text.

Cultural weight-making practices adopted by jockeys

This initial dimension demonstrates the presence of adverse nutrition practices in jockeys to make necessary riding weights (Dolan *et al.,* 2011). Two themes embodied this general dimension identified in Table 4, *dehydration to make weight* and *disordered eating to make weight*.

Jockeys expressed that whilst never having to make weight would be the ideal situation and where losing weight safely is preferred, Jockey 3 identified where that isn't possible, dehydration is the single best method to lose weight quickly:

> Well I try to do it properly. I run every night a good 3 to 4 miles to run my tea off or whatever, lose a bit of sweat, then I'll run in the morning – sweat suited up like. If I'm struggling I'll wear it in the car, you know get the heaters on, then if I'm still a bit over I'll jump in the sauna when I get to the racecourse. (Jockey 3)

Jockeys openly described the use of *disordered eating to make weight*. A unique feature of the present research is the discovery of their thought processes, the rationale and justification, and own perception of their uses and effects. These findings develop those from previous research where jockeys have only completed anonymous questionnaires simply identifying their strategies (Leydon and Wall, 2002; Moore *et al.,* 2002). One jockey shares their experience:

> I've never done it the right way. From pony racing to now I've used laxatives on a daily basis. I find that when I stop and come off them, I just gain like 5 or 6lbs really quickly. And when I've had to do light, if I'm not there I'll go and flip. (Jockey 10)

Methods such as laxatives and self-induced vomiting to maintain weight are characteristic of the eating disorder Bulimia Nervosa (American Psychiatric Association, 2013; Stewart *et al.,* 2015). Jockeys however are keen to address that such practices are not done in pursuit of an 'ideal' body image, but rather a tool to facilitate weight loss and only engage in such practices as a last resort often after all else has failed:

> Its fucking disgusting and I hate doing it, but some mornings when you're doing light you wake up, check your weight, go for a run, sweat… it's getting closer to the race and I'm still over the weight, I just take myself off and flip. I hate doing it, I hate the thought on the morning knowing that I might have to do it. (Jockey 10).

Due to the pragmatic approach jockeys take, it is perhaps incorrect to classify all jockeys who engage in extreme weight-loss practices as suffering from an eating disorder, however should be recognised that it is undoubtedly high on the disordered eating spectrum (Mountjoy *et al.,* 2014; Sundgot-Borgen and Torstveit, 2010).

Table 4. Cultural weight-making practices adopted by jockeys

Raw Data	Higher Order Theme	General Dimension
I'm not fantastic with my weight, I sit around 8 (stone) 7 (lbs) but because I'm still claiming (a weight allowance) I sometimes need to go way down to like 8-2, 8-3 so to make those weights, yeah, I sweat a lot (J-3).	Dehydration to make weight (n=10)	Cultural Practices Adopted and Presumed as a Matter of Routine
I skip breakfast, lunch is my main meal and I don't often have dinner. I'll usually have an apple if I'm riding heavy and some sweets if I'm riding light. (J-10)	Disordered eating to make weight (n=9)	

Individual Influences on Eating Practices

This general dimension reflects the factors and influences affecting nutrition choices which can be attributed to the individuals themselves. Table 5 illustrates four higher order themes that express this dimension, a) *reluctance to change,* b) *self-identification of athlete status,* c) *denial and bargaining*, and d) *the horse is the athlete.*

Table 5. Individual influences on the eating practices of jockeys

Raw Data	Higher Order Theme	General Dimension
The older lads are set in their ways, and they're going to do it (sweat), so they find the routine obviously this long that they're going to do, so they probably won't change it (J-1).	Reluctance to Change (n=9)	Individual Influences on Eating Practices
We're not the same. I mean, you see them elite guys like Lewis Hamilton, earning millions of pounds per year. We ride around in a race with three ambulances following us for a hundred and fifty quid, and that's before deductions. Do you know what I mean? (J-6)	Self-identification of 'athlete 'status (n=10)	
I know it's not good for you, but it's just what people like, and you know, if you don't have too much of it, surely it's not going to be that bad for you, just one can of Red Bull or something after you've done a lot of sweating, is it? (J-5).	Denial and Bargaining (n=9)	
The horses are the real athletes, but you have to do them justice, but it is a lot of the time, if you're on the best horse, it wins, which jockeys don't have that much difference (J-1)	The horse is the athlete (n=5)	

Some jockeys may be predisposed to disordered practices (Garfinkel and Garner, 1982) due to their physical stature, for example being a tall and naturally heavier jockey. Other factors may precipitate and perpetuate the issue, for example curiously trialling adverse cultural practices and experiencing initial success (e.g. winning a race) (Drinkwater *et al.,* 2005). Albeit coincidental, this acts as a validating process leading to an autonomous maintenance of adverse practices with little or no external influence.

It appears once these individual paradigms have been established there is a *reluctance to change* and are difficult to convince of a paradigm shift:

> The older lads are set in their ways, and they're going to do it (sweat) anyway, so they've found the routine obviously works this long that they're going to do, so they probably won't change it. (Jockey 1)

A common phrase "it works for me" was repeatedly used by several participants when discussing sub-optimal eating strategies and further consolidates the view of an averseness to change habituated practices. Of participants who were open to the discussion of evidence-based practices, there was a prevalence of *denial and bargaining* during interviews, and upon author reflection some of this could be attributed to a lack of nutritional knowledge. Through discussing the necessity of high energy drinks Jockey 1 suggests *"Red Bull I think should probably be kept, because the boys that are sweating, it obviously helps them."* Similarly, when discussing racecourse foods Jockey 4 offers *"chicken nuggets, they're not that unhealthy if they're cooked properly"* and *"I know you mostly don't think chips are that healthy, but you don't always want to be healthy, do you know what I mean?".*

An explanation for reluctance to change or perceived denial can be attributed to a lack of *self-identification of athlete status.* Despite a lifestyle with multiple parallels to other professional sports, and specifically weight-making or weight-sensitive athletes (e.g. boxing and motor sport), some jockeys do not feel on par with their counterparts:

> Anthony Crolla or Anthony Joshua or someone. I mean, you see the sacrifice. I mean, don't get me wrong, we put ourselves through sacrifice, and it's mental and tortuous… but I mean, sort of that's the sort of career path we chose, so, you know? I suppose different sports, they demand different things, but it's very hard to compare yourself to someone like them. (Jockey 6).

An alternative thematic explanation in the narrative is that of *the horse is the athlete* by where the jockeys believe their contribution to the outcome of the race is trivial and is largely foregone based on the ability of the horse:

> No matter how good of a jockey you are, yes you can get a better tune out of some horses, and you can get a bit more out of some horses, but ultimately, you cannot make a slow horse beat a fast one. It's like lining up in a Formula One race in a Mini. You'll get round the track, but they're going to lap you. (Jockey 5).

Previous research has indicated voluntary dehydration of 2% is enough to impair race-riding performance over a 2-mile simulated ride as well as upper and lower body strength (Wilson *et al.* 2013), offering an alternative perspective to that of the jockey. Some jockeys did self-identify as an athlete drawing on the necessity to be "very fit, very strong" to do what they do. In order to foster and develop this attitude, jockeys who hold and share these perceptions should be positively reinforced and encouraged so as not to be deterred.

Social Influences on Eating Practices

It is documented that in addition to their own perceptions and philosophies towards nutrition, athletes are exposed to and influenced by a number of external influences (Birkenhead and Slater, 2015). The following dimension purveys the social or extrinsic factors with varying degrees determine jockeys' eating practices, summarised in Table 6.

Table 6. Social influences on the eating practices of jockeys

Raw Data	Higher Order Theme	General Dimension
It would be wrong to blame them fully as it's up to us as individuals to make the weight appropriately. Some of the trainers are decent, make sure we don't do too much too soon, others not so much, couldn't give a fuck about jockeys, apprentices anyway, there's always another one to turn to. Easy come, easy go, you know? (J-3)	Peers and Trainers Influence and Pressure (n=7)	Social Influences on Eating Practices
No this is my first time but I'm hearing a lot more about the work been done over there, a few of the lads I've spoken to have been across to sees you and all say it's worth going over. I think once I'm further on my way with this rehab I'll book in to come across and get sorted (J-8).	Professional Nutrition Support Networks (n=7)	
Some are better than others, but I know some of the food they give you, it's not what we should be eating, but that's probably just because it's easy food. (J-5)	Racecourse Food Provision	

The relationship amongst jockeys is complex given that they are all self-employed and therefore are each other's competitor both on and off the track, yet at the same time, are all be part of a unique fraternity, described by Jockey 8 as "a bubble" with a strong culture of learning from experienced others and respecting traditions:

> So the thing is in racing, jockeys are a little bit like sheep. The young lads will watch what the old lads do, and when the old lads aren't that well educated, it sort of filters down the line, so the young lads aren't. If everyone was better educated, everyone would have a better understanding of it. (Jockey 6)

The notion of education being a potential solution aligns with the thoughts of other jockeys who voiced recognition and reported positive influences from the available *support networks* that provide nutrition and wellbeing support. Jockey 8 shared *"I'm hearing a lot more about the work been done over there (Liverpool JMU), a few of the lads I've spoken to have been across… and all say it's worth going over"*, echoed by having a sense of *"good knowledge"* nutritionally by Jockey 2 based on working with the industry's nutrition support team. Based on the insular tendencies of the jockey community when seeking nutrition support, it is crucial to create positive and successful experiences with the few jockeys who interact with these support groups so as the reputation and benefit of accessing the nutrition support networks will spread from within.

Several identified that as jockeys who spend much of their week at various courses that the racecourse's food provision was their main opportunity other than visiting motorway service stations to eat. This higher order theme reflected some levels of discontent with the type of food, its quality, and the frequency of turnover:

> They leave it out on the table all day, so after two races it's turning rotten. Not rotten, but it's lost its colour, and it looks shit. Then you wouldn't eat it, and it's the same with like all the other stuff. (Jockey 2)

Within these narratives however were notions of an improved service compared to previous times, and relationships with catering staff members was pivotal in how well they perceived a racecourse in terms of its service to jockeys. Given the relevance of this finding racecourses should build on their current provision to develop a menu conducive to both weight management and performance.

The Perception and Attitudes of the Jockey Support Network

Interview responses within this theme are represented in Table 7 and ordered in to five general dimensions: 1) influence of trainers on weight making practice, 2) influence of agents on weight making practice, 3) influence of coaches on weight making, 4) contention over recognising the jockey as an athlete, and 5) a need for industry education.

Table 7. The Perceptions and Attitudes of Jockeys' Support Network

Raw Data	Higher Order Theme	General Dimension
There's a yard in the south… he's very good in all ways with staff and jockeys. Many of them stay and live on site. He provides a cook who cooks three meals a day for them, he has rest rooms for them, simulators for them (JC-3)	Outward Facing Views on Nutrition and Science Support (n=6)	Influence of Trainers on Weight Making
A lot of trainers are so old-fashioned. Some. It's probably wrong to say a lot. Some are so old-fashioned and they're stuck in their ways, they're not interested. They feel it's the responsibility of them [jockeys] to look after themselves, because there's always another one coming along if that one can't cope with it (JC-3).	Cultural Reluctance and Lack of Time Inhibits Mentorship of Jockeys (n=13)	
My relationship is completely different to most agents. I treat them as if they were my children, because I get these lads come over from Ireland, and they've left their families and home. We're from a farming family, we try and give them a bit of love, you know (A-2).	Family-like approach to support (n=3)	Influence of Agents on Weight Making
"Get in the sauna, don't eat anything and you can ride the light weight for me." That sort of approach comes straight from the agent or trainer (JC-4).	Assigned too many jockeys with too much control over booking rides (n=6)	
Most of the time I try to be like more as a mentor and a friend… I try to associate situations that happened in your past to situations they're possibly having difficulty with (JC-3).	More than just a coach (n=4)	Influence of Coaches on Weight Making

Jockeys initially. Is that wrong or right? I don't know. I see them as jockeys. They're a different breed (A-2).	Lack of recognition of jockeys as professional athletes (n=10)	Contention over recognising a jockey as an 'athlete'
I definitely would [classify jockeys as athletes], yes, definitely, having sort of been there, and knowing the sort of demands and what not. They're definitely doing that (JC-2).	Support of views of professional athletes (n=11)	
I think we've got to, as soon as we get hold of them, we've got to say, "You're not going to be a jockey, you're going to be a professional athlete, who happens to ride horses on the racecourse, and we call that a jockey, the same way we call Wayne Rooney a centre forward (T-2).	Get jockeys at beginning of career (n=8)	A need for industry education
In my head, it's the *[names three jockeys]* the lads who are doing it properly, you can see it on the benefits they get from it, and it's not an accident, is it? So they're the people who they should be looking up to (JC-2).	Use of a role model key for delivery of message (n=9)	
I'm very into nutrition and the whole thing. Do you know what I mean? And there's so much information out there, and you don't know what's bullshit and what's not, do you? (JC-1).	Education needed for all industry members (n=8)	

Influence of Trainers on Weight Making

This initial dimension identifies the perceptions of industry members on the influence, both positive and adverse of racehorse trainers on jockeys, embodied by two polarised higher order themes of *outward facing views on nutrition and science support* and *cultural reluctance and lack of time inhibits mentorship of jockeys.* There is a faction of trainers that hold a liberal view towards supporting and promoting jockeys making weight in a safe way, facilitating performance and health simultaneously exemplified by Trainer 2:

> For me, if you've got a healthy, fit, strong jockey riding a sensible weight, who's in a good place mentally, he's going to do a better job on your horse than a jockey who's under-nourished, smashed a bit, carrying a lot of discomfort and mental angst. (Trainer 2).

Several anecdotes of supportive acts occurred naturally during discussions including trainers refusing to allow jockeys to ride too light in concern for their wellbeing and food being

prepared for jockeys on the yard (Agent 1). In contrary however, there is a feeling both from within this group of receptive trainers and the other jockey support network groups that alternative training yards do not provide adequate support to jockeys either through a lack of time, a diminished sense of obligation, or an elected stance of neglect towards the issues:

> A lot of trainers are so old-fashioned. Some. It's probably wrong to say a lot. Some are so old-fashioned and they're stuck in their ways, they're not interested. They feel it's the responsibility of them [jockeys] to look after themselves, because there's always another one coming along if that one can't cope with it. (Jockey Coach 3)

Influence of Agents on Weight Making

Similar to trainers, this dimension developed when talking about the perception agents hold of jockeys and the relationship that exists between the two. Themes emerging within this dimension are comparable to trainers in that they are divided between a *family-like approach to support* against a feeling agents are *assigned too many jockeys with too much control over booking rides.* Acting as an official representative for their registered jockeys, agents secure work with trainers based on the availability of their clients and a commitment to make the required riding weight. During interviews, it transpired some agents stand accused of exploiting the situation:

> Every time the agent books them a ride, they get 10% of the riding fee. So he's not missing his dinner, but his [jockey] is. So they'll go and book them a ride that's probably too light... if you haven't got a good agent, they can abuse the situation a little bit, and make you do lighter than you want to do. (Jockey Coach 1)

Validation of this perception was generated from fellow agents who were interviewed. Agent 1 who suggests they have a modest and therefore more personal portfolio of jockeys confirms *"some of the agents that have a lot of jockeys don't have the same relationship with them".* Agent 2 commented *"my relationship is completely different to most agents"* in the sense that they are sympathetic of the demands of being a jockey and took a more holistic approach to being an agent, communicating more frequently and refusing to place either physical or mental wellbeing in jeopardy for the sake of a ride. It is pertinent to mention that the initial work between professional jockeys and our research group was instigated through a

concerned agent seeking support for his jockeys, underlining the proactive and compassionate nature of some. Describing the relationship with *"I treat them as if they were my children"* and openly embracing them within the agents own family life was the cornerstone of the *family-like support* theme. Agent 1 consolidated Agent 2's approach:

> They all think I treat them like their parent. I think you've got a responsibility to them at the end of the day. If I can help them with anything, I will. Yes, I get their rides, but I do feel that I have a responsibility to look after them. I could put them on horses every day that are at their minimum weight, but I don't want to kill them. I don't want them to phone up and go, "I can't do this anymore. I'm not riding". So I do try to look after them, because I know it's hard. (Agent 1).

The number of jockeys allowed to be assigned to one agent is currently open-ended. *"I've got twenty-five on my books, which probably sounds a lot, but… there's [Agents](who have in excess of) probably sixty jockeys"* (Agent 2). All participants were agreed that this may lead to impersonalised representation, where agents may focus less attention on the welfare of riders in favour of ensuring jockeys have rides.

Influence of Jockey Coaches on Making Weight

This general dimension acknowledged the work done by jockey coaches, in working individually with jockeys on the demands of being a professional jockey through their period of being an apprentice or conditional rider. The sole theme emerging via discussion of the relationship was that coaches were *more than just a coach* and several participants referred to them as a "friend" or "mentor":

> I had one boy in the winter, and I did everything from yoga, cooking lessons, equiciser, anything. He couldn't cook, so he couldn't eat properly, so I actually did cookery lessons with him. I can basically do anything I want if they want it. (Jockey Coach 1)

At present only a modest number of jockey coaches exist and due to the dispersed geography of racing yards around the UK, there is a "lack of consistency" (Jockey Coach 3) with contact time between some young riders and their designated coaches. Unlike others in the jockeys auxiliary group, jockey coaches appear to be the ones who have no other interests other than the development and welfare of riders. A subsidiary

theme within the interviews was an increase in coaching numbers would be a worthy consideration.

Contention over recognising the jockey as an 'athlete'

Analogous to the views of jockey themselves, the concept of recognising jockeys as professional athletes similarly divides opinion between other industry professionals:

> They are [athletes], what they do is physical, massively physical. It's no less physical, apart from the accidents and thumps. It's similar to being a boxer. It has similar sort of requirements. (Trainer 2)

It is apparent that those industry members who recognise that jockeys are athletes have more outward-facing views on the value of nutrition and evidence-based approaches to weight-making, and similarly appear to recognise the detrimental impact on both health and performance of rapid weight-loss engagement. Traditional views are still maintained by many, considering jockeys to be *"somebody to sit on your horse and ride it"* (Clerk 6):

> I'm old-fashioned… I've always considered jockeys as jockeys, as opposed to athletes, and it's only in the last year or two… that the word "athlete" had been brought into the equation. (Jockey Coach 3)

The term 'jockey' derives from the 17th century denoting a small man who used to ride horses to deliver post (Wilson *et al.,* 2014), and void of consideration of the athletic demands placed on modern day riders. It was discussed that in a parallel to the term 'footballer' or 'cyclist', the word jockey should bring identity to the sport however not at the expense of the athletic recognition.

A Need for Industry Education

The most apparent general dimension emerging from support staff was the need for more industry education with regards to nutrition and weight-making given. A consistent theme that developed through all stakeholders was *educating jockeys at the beginning of the career.* At present only one afternoon during a licensing course is allocated to nutrition education with no obligation to maintain or develop this knowledge further throughout their career. A

consensus that more emphasis needs to be placed on nutrition early in their careers is represented by Agent 2:

> How do you change it? The grass-roots is always where the best comes from. Instil it into them early, and a lot of that needs to be from the BHA. They've got these apprentice schools. They need extra days at these schools to spend more time on it [nutrition]. (Agent 2).

The logistics of additional nutritional education was beyond the remit of the interviews however the *use of a role-model to deliver key massages* was second prominent theme. Suggesting that jockeys are *"very role model oriented"* from Jockey Coach 1 was supported by others suggesting the use of senior and/or successful jockeys to endorse evidence-based approaches would be best-practice and even necessary to create an industry-wide movement. This logic aligns with previous comments surrounding the "bubble" and a tradition of learning from within as well as jockeys' previous acknowledgement of sourcing advice from senior jockeys over nutrition professionals (Moore *et al.,* 2002). In addition to jockeys requiring substantive nutrition education, a feeling of *education needed for all industry members* stood out in order to better understand the benefits of optimising nutrition, the implications of adverse practices and to, where possible, help their associated jockeys:

> The trainer or the coach therefore on [the jockey's] behalf must have a basic knowledge of diet. I don't remember in our classes to become coaches that the diet was mentioned other than from a rugby coach tutoring us who had no idea of a jockey's lifestyle. I think the major step forward we can make is to make jockeys realise they are athletes and improve their lifestyles especially the diet and have trainers and agents understand this. (Jockey Coach 4)

Within this, it transpired that key support staff such as trainers, agents, and coaches are unaware of the available nutrition support teams or how to help jockeys access them.

Study 1 Part II:

Methods

Participants

To gain a comprehensive view of an industry's perspective on the race-day catering provision, a range of professionals associated with race-day performance were invited to participate. Using the same participants as within Part I of this chapter, this study recruited jockeys (n=10), and their support network made up of racehorse trainers (n=3), agents (n=2), and jockey coaches (n=4). A total of 19 racecourses were represented via Clerks of Courses (n=7), some of whom govern multiple tracks. Ethical approval to conduct this second phase of the study was granted by Liverpool John Moores University. Utilising the professional body's monthly publication, an open letter was sent to jockeys detailing the study and respondents were subsequently followed up via email. Representatives from apprentice and conditional jockeys through to senior professionals contributed enabling maximum data sampling. The other four groups were initially contacted through gatekeepers (general secretaries, chief executive officers) at their respective professional bodies via email.

Data Collection

Individual semi-structured interviews were completed with all participants as described in Part 1 of this study. Questions centred around gaining insight to participants thoughts on current provision and its conduciveness to health, performance, and weight maintenance for jockeys.

Data Analysis

As with Part 1, all transcripts were uploaded to analysis software NVivo10 (QSR International Ltd., 2012) to undergo the six stages of thematic analysis (Braun and Clarke, 2006).

Results

Themes generated during data analysis are outlined throughout this section using verbatim quotes to highlight the participants' responses. To clearly identify the narratives of the different stakeholders, the following section is split into three sections a) the perception of jockeys, b) the perception of racecourse clerks, and c) of the perception of the support network (i.e. trainer, agents, coaches) all in relation to current racecourse food provision.

The Perception of Jockeys on Racecourse Food Provision

Two general dimensions developed (see Table 8) relating to this initial theme; 1) The perception and satisfaction of racecourse food provision is explored through discussions relating to catering staff in addition to the food they provide, and secondly 2) jockeys offered solutions to improve the provision. Higher order themes are indicated by the use of italic text throughout.

Table 8 – General Dimensions and Higher Order Themes of Jockeys Perception of Racecourse Food Provision

Raw Data	Higher Order Theme	General Dimension
He's [caterer 1] a nice guy. Like I walk in, "All right, [name of jockey]. How are you doing? Cup of tea?" I'd say, "Yes, please", and he'd go, "Two sugars? Good drop of milk?" Like he remembers you, and he's more, like I don't know him that well, but you'd call him more a friend than, you know, he's...Some of the people there, you know, they're just doing their job, they're just caterers, it'd just be a young lad, not young, probably the same age as me, but they're just, you know. It's not nice to say, but they've not got an idea, you know (Jockey 5).	Relationships with Catering Staff at Racecourses (n=9)	Perception and Satisfaction of Racecourse Food Provision
They leave it out on the table all day, so after two races it's turning rotten. Not rotten, but it's lost its colour, and it looks shit. Then you wouldn't eat it, and it's the same with like all the other stuff, all that stuff. (Jockey 2) The stuff they bring down sometimes, you wouldn't give to a dog, and sometimes it's like crap, and I am a fussy eater, but that's what I think. (Jockey 6)	Discontent with Current Food Provision at Racecourses (n=10)	
More choice, and you get people like yourself, telling you that you've done your tests, and that has proven that's what we should eat. Now that's the sort of stuff you want to be seeing when you go to the races, and then it's going to be easier to follow that. Because when you're at the races every day, you can't cook your own food. You have to rely on whatever's there. (Jockey 4)	Food provision conducive to performance and weight management (n=10)	Offered Solutions to Improve Provision
It’s probably unrealistic, but more sociable people serving food like [caterer 1] and [caterer 2]. They make a big difference for a start. (Jockey 3)	Catering staff more relevant and engaging with jockeys (n=5)	
Unless there is a rule change, tracks aren't going to (improve) because they're owned by some people who are self-contained. They're owned by other companies,	Embedding regulatory minimum standards	

and it has to be a rule across the board that 'this' has to be provided, 'that' has to be provided. (Jockey 6)	for racecourses to adhere to (n=5)	

The Perception and Satisfaction of Racecourse Food Provision

This initial dimension describes the current thoughts of jockeys on the food provision at racecourses, and furthermore their level of satisfaction with what it provided. It appears that *relationships with catering staff at racecourses* is a key factor in how jockeys perceive and rate racecourse food provision and overall satisfaction of the service:

> Researcher: What makes [racecourse] good, then?
>
> Jockey 2: Different people, I think.
>
> Researcher: So would you say it's the people?
>
> Jockey 2: Yes, different caterers.
>
> Researcher: Because [caterer 1], he's got a good reputation?
>
> Jockey 2: [Caterer 1] is great yes, and he helps - do you know what I mean? I'm like, "[caterer 1], go and find us some Yorkshire puddings", and he would find me some Yorkshire puddings or something if they're not on there, and things like that. Do you know what I mean?

> (There's) a lady up at [racecourse] (who) is a lovely woman like, makes some homemade food and wants to look after us, so yeah she's OK too. I guess [caterer 2] and [caterer 1] have that craic, really funny like. (Jockey 3).

A personalisation of the service provided by catering staff and interaction towards jockeys appears to clearly influence the decision to engage with foods. Jockey 5 describes one caterer:

"*Lovely fella, tries to help you out, remembers your name, and that goes along way you know.*".

> I don't like everything they do because I'm not a fan of chicken and fish, but then again, I say that, [caterer 2] who does [racecourse] does chicken wraps and I'll eat them
>
> (Jockey 7)

> Fair play to the woman at [racecourse]. I can't think of her name that does the food, but she's ok, it's not the healthiest food in the world, but at the same time, everyone eats it.
>
> (Jockey 8)

The use of emotive words and phrases such as *"help"* and *"look after"* was a common feature in descriptions of the caterers who resonated with jockeys. Although not stated explicitly, in the context of the conversations this was undoubtedly referring to their assistance and empathy in the necessity to make the competitive riding weight. This point is substantiated further by recollections of negative experiences and a lack of understanding or knowing by caterers:

> Some of the young lads and girls (caterers) in some of the weighing rooms, [famous jockey] could walk in the room and I don't think they'd know who he is. Fair enough they may not be in to the sport and it's just their job, but there's no enthusiasm or will to help a jockey out you know. They have no idea the lengths some of the lads go to, to make a weight. (Jockey 8).

> The lads behind the food bar working in the jockey's room, they aren't like trained cooks they're just told to shove it in a deep fryer… they're all nice people but they

> haven't a clue of what it takes, how healthy you have to be, or what it means to make a weight. (Jockey 10)

It is not clear from previous research if catering staff specifically have enough presence to influence food choices, however individuals who are acknowledged as peers or friends may be able to (Herman *et al.,* (2003). Unlike other sports where caterers may be one-off contractors, or who only appear for a short period at meal times, caterers within the weighing room are in the same environment as jockeys for up to five hours per day, and for multiple days over the year. These accounts clearly highlight a novel finding in that catering staff, or individuals who are providing food to jockeys may play a key role in jockeys' relationship and engagement with food. This should be considered by racecourses when deciding who is present in the jockeys weighting room. Such changes may subsequently improve their ratings with jockeys considering all jockeys alluded to a *discontent with current food provision.* The most prevalent aspect jockeys feel an improvement is necessary is the type or quality of foods provided:

> Most aren't that good, some will do some good things and some bad things. Quality wise most of the hot foods aren't that smashing. More quantity than quality you know, big vats of curries or whatever, chilli's. (Jockey 3)

> A lot of the food they provide, it's not nice, so people won't eat it. Do you know what I mean? Like some of the food that you see at the tracks, honestly, it's horrendous. (Jockey 6)

> Heavy pasta dishes, lasagnes, curries, don't get me wrong I think they taste good a lot of the time. I love a lasagne but I don't be needing it before a race you know. It weighs on you a lot, and even if weight were no issue I guarantee on a 3 miler I'd throw it back up half way round. (Jockey 8).

Similarly, several jockeys eluded to being particular with the aesthetic appeal of foods, *"if I don't like the look of something, then I don't eat it."* (Jockey 2) and *"certain things look minging, they're probably not but I eat with my eyes sometimes."* (Jockey 3). Although weight is the main concern for jockeys, the sensory aspect of foods remains important to many (Pelly *et al.,* 2006; Smart and Bisogni, 2001). If jockeys opt to consume non-conducive foods over healthier alternatives due to their appearance, this may further compound weight-management issues whilst potentially impairing riding performance. Providing a catering service for such a unique population and their associated sporting demands is challenging. Whilst jockeys unanimously declared a need to improve food provision and its service as a general term, some acknowledgement was given to a number of racecourses who already provide high quality foods. For other jockeys, the availability of foods were the main areas of concern:

> The only problem I have is that when you go there before racing and there's never any food out. I'm one of the few people that don't have a weight problem… if I've just rode out, come home from work, literally got a quick shower, jumped into my car, gone racing and get there I need to eat something... but the food doesn't normally come 'til after the first race, which OK, like I say, maybe I'm only one in fifty, but I still need some food to eat. Do you know what I mean? (Jockey 1)

> You might have a light ride later on in the day, and you can't eat until you've finished that ride, or 'til you've finished the day, and then it's, well, everything's gone, you know? You (will have to) stop on the way home and pick up a sandwich at the services. (Jockey 6)

Offered Solutions to Improve Provision

This second general dimension naturally occurred following initial discussions surrounding the perception of provision. Subsequently, higher order themes within this general dimension mirror those of the opening one. Jockeys initially discussed making *catering staff more relevant and engaging with jockeys*.

> It's probably unrealistic, but more sociable people serving food like [caterer 1] and [caterer 2]. They make a big difference for a start (Jockey 3).

It was felt that being able to approach and converse with catering staff who understood the demands of weight-making and racing would go a significant way, and perhaps lead to an improvement in service. Similarly, jockeys described that some caterers in the weighing room often lacked autonomy in being able to provide individual nutritional requests in contrast to the aforementioned favourable caterers who were. This finding may suggest employees of catering companies may benefit from some initial training on the lifestyle and demands placed on jockeys and be encouraged to engage in dialogue and discussion with them. The strongest higher order theme within this dimension related to *developing a food provision conducive to performance and weight management*, indicating a preference towards better quality foods over their quantity:

> Rather than cereal bars and chocolate bars, I'd like to see more protein bars, more Greek yogurt and things, and the meats… plenty of choice for your meats. (Jockey 4)

> Light foods, stuff you can pick away at. A lot of lads can't or won't eat before a race, or if they do it's just a little bit of something to satisfy them, they don't want a plate of stodge. (Jockey 8)

A recurrent suggestion was the availability of more cooked meats due to both the feasibility of portion control and low calorie content, alongside its favourable taste. Furthermore, its versatility to make more substantial meals for when circumstances allowed was possible:

> Some courses have several meats, [racecourse] for example have a beef, chicken, a turkey crown, pork and that. Now that's good because we know it's good for you, it tastes pretty good and you can pick at it no problem. You can make a sarnie… it's up to you, wraps, whatever. (Jockey 3)

In tandem with the suggestions of providing more cooked meats, a reduction in the availability of perceived unhealthy foods was heard:

> Just cut out all the absolute you know, sausages and all the stuff that's no good, just cut it out. When you've had a long day it's just too tempting it grab that and just eat it you know? I think you should just make it so there isn't even that option to have (it)… If you eat a healthier meal, you feel like you've had a meal and it will stop you stopping on the way home as well. (Jockey 10)

The notion of needing to visit service stations to eat after competition repeatedly featured throughout the jockey narrative and related directly to a lack of availability of food provision towards the latter stages of race meetings. A desire to seize the impulsion of 'stopping off' to eat on the journey home was a common thread throughout interviews. Due to the financial costs of service station foods, but more importantly the negative implication of energy dense foods on weight management, jockeys expressed a clear message in wanting foods more readily available to take away with them after race meetings:

> I'd rather have more stuff that you can take away with you… sometimes when you get home it's late, and then you don't want to eat, so you'd rather have something (from the racecourse), or I'd end up stopping somewhere for a sandwich. (Jockey 5)

> (I'd like more) stuff to take away, at the minute you've either got to sit and eat some chilli or whatever before you leave or end up stopping off half-way home for some food. Sometimes I'm that buzzing I can't eat straight after the races, I need an hour to calm down you know but at the minute you can't really take much away with you other than a handful of biscuits or jelly sweets. (Jockey 3)

The final higher order theme related to *embedding regulatory minimum standards for racecourses to adhere to*. It was clearly communicated that an inconsistency exists amongst food provision at racecourses with some racecourses praised for their quality and effort, where others were condemned by multiple jockeys. A common theme of standardising provision was explored with some suggestion for this to be underpinned by regulation to force lesser performing courses to improve their offerings.

> Like some of the food that you see at the tracks, honestly, it's horrendous. I don't want to start naming them, but if it was a legal thing, or a thing set up that this is what you have to have in, then they'd have no other choice but to comply with it. But unless it's something brought in by the medical side of the BHA, it's never going to change. (Jockey 6).

An alternative suggestion was to share good practice between racecourses, enabling prominent racecourses to be learned from by others.

> What I'm saying, there's no standards there, so they're kind of getting to do what they want, when they want… but identify the people or the courses that are the best, and basically pick that up and try and replicate it everywhere else. (Jockey 9)

The Perception of Racecourse Clerks on Racecourse Food Provision

Clerks responses under this theme were defined into two general dimensions; 1) Their perception of factors influencing racecourse food provision, and secondly 2) Offered solutions to further improve provision (see Table 9).

Table 9 – General Dimensions and Higher Order Themes of Clerks Perception of Racecourse Food Provision

Raw Data	Higher Order Theme	General Dimension
Generally speaking, we do seem to be getting it better, and we're getting a better reaction to what we're putting out. Now whether we're putting the right things out is	Food at racecourses (n=7)	

still open to debate, but we're getting less… adverse reaction to what we put out (C-2).		Perception of Factors Influencing Racecourse Food Provision
We have a strange relationship with the jockeys, because they're in a position to make our life pretty uncomfortable, and we have no leverage over them. So it has to be a rapport between the clerk and the jockeys, built on trust (C-7).	Jockey-Clerk relationship (n=3)	
They all seem to like [caterer 2], but I'm not convinced he does anything actually that different. I think it's just because he's one of them, they really like him (C-1).	Caterers and budget (n=7)	
A lot of these weighing rooms haven't got kitchens, so the stuff's got to come from somewhere else, and then you start to run into food standards whatever it is for that, transporting stuff about too much, and that is, I don't think there's ever so much a cost issue for the racecourses, it's always the actual logistics (C-6)	Feasibility and logistics (n=3)	
I mean, the costs… I used to be like, "Oh God, don't put this in, and don't put that in", but as I say, for the past ten years, it's just easier to see it as money well spent, if it's doing, I see it as money well spent to keep them happy, as long as it is what they want (C-1).	Jockey satisfaction is priority over budget (n=7)	Offered Solutions to Improve Provision
I think the guidelines that we had were a good starting point. Had they been more widely agreed, or somehow got accepted by the jockeys, we would have been able to go a little bit further forward now (C-4).	Regulatory guidance and governance (n=7)	

Perception of Factors Influencing Racecourse Food Provision

Racecourse clerks generally held a common belief that the *food at racecourses* has improved in recent times: *"I think it's got an awful lot better, actually. I have seen quite a change in it"* (Clerk 1); "*I think it's improved a lot over the years, and I think that most of us would always be glad act in accordance with the best advice."* (Clerk 7), however ambiguity still exists to what optimal provision is:

> It's a bit of a minefield. We find it difficult to know what foods to put out... over the years we've received several different sorts of fact sheets about what we should and shouldn't be doing. You get to a point where you get a bit confused. (Clerk 2)

> Jockey's food typically is one that has, over the years, caused more headaches than anything else (Clerk 5)

Despite a lack of clarity, many clerks perceive their racecourse provides food of an acceptable standard for that of professional sportspeople, and on balance is met with approval from the jockeys:

> I mean, we've piled a lot of effort into it here, and I believe it's as good as any buffet restaurant you could walk into. So I think the standards here are right. (Clerk 4)

> I think our fare is very reasonable compared to a number of racecourses… we don't get many complaints. Every now and again somebody will come and have a bit of a paddy because we haven't laid on specifically what they want. [Ex jockey] had a moan once, so fillet steak was brought down for him. We haven't had a complaint about the food here probably for eighteen months, I should think. (Clerk 5)

> No, I don't think there's a need (to improve provision), from my tracks anyway. I think there's a nice balance there already. (Clerk 6)

An alternative perspective from some clerks however is that in the current absence of regulatory guidance, a balance in provision between optimal foods and comfort or "bad"

foods still needs to be provided in order to pacify jockeys who openly engage in archaic eating and weight-making practices:

> I think, for [racecourse], I think the quality is pretty good, but again, I know that they shouldn't be having chips, pizza, chicken nuggets, whatever else. But there is salad there, and there's cold meat, and they can make their own, do what they want with it. Should they be having sweets and bits of chopped up Mars Bar? No, probably not, but there's a balance between providing some of what's good for them, and some of what they want, because until it goes in the rules, we're going to get lynched. (Clerk 6)

> We will, for as long as it's legitimate, provide what you would consider to be bad food, because as I've said before, for the management of our relationship with the jockeys, I'm just not telling them, "Listen, I know better than you, and I've taken sweeties off the menu". I've got other things to argue with them about. (Clerk 7)

Clerks openly conceded that a more fundamental priority for them than food provision on race day is the track running surface and correctly judging its condition, or it's 'going'. This judgement is one on which the whole industry relies upon to make decisions relating to racing or placing wagers on certain horses.

> I'm there to look after the racing surface and racing, so my first concern is that racing goes smoothly, the jockeys are happy with the ground, everybody else is happy with the ground. The last thing you want is to have, as [sports psychologist] described it, a hunting pack of flat jockeys when they're on the moan about something. So where

> you can keep them happy, or not upset them, then you're going to do that. So yes, we probably know what we need to do for the good of the jockeys, but they would not like us doing what we know is for their own good, if they don't want it. (Clerk 6)

This hesitance to remove perceived "bad" foods was described to be in the interest of upholding the *jockey-clerk relationship*, a factor they feel is scarcely considered by other industry members.

> We have a strange relationship with the jockeys, because they're in a position to make our life pretty uncomfortable, and we have no leverage over them. So it has to be a rapport between the clerk and the jockeys, built on trust. (Clerk 7)

> (Food provision) impacts on our business in the jockeys moaning and screeching, and then, because they didn't win a race, they're now going to say, "Oh, the ground's shit", because they're pissed off because they haven't got the can of Red Bull, or whatever it is. (Clerk 6)

This unique finding identifies an important factor which influences the current provision at some racecourses in the UK. Previous assumptions by jockeys have been made that foods offered have been solely based on budget, however this new aspect should be factored into future discussions debating the existing and previous food provision.

Depending on the racecourse, the *caterers and budget* vary significantly. Some racecourses provide the jockeys' food provision "in house" from a main industrial kitchen which is subsequently transported to the weighing room. Alternatively, some tracks employ an external company, or individual, to provide catering for race day. Clerks are in agreement,

similar to the position of jockeys, that the person present in the weighing room can influence both the provision and the perception of it.

> Some bring in outside caterers, which can work, and sometimes does, and sometimes doesn't. One caterer looked after [racecourse] and [racecourse] for a bit, and she got rid of some things, did whatever, and I would say, the quality was better. She then couldn't do it… got somebody to cover for her, and the food just nose-dived. (Clerk 6)

> They all seem to like [caterer 2], but I'm not convinced he does anything actually that different. I think it's just because he's one of them, but they really like him. It's not rocket science really, what he's doing, is it? But they do like him, but I think it's probably because he is 'one of them' (Clerk 1)

A noteworthy factor is that race day food provision receives no industry funding. Consequently, financial expenditure on weighing room food impacts on total revenues for racecourses, or reducing profit margins to third-party catering companies who receive a fixed fee:

> Racecourse caterers can be very good, but ultimately they don't make any money out of it. It costs them. So again, they're trying to, not do it on the cheap, but do it as cheaply as they can (Clerk 3).

The *feasibility and logistics* of providing foods determines the type of foods certain courses are able to provide. Several of the UK's racecourses hold listed buildings, some of which contain the weighing rooms meaning their facilities are limited with an inability to significantly

modernise in line with the growth and demands of the sport. Similarly, adherence to health and safety laws and classification of buildings need to be recognised:

> If you start putting ovens and things into rooms, you then start to class it as a kitchen, and then it comes under separate fire regulations. The whole building starts to become differently categorised… [Racecourse] for example has got no cooker, they've got a sink, a kettle, a microwave, and that's it. Everything else comes in, and the area for the lady to work in would be (very small) (Clerk 6)

Many racecourses operate across multiple buildings and is common for the kitchens to be housed in a separate building to the weighing room. Clerks were pragmatic in explaining the operational challenges posed of transporting food from one building to another, stating it needs to be "*operationally achievable, and it has to be operationally sustainable"* (Clerk 5) on race days when often several thousand people stand between the two locations:

> A lot of these weighing rooms haven't got kitchens, so the stuff's got to come from somewhere else, and then you start to run into food standards whatever it is for that, transporting stuff about too much, and that. I don't think there's ever so much a cost issue for the racecourses, it's always the actual logistics. (Clerk 6)

Offered Solutions to Improve Provision

It was generally accepted that the discussed logistical barriers could not be remedied without unlikely and highly significant changes in circumstance such as a reclassification of premises or the development of a new building. In contrast, clerks openly offered solutions relating to factors that were within their control, some of whom have been proactive in implementing

them. Referring to food specifically, clerks described that *jockey satisfaction is priority over budget* and typified by a statement from Clerk 7 *"in the grand scheme of things, budget's not a part of this".*

> Caterers are responsible for their catering budget, and they know what that's a non-revenue making area. However, I bang on that we need a good relationship with jockeys. (Clerk 5)

> If I showed you my list of what we spend on jockeys' food each meeting, and the menu that we provide… there must be over twenty different food types on that list. There's chicken, there's pasta, there's pork, there's bread, there's salads, there's beans. You name it, it's on there, and I now have the case of, if they want it, give it to them, because it is easier. (Clerk 1)

This representation of budget not being the influencing factor and clerks ultimately want to satisfy jockeys, indicates a willingness to implement strategies with the caveat that they are endorsed by jockeys and supported by the industry's regulatory bodies. The strongest suggestion focused around receiving *regulatory guidance and governance* on food provision rather than being allowed complete autonomy.

> There needs to be a minimum standard, and if that could be as tall as it is long, as it is wide, whatever, then racecourses can pick and choose from within those parameters. If [regulatory bodies] come up with the policy where there's been a conversation with jockeys… it gets easier to implement, doesn't it? (Clerk 5)

> We would certainly like to match what you're telling them to do. From our point of view, it's important to put on what they're being told… there's little point in us not following that, because it's a very important education message to get across, as to what a sportsman should be doing. (Clerk 2)

Whilst some clerks suggested guidance and regulation simply as a concept that would be welcomed, others offered more specific models of how they felt new guidelines and directives would benefit all stakeholders:

> I'd break it down into points (scoring system). Thirty points, fifty points, whatever. You must score forty-two out of fifty (for example). We accept some things you won't be able to do, but there is no excuse for not having "this" because that's easy. OK, you can't provide the ready-cooked omelette when they want it, because you can't put a cooker in there… we accept some things you just can't do where you are. You should be aiming for it, and if you rebuild the weighing room… (it should then be included). (Clerk 6)

The prospect of guidance from industry bodies on food provision is not original, however previous attempts to do this within horseracing have lacked consultation with both jockeys and clerks to devise an agreeable solution (PJA, 2016). Similarly, previous guidelines have never been made a mandatory requirement of racecourses by the sport's regulatory body, the British Horseracing Authority (BHA). Clerks appear keen to have a framework by which they are bound, allowing them to provide optimal food provision whilst having legislation to refer to when debating with jockeys who request non-conducive foods:

It would undoubtedly have to be driven by the BHA, and not by any other party. Otherwise, what you will get is, you will get a certain number of the jockeys to embrace it voluntarily, and the others won't. (Clerk 7)

I think it's a very good thing, but it needs to go into the rules, so we are able to say, "Look, the rule says..." It's a breach of the BHA's instructions, which are what we have to (follow), and if we're in breach of them, we get fined. (Clerk 6)

The Perception of the Support Network on Racecourse Food Provision

This general dimension reflected the support network's thoughts on current provision through their position as key stakeholders in jockeys' performance. Comparable with the previous participant groups, higher order themes for the support network were separated in to 1) Perceptions of weighing room provision and influence on weight, and secondly 2) Offered solutions to further improve provision (see Table 10).

Table 10 – General Dimensions and Higher Order Themes of Jockeys' Support Network's Perception of Racecourse Food Provision

Raw Data	Higher Order Theme	General Dimension
I think it's, and I go to racing once a week, and I think it's head and shoulders above what it used to be, consistent and fresh and hot and all those sorts of things. (Jockey Coach 2)	Better quality provision than before (n=4)	Perception of Weighing Room Provision and its Influence on Weight
The clerks of the courses, the only thing they want is calmness. They don't want any objections; they just want to keep the peace. So the best way to keep the peace is just give them the food that they want, rather than what they need, so it'd be chocolates, biscuits, you name it, pastries, sausage rolls. (Jockey Coach 3)	Not conducive to weight management or riding performance (n=4)	

They've got to the stage now where they're much more educated. You know, jockeys that take the middle out of a sandwich if it's a sandwich sort of thing, and so there's more option, and some of the food can be quite wholesome, and they can ride, and when they've finished riding, they can have a warm meal, and so they don't need then to stop on the way home. But if the food looks a bit skanky, they stop on the way home, because they've got to put fuel in, the same as a car. (Agent 2)	Improve food quality and align with education content (n=4)	Offered Solutions to Improve Provision

Perceptions of Weighing Room Provision and its Influence on Weight

Support network participants generally agreed that weighing room provision although not always ideal, is considerably *better quality provision than before*, echoing similar sentiments to the racecourse clerks:

> I think that they've come on a lot, bearing in mind I used to ride, it was just like pork pies and stuff like that… I ask my jockeys about it, and they've got like everything. They've got thumbs up for some, and maybe not, sort of borderline, with others (Agent 2).

Holding more personal relationships with jockeys, the support network was similarly able to reflect upon open discussions with their athletes regarding positive developments in racecourse provision:

> I think even some of the older ones would so much appreciate it. Like as soon as I asked [jockey], it was like, "Ah, [racecourse] is great, you get joints of meat". (Agent 1)

Concurrent with views of jockeys and clerks, support staff recalled multiple anecdotes that despite improvements many racecourses still offer food that is *not conducive to weight management or riding performance*:

> It was literally a lump of dough with a tiny piece of ham in the middle, and I thought, that is ridiculous, to give somebody something to eat with this lump, and then I said to [jockey] about it, and he said the food recently, it's terrible. Like chocolate and sweets is all he said they got somewhere. I've been there, and they've [the jockeys] gone to me, "I'm going in now, because the chips are coming out" (Agent 1)

> One of the biggest problems is the fridges. I can remember, and it's probably changed… but the fridges would be full of Coke and Red Bull. (Jockey Coach 1)

A relevant point raised within the narrative is the clear disconnect between what jockeys are advised to eat during their limited nutrition education during jockey school and what is often provided on racecourses:

> They (jockeys) would all tell you that crap is what they're fed. Which you can't try and educate them on nutrition as to what they're supposed to eat… then it's like, "Well, yes, it's great what they told me there, and I understand all of that, but now what do I do?" Because none of what you've told them they should be eating is actually on that table in front of them. (Agent 2)

The *offered solutions* sought to address this conflict with participants suggesting that what is conveyed in education material needs to be represented in the foods provided to jockeys in

the weighing room. It appears sensible to suggest that until these two elements of jockey nutrition are aligned, a shift in culture is unlikely to occur:

> You can only tell them what is right, but you then need to be able to put things in place for them to eat what you've said to them is right, which at the moment is not there, is it? (Jockey Coach 1)

Overall Discussion

This study aimed to explore the culture within horseracing and determine the perception and influences of its key stakeholders on nutritional and weight-making practices of professional jockeys. Initial themes generated consolidate findings from empirical studies on the weight-making practices of jockeys (Dolan *et al.,* 2011; Cotugna *et al.,* 2011; Wilson *et al.,* 2013) confirming disordered eating and dehydration are preferred methods. A novel aspect of the present study also sought the experiences and narratives of the wider racing community, and in doing so identifies a widespread awareness of nutritional malpractice amongst jockeys suggesting levels of cultural acceptance and conformity towards the issue. New findings relating to the factors behind *why* jockeys engage on archaic practices also emerged from the study.

Findings demonstrated that a range of social factors influencing dietary approaches, reflected in the accounts of both jockeys themselves and the professional network around them. Previous research has indicated that a combination of physiological, educational, psychological, social, and economic factors all play a part in the food choices of professional athletes (Birkenhead and Slater, 2015) and appears especially relevant in weight-making sports (Sundgot-Borgen *et al.,* 2013). Specifically, influences from trainers, agents and some

racecourses food provision appear to be negative and based on the traditional preferences of the sport and are present from the very start of a jockey's career. It is reported early sport-specific training, frequent weight-cycling and pressured coaching are all risk factors of developing disordered eating practices (Sundgot-Borgen and Torstveit, 2010) and perhaps all are no more prevalent in any other sport than horseracing. Narratives of positive influences were present in the data indicating that sections of the racing community are in favour of evidence-based approaches and the delivery of a high standard of jockey welfare. The promoting of such practices from industry bodies may help to encourage their adoption more widely.

There is a clear contention in the industry over the recognition of jockeys as athletes and subsequently acts as a barrier to acknowledging the necessity of optimal eating and healthy weight-making strategies. There is a lack of prominence in horseracing placed on jockeys developing an "athletic identity" (Wiechman and Williams, 1997) which refers to the level of which one self-identifies as being an athlete (Brewer *et al.,* 1993). It is documented that where strong athletic identity exists, continuing psychological benefits such as increased motivation, greater positivity and improved social interactions are reaped (Brewer *et al.,* 1993). In endurance running, a significant relationship between athletic identity and personal best times exists (Horton and Mack, 2000) suggesting that if jockeys approached all facets of their trade with an athlete mind-set, there is an increased likelihood of better riding performance. Cultural assumptions on the horse being the athlete needs to be challenged and promote the athletic ability of the rider can influence the outcome of the race. After all, between 2007-2012, only 32% of race wins went to the predetermined 'favourite' horse (Sports Media Society, 2012).

To our knowledge this is the first body of research to investigate the opinions and practices of racehorse trainers in relation to jockey welfare and opens up a debate. From extensive applied work in the industry from the first and second author, trainers are an elusive group who work independent from each other with a level of concealment and feel the presented data is reflective of the current position in industry. From in excess of 400 invites to participate only five initially expressed interest. Whether this is due to a lack of time or an example of cultural reluctance, it is clear further engagement with trainers is required to establish a clearer landscape and devise strategies to build on the already positive work taking place within their network. A correlation appears to exist between industry members who identify jockeys as athletes and their philosophy on the importance of nutrition. Similarly, individuals with an athlete-oriented perception appear to themselves provide a more holistic and liberal approach within their respective roles. First-generation trainers appear more likely to form the opinion of jockeys as athletes over those who have inherited a training yard or learnt through their parents, further underscoring the influence of the sports deep-rooted traditions. Further investigation into horseracing would help to determine the reasoning behind the cultural reluctance to proactively facilitate a healthier approach to riding.

This study was the first conducted that seeks to determine the perception and satisfaction of jockeys and the other key industry stakeholders on the food provided on competition day at the racecourses. The interviews provide a novel and transparent lens into to the complexity of getting food provision right in a sport where food and weight management are central. The strongest theme that ran throughout the data was that whilst current provision has improved from previous times, it requires further development in a manner which better facilitates the demands of modern day professional jockeys, specifically their requirement to make weight and optimise their riding performance. A cross-participant

proposal of better governance or improved regulatory guidance was a clear suggestion. Guidance for caterers has been present in many other sports since the 1980s (Pelly *et al.,* 2014; Burke *et al.,* 2008) where catering for athletes has evolved from a focus on variety to more specialized food provision that considers their performance needs (Burkhart and Pelly, 2013a). Examples of specific catering have recently been promoted in professional football (Smith, 2016), professional road cycling (Morton and Fell, 2016), and the Olympic games (Burkhart and Pelly, 2013b). Similarly, processes exist in other sports where catering guidelines are issued and subsequently reviewed (Pelly *et al.,* 2014), a model that racecourses collectively could potentially benefit from.

Perhaps the clearest finding is the current perceived systemic lack of nutrition education within the sport, and the necessity to develop this as voiced by the participants of this study. Insufficient emphasis is placed on nutrition during the licensing courses and developmental apprentice and conditional periods. Similarly, there is no mandatory requirement to attend supplementary` sessions beyond this initial period of their career (Caulfield and Karageorghis, 2007). Consequently, jockeys are entering the industry with little or no theoretical or applied knowledge of nutrition and weight-management in a sport where the necessity to manage weight is greater than any other sport based on their need to make weight every day. No recognition of jockey nutrition, or strategies to facilitate the need is apparent on equivalent courses to become a jockey agent, racehorse trainer, or racecourse clerk. Subsequently, a potential exists where an entire jockey entourage may lack knowledge of a cornerstone aspect of the sport, and one which perturbs its athletes in a fashion that impacts on both physical and mental wellbeing. The minimal education similarly means there is a lack of awareness of the specialist nutrition support groups available for jockeys to be signposted to.

Conclusion

Based on the unique findings of the work further areas of investigation and practical recommendations have naturally presented:

1) The development of an industry-specific nutrition education or behaviour change intervention when an education platform makes up a part of it would benefit professional jockeys entering the industry. Through a more comprehensive approach to nutrition education, jockeys would be equipped with the necessary skill-set to autonomously deliver an evidence-based approach to weight-management. Similarly, the instilling and fostering of jockeys being athletes should be embedded during such education schemes and reinforced within industry.

2) A strategy to share best practice amongst industry members should be considered. Sections of the racing industry are already delivering excellent jockey welfare provision and approaching jockeys as professional sportspeople, this should be recognised and given the opportunity to disseminate to others. This, in tandem with the inclusion of the jockey athlete in the licensing process of agents, trainers, clerks and coaches will hopefully direct and encourage more industry members to embed a more holistic approach to their trade, and actively promote the use of the nutrition support teams.

3) Racecourse food provision appears to be an ideal target for the industry to implement best practice given the daily racing calendar therefore future work should look at strategies to optimise nutrition based on jockey needs.

This initial study sought to debate, rather than dictate the athletic status and professional practices of the horseracing industry. The findings from this study suggest whilst some good practice occurs, cultural barriers inhibit the widespread development of optimal

athletic practices in jockeys. The development of an education or behaviour change platform may be the most effective way to challenge and remedy the current position.

Reflections on the Research Journey: Racing Silks Syndrome

I can now call myself a Researcher-Practitioner, I think. Up until this point I had been a nutritionist within horseracing who had only talked about and planned research. After completing the initial study, I am now (technically) on the research path.

During this first study I learnt and experienced how, and maybe why, the work of some researcher-practitioners has the ability to be fantastically insightful, more-so than perhaps a dedicated researcher who is alien to subcultures such as the ones that exist in professional sports, and undoubtedly within horseracing. During one-to-one interviews with jockeys and members of their support entourage throughout Study 1, I uncovered some raw and forthright opinions on how jockeys feel about the industry that supports them, and how this industry perceives jockeys in return. It occurred to me during early interviews, and confirmed in subsequent ones and upon my own reflections (often during long drives back) that the purity gleaned during interviews was in part down to my position within the industry as a practitioner long before I assumed the role of being a researcher also. Often, the so called 'white coat syndrome' may alter the way in which participants choose to engage, or if they choose to engage at all. Instead, I think I may have swapped the metaphorical white coat for a set of racing silks, and in this sense the industry were talking to me much more openly. I believe the success of this initial study (relative to its aims) was in part down to my role and familiarity with the industry as a practitioner first. I could speak their lingo, I understood their etiquette, I could make meaningful small talk to build up trust before the Dictaphone light came on.

A more privileged and honest insight into the thoughts and perceptions of the racing industry ultimately delivered direction on where this research could and should go next, namely focussing on education and racecourse food provision.

As a researcher I achieved the aims of the initial study however I realised quickly that it was also opening my eyes and expanding my knowledge and understanding as a practitioner in a way that solely being a practitioner could never have done. Acting in the interest of a researcher I asked questions to jockeys I probably wouldn't necessarily ask them as a practitioner, and I spoke to people such as agents and trainers in a capacity that I also never normally would do. In doing this, I learnt an unfathomable amount and was able to build a landscape that not only would provide direction for research, but would help me in a separate capacity as a nutrition practitioner.

Chapter 3

Study 2: The Development of a Sport-Specific Nutrition Education Platform Grounded in COM-B and Behaviour Change Wheel Theory

STUDY MAP

STUDY AND AIMS	OBJECTIVES	OUTCOMES
STUDY 1 Explore the perspectives of key stakeholders within the horseracing industry on their perception of nutritional and weight making practices of professional jockeys	1. Determine dietary practices of jockeys and their perceptions of the factors that influence nutritional decisions and behaviour 2. Establish perceptions regarding the identity of jockeys as professional athletes 3. Identify the perception of jockeys and current weight-making strategies by other industry professionals (agents, trainers, coaches, racecourse clerks) 4. Determine the perceptions of existing food provision at race-courses	1. Widespread knowledge and perpetuation of archaic weight-making practices. 2. Contention over the athletic identity of jockeys and may influence nutrition behaviours. 3. Trainers and Agents have a strong influence on weight-making practices. 4. A systemic lack of nutrition education across the industry and need for redevelopment.
STUDY 2 Develop an industry-specific nutrition-education platform for professional jockeys	1. Use co-creation methods to obtain the conceptual thoughts and ideas from a range of stakeholders within the racing industry on the content and design of a nutrition education platform for professional jockeys 2. Identify potential barriers to the successful development and implementation of a nutrition education platform 3. Map concepts to a behaviour change theory model to ground in behaviour change science and construct interventions. Design an industry and context specific nutrition education platform for jockeys	
STUDY 3 Implement and pilot the developed education platform direct into the horseracing industry	1. Pilot the developed education platform for one licensing cohort allowing new feature to be piloted and experienced 2. Preliminarily evaluate the effect of the new platform on nutrition knowledge via a NKQ Preliminarily evaluate the effect of the new platform on dietary behaviour via EAT-26 and 24-hour recall analysis	

Introduction

In light of the findings of Study 1 and recommendation to develop an industry-specific nutrition education platform, this second study aims to pursue this suggestion. Study 1 suggested a more comprehensive education may equip jockeys with the required knowledge and skills to manage weight more safely. Previous work from Wilson *et al.* (2015) has already identified that attitudes and behaviours towards food remains unchanged despite following successful prescriptive diets, therefore a deeper understanding of nutrition knowledge may help facilitate attitude and behaviour change. Nutrition education studies in other sports has proved successful in improving food knowledge (Cholewa *et al.* 2015, Doyle-Lucas and Davy, 2011) however its effectiveness on the psychology and participant's relationships with food was unreported. Education or capability is a fundamental component of behaviour change (Michie *et al.,* 2011) however needs to be done in consideration of other factors such as the environments in which athletes train, compete and socialise in, as well as their own motivation to change or perform the desired behaviours. To accommodate this and to create a valid nutrition education platform the present study applied the Behavior Change Wheel (BCW) framework, underpinned by the Capability Opportunity Motivation Behavior (COM-B) model (Michie *et al.,* 2014).

Based on the social and cultural challenges associated with weight-making amongst professional jockeys identified and discussed in Study 1, the development of any education platform should be designed in collaboration with the industry members to yield a greater chance of success. Collaborative approaches to education development, referred to as co-creation or co-development, is a method used curriculum development both within schools and higher education institutes (Bovill, 2014). To our knowledge, this approach has never

been used in professional sport to develop an intervention for its athletes. Therefore, the aim of this research is to utilise the BCW to develop an industry-specific nutrition education platform for professional jockeys relating to nutrition and weight-making practices. We intend to do this by collating industry-wide input and use this to develop a socially valid and evidence-driven intervention. The agreed objective for Study 2 are:

1. Use co-creation methods to obtain the conceptual thoughts and ideas from a range of stakeholders within the racing industry on the content and design of a nutrition education platform for professional jockeys
2. Identify potential barriers to the successful development and implementation of a nutrition education platform
3. Map concepts to a behaviour change theory model to ground in behaviour change science and construct interventions.
4. Design an industry and context specific nutrition education platform for jockeys

By documenting the process we also hoped to create a framework that can be replicated by practitioners in other professional sports where education or behaviour change platforms may be needed.

Methods

A four-stage approach to the development of an intervention was followed in a similar manner to previous intervention design research (Connell *et al.,* 2015). Stage one involved recruiting a diverse participant group made up of multiple industry stakeholders including jockeys to reflect the industry-wide approach proposed. Stages two and three revolved

around intervention design by the groups, whilst the final stage was analysis by the research group.

Intervention Design Group Participants

Two groups of participants were recruited to contribute to the design of the education platform: a) athlete support personnel (ASP) (n=12) (made up of performance nutritionists, physiotherapists, secretaries/executives of industry bodies, medics, psychologists, jockey coaches, and retired jockeys), and b) licensing jockeys (n=6) (currently attending their professional licensing course). Input was sought from a range of industry professionals and not solely jockeys to better facilitate the platform's development, drawing on the experiences and knowledge bases of several, rather than one exclusive group. Ethical approval was granted from Liverpool John Moores University's ethics committee. ASP operating within the industry were invited by email to participate. Licensing jockeys were contacted via a gatekeeper who administrated the jockeys' licensing courses at one of the UK's licensing schools.

Co-creation Workshops

Data was collected in two phases, with the initial phase being a co-creation workshop. A schematic of data collection is illustrated in Figure 8. Co-creation workshops took place at the university for the ASP group, and at one of the UK's licensing schools for the jockey group. For feasibility and to gain a better insight, the ASP group were divided into two groups of six participants – meaning in total there were three groups of six participants. A brief presentation was given by the lead researcher to outline the concept of developing a platform and the COM-B model before participants took part in a 60minute co-creation workshop.

The co-creation workshops provided an opportunity for group members to collectively spawn and discuss ideas in relation to developing a new education platform, taking into account the need to develop the capabilities (knowledge and skills), opportunities (physical and social), and motivation (reflective and automatic) of jockeys to manage their weight safely. Providing a space for such discussions allowed stakeholders to jointly identify and define problems and subsequently co-create and provide solutions to suit the context and real world-ness of professional horseracing. Groups were directed to include within discussions how a new platform would best be structured, what content needs to be included, how it may be delivered, and who and/or where should aspects of it take place. Additionally, groups were asked to consider the main perceived barriers for why a new platform may fail to succeed.

Group Interviews

Semi-structured group interviews took place shortly after the co-creation workshop so information and ideas were still familiar. A conversational and informal approach was adopted by the interviewer to develop rapport between the group and improve contribution and depth of responses. Open-ended prompt questions such as “what content do you feel needs to be included in the intervention?” and “how should content be delivered?” were asked to allow the groups to then direct the conversation. The group navigated its way through the areas discussed during the workshop, seeking the participants’ opinions and ideas on concepts such as educational content required to be delivered to jockeys, the delivery methods, and from an organisation perspective, the best format for it take for feasibility and success. Group interviews were recorded using a Dictaphone and were transcribed verbatim, with average interview length lasting 55minutes.

Data Analysis and Development of Intervention

All transcripts were uploaded to software package NVivo11 to facilitate the six-stage process of thematic analysis (Braun and Clarke, 2006) as explained in depth within Study 1 of Chapter 2. Once general dimensions and higher order themes were established, suggestions for intervention functions and content within these were mapped onto the BCW to create industry-specific intervention functions.

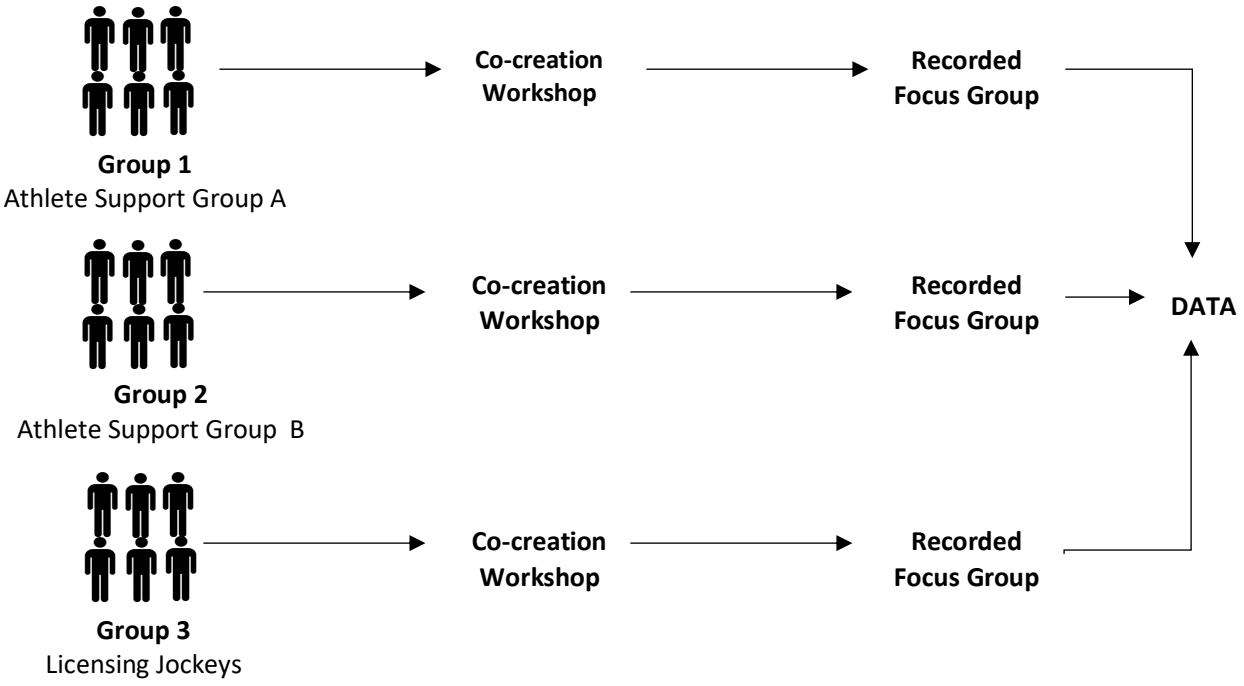


Figure 8. Data collection group schematic

Results

This section is split into three sub-categories (a) the co-created ideas of the horseracing industry, (b) mapping of the ideas onto the BCW, and (c) a co-created behaviour change intervention in the context of horseracing.

Co-Created Ideas of the Horseracing Industry

Themes generated via analysis of the groups interviews are delineated using verbatim quotes to highlight the groups' thoughts and ideas. Table 11 illustrates four general dimensions that were developed through the group interviews; (1) Content of the Platform, (2) Format and Structure, (3) Personnel and Delivery Style, and (4) Perceived Barriers to the Success of a Platform. Higher order themes within these dimensions are indicated by the use of italic text.

Content of the Platform

This dimension outlines what is perceived to be the most necessary content to be delivered in a potential education platform, with the focus much on developing young jockey's capabilities (C within the COM-B model). Three themes embodied this general dimension; *Applied Content and Practical Skills Relevant to the Real World, Scientific Support During Licensing,* and *Benefits and Hazards to Health & Performance.*

All groups considered *applied content* and offering *practical skills* that helped facilitate daily weight management and athletic performance was the most relevant content to educate jockeys on.

> *"The end idea is that the jockey has an understanding of what a healthy diet is and how to achieve that, going through practical application and cooking and how to perhaps manage his own diet, weight, etc."* (ASP Group 1)

It was expressed that there was little need to teach a bank of theoretical knowledge relating to food science, or anything other than the superficial properties of individual nutrients. Jockeys appeared ardent on learning content that they felt addressed the *real world problems*

in their lifestyles as jockeys, in favour of what they described as *"generic information"* where they may have to bridge the gap between knowledge and application themselves:

> *"Rather than giving us generic information, we need it to be applied so we can actually use it in daily life. Like in real world format. Tell us what to eat, how much to eat, and the best times of day to eat."* (Jockey Group)

The proposed content contributes to a positivist curriculum, focusing on the beneficial effects and changes that can be embedded into a jockeys lifestyle. Including access to *scientific support during licensing* was promoted, effectively establishing its necessity and role in professional horseracing, and its use in nutrition and weight management from the very start of their career, potentially developing their reflective motivation (M):

> *"Something that could be made part of the licensing course, or make it a condition that very soon after they've got their license they had to do one day at the university for science support, DEXA scans etc."* (ASP Group 2)

Format and Structure

This dimension discusses the logistics of the proposed platform, in terms of format and dissemination to athletes. Three themes represent this dimension; *Adopt Evidence-Based Lifestyle Whilst Licensing, Social Media Platforms for Continuous Education,* and *Racecourse Education Material*.

The current licensing process for UK jockeys requires attendance to a two-week residential licensing course, with a curriculum covering the range of aspects associated with being a professional jockey. All groups spawned similar ideas that this initial period at the beginning of their careers, motivation (M) to maintain best nutrition practices once licensed should start at the licensing schools. In order to create good habits, groups suggested that licensing courses *adopt an evidence-based lifestyle*, and be used as an immersive experience for licensing jockeys to learn and practice first-hand how to safely and effectively manage their weight using nutrition around the existing curriculum:

> *"At the racing schools for the licensing course, that should be the first two weeks of getting them into the habit of getting up in a morning, doing 30 minutes (exercise), and getting six, smaller, protein rich meals a day…"* (ASP Group 1)

Whilst the wider core curriculum of the course still needs to be delivered, the structure of the days could be altered to accommodate smaller and more regular food intakes, rather than the current format of three main, larger meals. These changes would facilitate better opportunity (O) to perform the desired dietary behaviours. All groups acknowledged that the licensing course alone will not achieve the required level of learning and practice of optimal nutrition strategies, therefore *continuous education* upon conclusion of the licensing course, to consolidate and reinforce the nutrition education is necessary. The notion of *social media platforms* was strongly discussed to facilitate this:

> *"Whatever you do at the licensing course, there has to be another vehicle that continues the message, whether it's an app or social media for videos and information."* (ASP Group 2)

Given the various platforms available and the flexibility they can provide in delivering education, groups discussed the diversity and consistency it could provide, including private messaging groups, short videos, infographics, and push messages either through the development of a racing-specific app, or using existing social media platforms such as WhatsApp, Twitter, and Instagram. Whilst the concept of social media appears both warranted and useful in a potential education platform, groups recalled that mobile devices are prohibited in weighing rooms during race-meetings, with some jockeys spending several hours there per day, therefore advocating *weighing room material* would need to be non-internet based. Similarly weighing room food should be in-line with jockeys education to provide more conducive environments (O) to eat well and provide nutrition information to provide social nudges towards better food (M).

Personnel and Delivery

The third dimension focuses on individuals who are perceived to best deliver any education or training. Three themes make up this general dimension; *One-to-One Support, Industry Acquainted Nutrition Experts, and Jockey Role-Models.*

The groups when interviewed established the necessity for *nutrition experts* that engage with jockeys are *industry acquainted,* having a good understanding of the challenges they face:

"For nutrition experts who work with jockeys, they need to be experts in nutrition but also have a very good understanding of horseracing too for it to work, or a lot of what you might tell us could be useless." (Jockey Group)

To help bridge the gap between nutrition knowledge and industry awareness, and to increase a young jockeys motivation to use evidence-based approaches, the use of *jockey role-models* who have either re-trained in nutrition, or are currently integrating optimal nutrition strategies effectively within their own career in the saddle were discussed.

Given the traditions of horseracing in learning from experienced elders, jockeys described the potential positive impact of using role-models alongside qualified nutritionists in educating them:

"We would 100% listen to ex-jockeys on how to make weight, especially the ones who were very good or masters at it… the ones who didn't' have to use the baths and the saunas, (and) go for runs" (Jockey Group)

Perceived Barriers to the Success of Platform

This final dimension focuses on the potential obstructions to the success of a new education platform. Two themes constitute this general dimension; *Reluctance by Trainers & Older Jockeys,* and *Lack of Central Co-ordination & Funding.*

Given the multiple stakeholder groups who all provide varying degrees of support directly to jockeys, the group interviews suggested it would be unclear and potentially raise conflict as to who should *fund* any intervention either in its entirety, or the individual facets. Similarly,

given its industry-wide ambitions, it was also raised that a lack of *central coordination* would likely jeopardise the operational success of a new education platform and its multiple parts:

> *"There's so many different bodies, there isn't one body that says 'right, this is what we're going to do' in racing. There is definitely a need for one person, or one body of people to co-ordinate it and work with the various bodies individually."*
>
> (ASP Group 2)

Table 11. The Co-Created Ideas of the Horseracing Industry

EXAMPLE QUOTES	HIGHER ORDER THEMES	GENERAL DIMENSION
"Rather than just giving us generic information, you need it to be applied so you can actually use it in daily life. Like in real world format." (Jockey Group)	Applied Content and Practical Skills Relevant to Real World	Content of Platform
"We want them to access sports science and nutrition support… why don't we make coming here (LJMU) part of the course?" (ASP Group 1)	Scientific Support as Part of Licensing Course	
"I think we should talk quite a lot about the adverse practices, most of the jockeys don't realise how dangerous it is." (Jockey Group)	Benefits and Hazards to Health & Performance	
"I think a two-week licensing course which is much more integrated rather than just lecture, lecture, lecture – reform it and say 'these are the best practices and this is the lifestyle you're going into so get yourself in to it' and we prepare them for what they're actually going to do." (ASP Group 1)	Adopt Evidence-Based Lifestyle Whilst Licensing	Format and Structure of Platform
"Social media – Facebook, Instagram or something. These would be best for sharing pictures, simple information, videos especially." (Jockey Group)	Social Media for Continuous Education	
"Just little reminders and mental cues to what you should be doing cos like I say some of the food in the weighing room is not made for people that need to be light… maybe simple information on the food that is there so we sort of know what we are eating" (Jockey Group)	Weighing Room Material	
"Everyone's different so obviously you need to determine a person's weight and things like that and where they need to go from there." (Jockey Group)	More One-to-One Support	Personnel and Delivery
"For nutrition experts who work with jockeys, they need to be experts in nutrition but also have a very good understanding of horseracing too for it to work, or a lot of what you might tell us could be useless." (Jockey Group)	Industry Acquainted Nutrition Experts	
"Everyone in our group said the same, to use jockey role-models as roaming ambassadors and it would be rewarding for them too. Jockeys listen to jockeys." (ASP Group 2)	Jockey Role-Models	
"Jockeys that have been doing it now for 15-20 years, forget them, you're not going to change them. They've learnt what works for them and I think it's too late." (ASP Group 1)	Reluctance by Trainers and Older Jockeys	Perceived Barriers
"We need to be more cohesive and not go off in our individual groups… There's a need for co-ordination" (ASP Group 2)	Lack of Central Co-ordination and Funding	

Eluding to the multiple industry bodies within horseracing, phrases such as *"too many chiefs"* suggested that without a central coordinator to harmonise which industry body would facilitate specific aspects of an industry-wide platform, it would lack cohesion and standardised delivery.

Mapping Ideas onto the Behaviour Change Wheel

The content discussed within the workshops and group interviews was successfully applied to the BCW. Table 12 summarises the intervention functions and policies selected to deliver the suggested changes and/or innovations to the existing support. Content during the group interviews referring to developing the knowledge and skills of jockeys relate to improving their capability (C), using intervention functions of 'training' and 'education' to facilitate it. To enable this, the policies identified relate to the development of, or amendment to guidelines given to licensing schools, and a communication and marketing strategy to facilitate a broader educational approach. This logic was applied to the entire data set to establish intervention functions and policies to promote opportunity and motivation for behaviour change. The colour scheme of the existing COM-B model was maintained for continuity.

Table 12. Co-created Ideas Mapped with COM-B and BCW model

Element of COM-B Model	Component	Intervention Function	Policy Used	Applied Example
CAPABILITY	Physical	Training	Guidelines	Changes to licensing course education / include more practical
	Psychological	Education	Guidelines	Changes to licensing course education
			Comms & Marketing	Poster campaigns and social media use
MOTVATION	Automatic	Persuasion	Guidelines	Food information cards at races
	Reflective	Modelling	Giudelines & Service Provision	Jockey role-models & jockey athlete ambassadors during licensing and beyond
		Education	Giudelines & Service Provision	Promotion of athlete/SES support services – benefit health & performance
OPPORTUNITY	Social	Education/Training	Service Provision	Education & CPD days for racecourse caterers
		Persuasion	Environment Planning	Poster campaign and food info at meals
	Physical	Enablement	Guidelines & Regulation	Correct / conducive foods at schools and racecourses
		Restriction		
		Environment	Environment Planning	Food layout, social nudges, support services information / posters in relevant place

A Co-Created Nutrition Education Platform

Based on all participants input, Figure 9 illustrates an industry-specific nutrition education platform, developed through the combined spawned ideas from jockeys and the ASP groups and grounded in behaviour change theory using the BCW. Its delivery can be separated into two distinct periods, 1) licensing, and 2) continuing career.

Licensing

Requiring any spawned ideas to fit within the existing two-week long licensing course, four clear areas were created and prioritised. To provide the physical and social opportunity to develop the desired nutrition behaviours, rather than maintain the current eating strategy of three main meals, licensees should adopt the *evidence-based lifestyle* (Wilson *et al.,* 2015) during the licensing programme, eating six smaller meals per day of increased protein and moderate carbohydrate, with a structured bout of exercise. By maintaining this lifestyle for two weeks, it provides licensees with a lived, immersive experience of weight-management for professional weight-making athletes developing their knowledge and psychological capability. During their nutrition module, emphasis will be given to *practical skills development*, teaching jockeys how to cook and prepare multiple conducive meals options. In support of developing motivation and to similarly bridge the gap between education and racing, the use of *jockey guest speakers as role-models* should be embedded, potentially developing their reflective motivation and inspiration to imitate optimal practices. This allows for young jockeys to see what experienced riders currently do and provides opportunity to ask applied questions. Finally, given the need for individualised support and the increased availability of industry nutrition services, licensing jockeys should be given the opportunity to engage with leading *Sport and Exercise Science Support,* allowing individual strategies to be established alongside general information.

Continuing Career

Acknowledging that a two-week licensing course alone will unlikely facilitate widespread changes to eating behaviours and develop a robust nutrition education, three post-licensing functions were determined. To maintain capability, the use of *social media* to reinforce the

key principles of optimal nutrition for health, weight management and riding performance, as well as applied content such as videos and recipes to follow. Social media could also be used for jockeys to access real-time advice through private chats if required. To develop conducive environments and opportunities to engage in best practice within the real-world of professional racing means upholding changes to the catering standards and guidelines for racecourse food provision (reinforcing the recommendation from Study 1). Food provision should reflect what is taught during the licencing schools with nutritional information available to help make more informed food choices. In addition, education material will be provided for racecourses to deliver through poster awareness campaigns, and TV clips to be made available within the dressing rooms. Finally, maintaining the already in place *jockey education seminars* to develop further the education provided during licensing, and make mandatory for all newly licensed jockeys to receive a minimum of a single *one-to-one* nutrition support session.

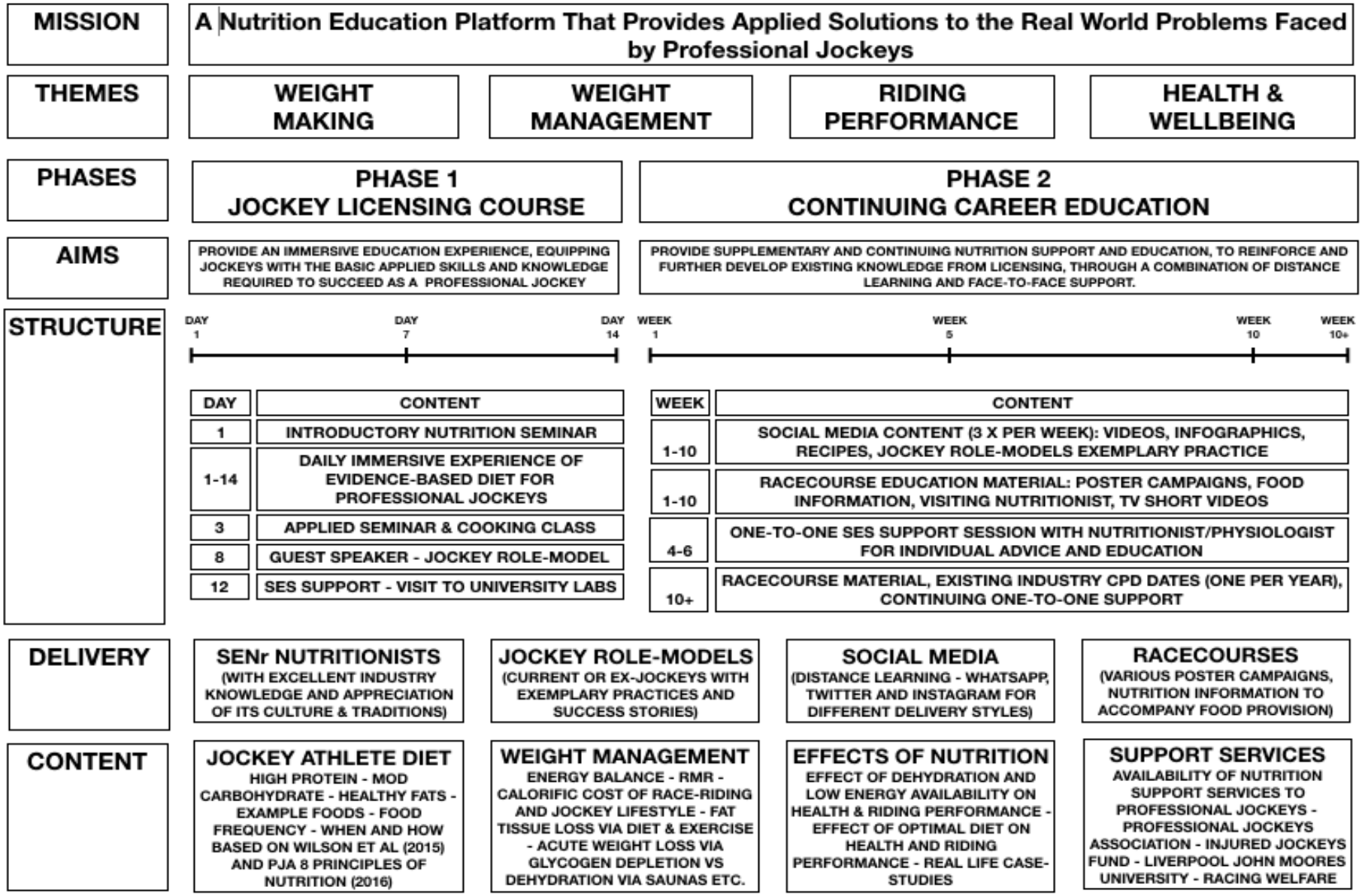


Figure 9. A co-created nutrition education model for professional jockeys

General Discussion

This research aimed to design an industry-specific nutrition education platform for professional jockeys relating to nutrition for health, wellbeing and performance. We believe this is the first study to utilise athletes and the support network within a professional sport to co-develop an education platform. We have applied a systematic and evidence-based process to the analysis of group interview data to develop a product intended to improve knowledge and subsequently behaviour relating to weight management strategies and the incidence harmful rapid weight-loss methods.

Similar to previous intervention design studies, this research involved multiple stakeholders in the design and functionality of a potential intervention (Alexander *et al.,* 2014; Connell *et al.,* 2015; Curtis *et al.,* 2015). Using jockey athletes themselves alongside former jockeys and the support network around them, all groups when interviewed intimated the need for a multi-faceted intervention.

Analysis of coded group interview transcripts allowed a refined understanding of the existing barriers to jockeys engaging in optimal nutrition, yet more pertinently identified the perceived enablers that may improve their dietary and weight-making behaviour. Applying these findings through the BCW has facilitated the development process of a multi-faceted industry-specific intervention.

Providing an environment to better learn and 'live' the principles of optimal nutrition during the licensing process developed as a strong theme. This approach was believed to be more conducive to developing the required capabilities through better learning and retaining of

knowledge, than orthodox classroom-based workshops alone. Participants felt this was an ideal opportunity to actively embed nutritional practices that have a scientific evidence base (Wilson *et al.,* 2012, 2015) into their daily lifestyles. Learning applied knowledge and skills would equip them with solutions to the challenges they would face in the real world of professional race-riding.

When applied to the BCW, the concept of a more relevant and applied licensing curriculum nurtures the physical and psychological capabilities of athletes with respect to nutrition, through hands-on cooking, meal preparation skills, and the knowledge of how to do it. It is timely therefore to do this during the licensing programme as this occurs during the infancy of their careers. Applying this element of the wider intervention at the licensing school may also provide a supportive environment, providing young athletes the physical and social opportunities to develop and practice such skills and behaviours.

The use of sport and exercise science support within horseracing has expanded in recent years (Wilson *et al.,* 2014) with an increasing number of empirical studies relating to the health and performance of jockeys. Perhaps in acknowledgement to this, the integration of sports science support within the licensing process was a key area of interest within group interviews. Further integration of science support within the intervention may promotes its value to jockeys and contribute to them developing a stronger identity of being a professional athlete. This phenomenon may not exist in other sports however does within horseracing and has been identified and discussed as a contributing factor to poor nutrition and lifestyle habits within Chapter 2. By promoting the benefits of, and engaging with performance

sciences within early career education it may help to develop reflective motivation through developing a greater sense of professionalism.

Jockeys expressed the opinion that any 'expert' (e.g. nutritionists) who engages with them should also be well acquainted with the industry so as to provide valid knowledge and support services. This is noteworthy given that the lack of understanding from extra-industry professionals could in part explain the insular tendencies of jockeys that seek nutritional guidance and support from their peers rather than suitably qualified nutrition professionals (Moore, 2002). Suggestions from all parties to integrate retired and current jockey role-models as a medium to transmit information, or inspire others to emulate their practices seems logical. The use of role-models as a form of education and to develop motivation is widely used in health-care, medicine and entrepreneurship to support both knowledge development and practical competence relative to their careers (Entrialgo & Iglesias, 2018; Jack *et al.,* 2017; Rahman & Day, 2015), however its use in professional sport is not documented in literature. Transmitting knowledge, skills and attitude through a person deemed worthy of emulation by the learning group is a powerful strategy (Perry, 2009). Specifically, early career professionals who are excelling and may only be a few years ahead of the learner may be more impactful due to their relatability and the capacity it allows for learners to visualise the progress made (Kuckertz, 2011). The use of role-models within the present intervention to further develop motivation to improve dietary practices is therefore a necessary inclusion.

The need for continuous intervention functions that ensues the licensing (or athlete development) programme is needed. The use of social media platforms may be the most

relevant and desired for continuing education given the described daily interaction between jockeys and their smart devices, a behaviour that aligns with the trends of the general population, where 90% of people aged 16-34 are active on social media (Office for National Statistics, 2017). The age groups of current licensing jockeys suggest they have limited or no experience of a world without smartphones and social media (Shatto and Erwin, 2017). Within this group, it is suggested that social media is now the preferred mode of accessing information (Newman *et al.,* 2017). Existing platforms such as Facebook, Instagram and WhatsApp can offer a realistic and cost-efficient approach to providing information or education. Emerging evidence implies social media interventions may be effective in improving both nutrition knowledge and dietary behaviours (Nour *et al.,* 2016; Pagoto *et al.,* 2013). Facebook and WhatsApp private groups moderated by health professionals have proved effective in smoking cessation (Cheung *et al.,* 2015) and weight loss (Napolitano *et al.,* 2013) in recent studies. Providing a social-media based platform to newly licensed jockeys may therefore promote the likelihood that best practices taught and practiced during licencing are maintained. Where 90% of young adults profess to trusting social-media based health and nutrition information (PricewaterhouseCoopers, 2012), the risk of athletes being misinformed is genuine, therefore the presence of a reliable and evidence-based information hub for professional jockeys is perhaps necessary as much as desirable.

Current legislation inhibits the use of mobile and smart devices within the dressing room at racetracks. In consideration of the time spent at racecourses by some jockeys, access to information via social media platforms may be restricted. Education material within the dressing rooms themselves may pose a suitable alternative during these periods. Passive interventions such as poster campaigns can be an effective method of disseminating

information without the need for active participation (Marx *et al.,* 2010). Very little is known about the effectiveness of this model of broad educational campaigns (Marx *et al.,* 2008) however a previous study showed to improve knowledge surrounding the effects of disordered eating (Duffy and Henkel, 2016), an area particularly relevant to jockeys given reports that 86% of jockeys routinely engage in disordered eating and acute weight loss (Dolan *et al.,* 2011). An ongoing study aligns its poster campaign material on the detrimental effects of smoking on health, to a smartphone education application that provides further information (Brinker *et al.,* 2016). A similar approach could be established within racing, associating a potential poster campaign function with the social media content to deliver a multi-faceted approach to consolidate the principles learned during licensing. The use of TV media can similarly be used as part of a wider passive education platform (Marx *et al.,* 2008). Given the numerous televisions present in dressing rooms showing live racing, short informative adverts could be integrated to be shown between races. Previous TV media campaigns in the form of short documentaries (3-10minutes) within horseracing covering concussion, mental health, and nutrition (Jockeys Education and Training Scheme, 2016) have proved effective in jockeys seeking professional support as a result of engagement. With videos delivering personal accounts and advice from leading jockeys, the success of these videos similarly reinforces the effectiveness of employing role-models in disseminating and sharing information. Collectively, these intervention functions not only support knowledge, but when rolled out on an industrial scale across the 1509 race meetings per year, may start to promote a more accepting culture and supportive environment towards sensible weight-making.

The redevelopment of racecourse food provision has been recommended in Chapter 2 and echoed within the group interviews of this study. Given the daily interaction between racecourse catering and jockeys, it is acknowledged as the primary opportunity to engage or relapse in desired behaviours depending on what it provided. Restriction of calorie-dense foods and promotion of foods conducive to weight management would enable jockeys to practice optimal nutrition. This function could be underpinned by regulatory change and supported with guidance for catering personnel.

Challenges to the successful implementation of a new behaviour change intervention within the industry exists. Organisational or central barriers may endure in the form of inadequate funding for projects and/or resources, or through a lack of coordination in the multifaceted delivery of a platform. A lack of funding has previously been cited for a lack of jockey support within racing and discussed also within Chapter 2, therefore the structure and funding of an intervention needs to be considered and established in advance.

Conclusion

This study demonstrates that the BCW can be applied in the collaborative development between professional athletes, in this case jockeys, and the support network around them of an industry-specific nutrition behaviour change intervention. Using an evidence-based approach this study has identified multiple areas available to develop jockey's capabilities, opportunities and motivation to engage in optimal dietary behaviours and reduce hazardous weight-making practices. Intervention functions can be applied during both the infancy of their careers to embed automatic motivation alongside capability development in a supportive and opportune environment, and built upon further with interventions within their competitive career. Whilst the designed intervention is specific to horseracing the

methodology in reaching it is highly transferable and hopefully acts as a blueprint for other practitioners to follow. A pilot study implementing the intervention is now required.

Reflections on the Research Journey: Herding Cats

There were multiple points during this second study that made me value (in a positive sense) being a practitioner-researcher. Working exclusively as a researcher without the knowledge or experiences I hold as a practitioner within the sport of horseracing, I could have and quite possible would have altered the scope of the research and the methods. Logistically, executing the methods described throughout the chapter was incredibly difficult and relied on a number of people (the athletes and support personnel) all with their own day jobs, who were located the length and breadth of the U.K., and who had no obligation to, to commute and convene at Liverpool John Moores University on the same day. It was if not for a better phrase, like 'herding cats'. As a practitioner however with insights and knowledge of how nutrition-education reform was needed, this galvanised me to continue with the planned collaborative approach, which research aftercall informed me is the best way of developing an effective intervention. I thought in a way that an industry-evacuated researcher may not, and to think like someone who already works in the industry. I needed to be pragmatic (as was my entire approach to the research) – 'what would be in it for them?' other than simply taking part in research? I decided to make a potential trip to Liverpool for participants more worthwhile than simply partaking in a research study. I also hosted an industry staff 'away day'. In this sense, the morning of the data collection day was an industry focused CPD day where other speakers presented and was a chance to meet and collaborate on other industry projects, where the afternoon was research focussed and the aim was to engage in the described co-creation workshops and group interviews.

The organisation of such an event was challenging, both in the logistics and the anxieties for me personally it caused – would people show up on the day? Would it run smoothly? Would the morning's activities be perceived as high enough value to warrant the journey to

Liverpool? Would they still have enthusiasm to for the afternoon, when I needed them most? And perhaps most importantly, would they collaborate well?

Upon reflection, the day worked out well. The morning was valued and data was successfully attained through the afternoon. But was it as successful as it could have been? During the afternoon, the co-creation groups were not recorded, it was dedicated as time to think creatively to spawn concepts for the potential new platform. The data was captured through the group interviews that took place shortly after, so the data captured, in my mind at least, would not be creative ramblings (and would be a nightmare to transcribe and code), but more so a concise and collected account of the co-creation process. In retrospect, perhaps it would have been useful to capture those raw moments also. I wonder if there had been further useful content during those unrecorded discussion that were somehow filtered or ironed out that didn't make it through to the group interviews.

Ultimately, I had my reasons for maintaining the methods I did, the main one being the pragmatist that I am. At the time of planning, it simply made more sense to do it that way. If being a pragmatist in this sense maybe limited the rawness and purity of some of the data I captured, I need to remember that it was my actions of being a pragmatist that also what got participants to travel at Liverpool in the first place.

Chapter 4

Study 3: The Implementation and Evaluation of a Nutrition-Education Platform Grounded in COM-B and Behaviour Change Wheel Theory: A Pilot Study

STUDY MAP

STUDY AND AIMS	OBJECTIVES	OUTCOMES
STUDY 1 Explore the perspectives of key stakeholders within the horseracing industry on their perception of nutritional and weight making practices of professional jockeys	1. Determine dietary practices of jockeys and their perceptions of the factors that influence nutritional decisions and behaviour 2. Establish perceptions regarding the identity of jockeys as professional athletes 3. Identify the perception of jockeys and current weight-making strategies by other industry professionals (agents, trainers, coaches, racecourse clerks) 4. Determine the perceptions of existing food provision at race-courses	1. Widespread knowledge and perpetuation of archaic weight-making practices. 2. Contention over the athletic identity of jockeys and may influence nutrition behaviours. 3. Trainers and Agents have a strong influence on weight-making practices. 4. A systemic lack of nutrition education across the industry and need for redevelopment.
STUDY 2 Develop an industry-specific nutrition-education platform for professional jockeys	1. Use co-creation methods to obtain the conceptual thoughts and ideas from a range of stakeholders within the racing industry on the content and design of a nutrition education platform for professional jockeys 2. Identify potential barriers to the successful development and implementation of a nutrition education platform 3. Map concepts to a behaviour change theory model to ground in behaviour change science and construct interventions. 4. Design an industry and context specific nutrition education platform for jockeys	1. Licensing curriculum should be structured to deliver a real-world experiential approach. 2. Delivery needs to be by credible and reliable practitioners and/or current/ex jockeys. 3. Embed SES with licensing to normalise and promote its use 4. Continuing education needed post-licensing via social media, racing yards and racecourses. 5. Lack of funding and resistance from trainers key barriers.
STUDY 3 Implement and pilot the developed education platform direct into the horseracing industry	1. Pilot the developed education platform for one licensing cohort allowing new feature to be piloted and experienced 2. Preliminarily evaluate the effect of the new platform on nutrition knowledge via a NKQ Preliminarily evaluate the effect of the new platform on dietary behaviour via EAT-26 and 24-hour recall analysis	

Introduction

Based on the research journey and outcomes of the previous studies within the thesis, this study aimed to implement an intervention directly in the sport. The previous two studies had initially identified the need for a more robust nutrition education provision, then subsequently spawned and developed concepts into a useable, sport-specific education intervention. The logical and necessary progression from Study 2 if we are to effect change in the sport, is to implement and pilot the education platform to measure its effectiveness in the real world environment. This progression therefore means switching the methodological approaches that have ran through Studies 1 and 2 from qualitative constructivist research where the objective has been to understand the experiences of jockeys, to a more quantitative positivist approach, where the objective will be to measure the effectiveness of the platform in an objective manner. Traditional positivist research prefers large participant numbers (Easterby-Smith *et al.,* 2008) however the present study although positivist in its construct, uses only a moderate participant number and adopts the philosophy of a pilot study. Given the cultural and institutional barriers identified in Study 2, and the objective to provide a proof in principle account that the co-developed education platform is effective, moderate participant numbers in this pilot are appropriate.

Pilot studies as a concept are difficult to define due to a lack of methodological guidance from peer-reviewed journals, however the purposes and objectives of pilot studies have been proposed within previous literature who have questioned the position of pilot studies prior to the present thesis (Lancaster *et al.* 2002). Pilot studies can be treated as a 'dummy run' or 'first run' (Ross-McGill *et al.,* 2000; Burrows *et al.,* 2001) allowing all procedures from participant recruitment, data collection, data handling, and analysis to be conducted and reviewed before a larger scale project or intervention. Piloting data collection, and specifically

self-completing questionnaires (which is a feature of the final study) is particularly important to pilot as queries and potential problems with questions and format can arise in a manageable sample size (Carfoot *et al.,* 2002) and be amended for future use. This process is distinctly different from questionnaire validation however which is a significantly more demanding process, the purpose of the pilot is to test or practice its administration (Streiner and Norman, 2015).

Given the developed education platform designed in Chapter 3 has never been implemented, these points align themselves and embody the purpose of this final study. Despite having a somewhat captive audience in the licensing cohorts, adopting a pilot study approach allows the research group to also determine levels of consent rate (Ross-McGill *et al.,* 2000; Burrows *et al.,* 2001) and if there is a willingness to share their data for the purpose of research. Failure to recruit numbers or obtain consent from convenience samples such as the ones within this research study are the main reasons larger scale studies are abandoned (Ross *et al.,* 1999). The structure of the proposed education platform holds the potential to be recommended for implementation within the industry and obtain data to assess its effectiveness over a longer period with larger numbers. If there is a resistance to consent, or there is a lack of appeal (Lancaster *et al.,* 2002) in its present proposed format however, this pilot study should highlight these hesitations.

As the focus of this final study is on piloting the co-designed intervention, its analysis therefore, as with any type of pilot study, shall be mainly descriptive statistics (Bunn *et al.,* 1998; Bauhofer *et al.,* 2001; Carfoot *et al.,*2002) or focus on confidence interval estimation (Burrows *et al.,* 2001). Although hypothesis testing can be used, it is advised to recognise any

results with extreme caution and not to place undue significance on results due to the lack of sample size and power (Lancaster *et al.* 2002; Stevinson and Ernst, 2000).

Given the robust methodology in the previous two studies to develop what is an industry informed and evidence led education platform, the aim of this final study is to implement, pilot, and evaluate the co-developed, industry-specific education platform direct into the horseracing industry. To achieve this, it will achieve the following objectives:

1. Pilot the developed education platform for one licensing cohort allowing new features to be piloted and experienced
2. Preliminarily evaluate the effect of the new platform on nutrition knowledge via a NKQ
3. Preliminarily evaluate the effect of the new platform on dietary behaviour via EAT-26 and 24-hour recall analysis

Methods

Participants

Two groups of seven licensing jockeys were recruited all of whom were attending a two-week duration flat/apprentice licensing course at one of the UK's jockey licensing schools. General group characteristics are detailed in Table 13. Group One identified hereafter as the control group (CG) consisted of five males and two female riders (mean age = 18.2years ± 1.5years; mean weight = 51.6kg ± 2.2kg; mean time as amateur = 4.1years ± 2years). Group Two identified hereafter as the intervention group (IG) consisted of four males and three females (mean age = 19.3years ± 2.8years; mean weight = 52.1kg ± 2.1kg; mean time as amateur = 9years ± 4.5years).

Table 13. Group Characteristics

	Control Group (CG)	Intervention Group (IG)
Age (years)	18.1 (±1.6)	19.2 (±2.8)
Weight (kg)	51.6 (±2.2)	52.1 (±2.2)
Weight (stone and lbs)	8st 2lbs (±4.6lbs)	8st 3lbs (±4.6lbs)
Height (cm)	163.5 (±6.5)	161.3 (±7.9)
Years Riding as Amateur	4.2 (±2)	9 (4.5)
Gender	5Males, 2 Females	4 Males, 3 Females

Licensing Course Education

The CG attended their licensing course as normal and received the standard nutrition education which was already present on the licensing course. This consisted of one nutrition seminar and one cookery workshop.

The IG attended their licensing course which was run as normal however with the inclusion of the newly created education functions being embedded over their two-week tenure. This included an amended menu that aligns itself with jockey-specific nutrition research guidelines (Wilson *et al.,* 2015) which consisted of six smaller intakes per day versus the regular three. Contact with nutrition experts involved an education seminar, a cookery workshop, and a one-to-one consultation to discuss personal and bespoke needs. A jockey role-model guest speaker was also delivered discussing the role of optimal nutrition and training in their lifestyle and the impact on their health, wellbeing and performance. A scheduled trip to university laboratory facilities was unable to take place due to travel feasibility so was substituted by a guest workshop to explain the facilities, testing procedures and the role of sports science in the career of a jockey and its potential benefit to health and performance.

Career Education

Upon completion of the licensing course the CG received no further direct education as part of the intervention as is standard. Like any licensed jockey they were free to access the industry's support networks on a voluntary basis.

The IG received eight-weeks' worth of continuous education via a social media platform in the form of infographics, recipe cards, short videos, examples of role-models performing exemplary practices, and direct messaging. They were also provided with content that would only normally be accessible at the racecourses such as poster campaigns and short documentaries. After four-weeks they were provided with the opportunity to visit the university laboratories for a one-to-one consultation with an industry-acquainted nutritionist to embed personal science-informed nutrition practices.

Measurement of Nutrition Knowledge and Behaviour Change

Participants from both the CG and IG completed a 125-point modified nutrition knowledge questionnaire (NKQ) during the first week of their licensing course to obtain base knowledge. They also completed a typical 24-hour food recall diary, and an EAT-26 inventory to assess eating attitudes and behaviours prior to any education.

Due to the extensive time required to develop and validate a new NKQ specifically for a jockey population, existing ones were modified and used. The recently validated NSKQ (Trackman *et al.,* 2017) and the PKM-11 (Motelli *et al.,* 2016) were adapted and made context specific for the present population as has been done in previous research (Abood *et al.,* 2004; Devlin and Belski, 2015). The modified NKQ was divided into eight subsections (Carbohydrate, Protein, Fats, Vitamins & Minerals, General Nutrition for Health, Hydration, Riding Performance Supplementation, and Practical Food Knowledge) to assess knowledge in both specific areas

of food groups, but also applied knowledge of foods and nutrition health and/or performance. Changes included altering key words such as '100m sprinter' to 'jockey athlete', and contexts such as 'after a track sprinting session' to 'after riding out'. One example of a question change includes "For a jockey trying to lose weight, how much protein should they be eating per day (g/kg BM = grams per kilogram of body mass)" where the original questions referred to protein intake for gaining muscle mass in a track and field athlete. A 24-hour activity and dietary recall of a typical day in their professional lives was performed similar to previous studies with jockeys (Wilson *et al.,* 2015). Given the limitations of 7-day food diaries and the lack of time professional athletes have to complete them independently when in training and/or competition (Bradley *et al.,* 2014), the 24h recall method was preferred. The initial food diary was conducted with support from the researcher (also an SENr Performance Nutritionist) to reduce the incidence of over or under-reporting. The second food diary completed at the end of the 10-weeks was self-reported but were supplied with guidance notes to promote accuracy of recording. Food analysis was completed using a dietary software package (Nutritics, UK). Finally jockeys were asked to complete the EAT-26 inventory to ascertain eating attitudes and identify disordered eating behaviours as has been done in several previous studies with jockeys (Caulfied & Karageorghis, 2008; King and Mezey, 1987; Leydon and Wall, 2002; Wilson *et al.,* 2015). Examples items that participants rated on a Likert-style scale (Always; Usually; Often; Sometimes; Rarely; Never) included *I am terrified about being overweight, I vomit after I have eaten,* and *I am preoccupied with the thought of having fat on my body.* Both groups were asked to complete these three components at baseline (the start of their licensing course) and again ten weeks later (eight weeks post-licensing course).

Data Analysis

Descriptive analysis was performed on nutrition knowledge gross scores and percentages, EAT-26, and data from food recall diaries. Independent T-Tests were also performed on the same variables to assess the difference in change and determine both upper (UCI) and lower (LCI) 95% confidence intervals. Confidence intervals are presented in line with pilot study guidelines (Burrows *et al.,* 2001; Lancaster *et al.,* 2002) with less emphasis placed on the statistical significance or P-Value given the low power available due to pilot study participant numbers.

Results

Nutrition Knowledge

The nutrition knowledge data is summarised in Table 14. Both CG and IG groups displayed improved nutrition knowledge scores 8-weeks post licensing course, captured through the NKQ. The CG improved nutrition knowledge scores (PRE mean:56.4±15.9; LCI 41.7; UCI 71.1; POST mean: 60.9±12.6; LCI 49.2; UCI 72.5; DIFF mean: 4.5±5.7; LCI 0.9; UCI 9.7) whilst IG also improved nutrition knowledge scores with greater difference between pre and post intervention (PRE mean:56.4±14.5; LCI 43; UCI 69.9; POST mean: 71±15.8; LCI 56.4; UCI 85.7; DIFF mean: 14.6±6.9; LCI 8.2; UCI 21). Statistical analysis via an independent paired T-Test indicates a significant mean difference in change between CG and IG of 10.14 (p=0.01) with LCI=2.77 and UCI=17.52. Analyses of mean differences of change are depicted in Table 15. CG percentage scores improved by an average of 3.6%±4.5 (LCI 0.9; UCI 9.7) with mean pre scores of 45.1%±12.9 (LCI 33.2; UCI 57) and post scores of 48.7%±10.3 (LCI 39.2 UCI 58.3). Relative IG scores pre intervention were 45%±11.8 (LCI 34; UCI 56) versus 56.7%±12.6 (LCI 45.1; UCI 68.4) resulting in a mean percentage score improvement of 11.7%±5.5 (LCI 6.7; UCI 16.7). The

mean difference in change between both groups of 8.14 (p=0.01) indicates a significant improvement in knowledge however with confidence interval variance of LCI=2.3 and UCI=14.

EAT-26

Pre and post eating attitudes scores are displayed in Table 14. Both CG and IG groups scored collective mean scores that fall within normal ranges (<20). One participant within each group in the initial tests scored significantly higher than their group peers, increasing standard deviation values.

CG participants recorded a minor improvement towards normal eating attitudes with a mean decrease of 1.4±2.3 points (PRE 8.7±11.7; LCI -2; UCI 19.5 vs POST 7.3±9.7; LCI -1.7; UCI 16.3). IG reported a greater improvement with a mean decrease of 3.3±3.4 points (PRE 11.7±9.2; LCI 3.2; UCI 20.2 vs POST 8.4±7; LCI 2; UCI 14.9) however still overall maintaining higher overall EAT-26 scores (CG 7.2 vs IG 8.4). Neither groups' improvements were statistically meaningful, with a mean difference of 1.86 (p=0.26) and confidence interval LCI=-5.24 and UCI=1.52.

Dietary Behaviours

Dietary habits recorded by 24-hour food recall diaries showed improved eating habits in both groups, with decreases in overall calorie and carbohydrate intakes, and increases in protein consumption, moving closer to the nutritional guidelines for this population (Wilson *et al.,* 2015).

Carbohydrate Intake

The CG had a mean decrease in carbohydrate intake reducing from 5g.kg.bw±0.5 to 4.5g.kg.bw±0.4 (PRE LCI 4.5; UCI 5.5 vs POST LCI 4.2; UCI 4.9; DIFF 0.5±0.3; LCI 0.2; UCI 0.7).

Although still higher than recommended for jockeys it represents a move in the correct direction. Whilst energy contribution from carbohydrates overall was reduced, sugar levels were still considered elevated (135g) compared to recommended levels of 30g or 5% of total energy intake (Public Health England, 2015; Scientific Advisory Committee on Nutrition, 2015) and fibre was still low, despite some improvement on pre-score. A more detailed nutrient breakdown of intake is illustrated in Table 16. The IG displayed a daily mean carbohydrate intake reduction from 5.2g.kg±0.7 (PRE LCI 4.6; UCI 4.9) to 3.7g.kg±0.7 (PRE LCI 3.1; UCI 4.4; DIFF 1.5±0.6; LCI 0.9; UCI 2.1). Fibre intake increased to near recommended levels of 30g.day however was still short, and sugar intake remained high. Mean difference in change between groups was 1.1g.kg.bw (p=0.01) indicating potential significant change following the intervention. 95% confidence interval analysis indicated LCI=0.51 UCI=1.63.

Protein Intake

CG protein intake improved by 50%, increasing relative intake from 1.3g.kg.bw±0.2 (LCI 1.2; UCI 1.5) pre intervention to 1.9g.kg.bw±0.2 (LCI 1.7; UCI 2; DIFF 0.5±0.1; LCI 0.4; UCI 0.6) post. Despite being higher at base line, protein consumption within IG participants also increased from 1.9g.kg.bw±0.2 (LCI 1.7; UCI 1.9) to 2.2g.kg.bw±0.2 (LCI 2; UCI 2.4; DIFF 0.3±0.2; LCI 0.2; UCI 0.5) aligning itself with protein intakes akin to recommendations for this population and other weight-making athletes (Wilson *et al.,* 2012, 2015; Morton *et al.,* 2010). Mean difference in change between groups was 0.2g.kg.bw (p=0.02). 95% confidence interval analysis reported LCI=0.12 UCI=0.37.

Table 15. Analysis of Mean Difference. P-Value via Independent T-Test.

Variable			**95% Confidence Interval of the Dif.**	
	Mean Difference	**P-Value**	**LCI**	**UCI**
Score	10.14	0.01	2.77	17.52
Score %	8.14	0.01	2.29	14
EAT-26	1.86	0.26	-5.24	1.52
CHO	1.07	0.01	0.51	1.63
FAT	0.28	0.78	-0.18	0.25
PRO	0.2	0.02	0.12	0.37

Table 14. Pre, Post and Difference descriptive statistics for both CG and IG. Score is gross score out of 125 questions. CHO (total carbohydrates intake), FAT(total fats intake) and PRO (total protein intake) are all in g.kg.bw.

Variable	Control Group												Intervention Group											
	Pre				Post				Difference				Pre				Post				Difference			
	Mean	SD	LCI	UCI	Mean	SD	LCI	UCI	Mean	SD	LCI	UCI	Mean	SD	LCI	UCI	Mean	SD	LCI	UCI	Mean	SD	LCI	UCI
Score	56.4	15.9	41.7	71.1	60.9	12.6	49.2	72.5	4.5	5.7	0.9	9.7	56.4	14.5	43	69.9	71	15.8	56.4	85.7	14.6	6.9	8.2	21
Score %	45.1	12.9	33.2	57	48.7	10.3	39.2	58.3	3.6	4.5	0.6	7.8	45	11.8	34	56	56.7	12.6	45.1	68.4	11.7	5.5	6.7	16.7
EAT-26	8.7	11.6	-2	19.5	7.2	9.7	-1.7	16.3	1.4	2.3	-1	1.6	11.7	9.2	3.2	20.2	8.4	7	2	14.9	3.3	3.4	0.14	6.4
CHO	5	0.5	4.5	5.5	4.5	0.4	4.2	4.9	0.5	0.25	0.2	0.7	5.2	0.7	4.6	5.9	3.7	0.7	3.1	4.4	1.5	0.6	0.9	2.1
FAT	1.5	0.2	1.3	1.7	1.3	0.1	1.1	1.4	0.2	0.17	0	0.4	1.2	0.3	1	1.5	1.1	0.15	0.9	1.2	0.2	0.2	-0.1	0.4
PRO	1.3	0.15	1.2	1.5	1.9	0.15	1.7	2	0.5	0.1	0.4	0.6	1..9	0.24	1.7	1.9	2.2	0.2	2	2.4	0.3	0.2	0.2	0.5

Fat Intake

Overall fat intake within CG reduced from 1.5g.kg.bw±0.2 to 1.3g.kg.bw±0.1 (PRE LCI 1.3; UCI 1.7 vs POST LCI 1.1; UCI 1.4; DIFF 0.2±0.2; LCI 0; UCI 0.4) indicating further work is needed to reduce fat intake. Although an improvement in global fat intake, saturated fat intake was not reduced (PRE 29g vs POST 30g) indicating that fat intake reduction was from mono and polyunsaturated fat food sources. IG fat intake was marginally lower post intervention (PRE 1.2g.kg±0.3; LCI 1; UCI 1.5 vs POST 1.1g.kg±0.2; LCI 0.9; UCI 1.2; DIFF 0.2±0.2; LCI -0.1; UCI 0.4). Unlike CG, the IG saturated fats intake reduced to approximately one third of total fat intake (18g) versus a 50% contribution (27%) at baseline. Mean difference in change between groups was 0.3g.kg.bw (p=0.78) indicating a lack of significance in eating behaviours towards fats. 95% confidence interval analysis indicated LCI=-0.18 UCI=0.25.

Table 16. Mean calorie and macronutrient intake pre and post for control and intervention

		PRE		POST	
Licensing Group	**Measure**	**Total**	**g.kg**	**Total**	**g.kg**
Control Group (51.6kg)	Kcals	2114		1940	
	CHO's (g)	256	5	235	4.5
	Sugars (g)	114		135	
	Fibre (g)	10.3		16	
	Fats (g)	76.5	1.5	67	1.3
	Saturated	29		30	
	Protein (g)	64	1.3	99	1.9
Intervention Group (52.1kg)	Kcals	2227		1872	
	CHO's (g)	272	5.2	195	3.7
	Sugars (g)	98		115	
	Fibre (g)	17		28	
	Fats (g)	60	1.2	59	1.1
	Saturated	27		18	
	Protein (g)	90	1.7	115	2.2

Discussion

The aim of the present study was to pilot the collaboratively designed nutrition education platform detailed within Chapter 3, and discuss its efficacy in improving nutrition knowledge and effecting dietary behaviour practices of licensed jockeys.

The findings from this pilot study demonstrate the new education platform may contribute to the improvement of nutrition knowledge and associated improved dietary intake relative to the needs of being a professional jockey athlete.

Scores from both groups increased indicating the existing industry nutrition education may have a moderate effect on nutrition knowledge, however the piloted education platform yielded score improvements of over three times greater (CG 3.6% vs IG 11.7%). The reasons behind this are likely due to a combination of the increased quantity and continuous nature of education, with the athletes receiving some form of education or practice every day through their licensing course followed by the social media content for eight weeks. Although delivered through several functions, the underpinning industry-informed design, constructed through Chapter 3 of the thesis is likely the key influence in its efficacy. With that considered, the scale of knowledge improvement is comparable to previous nutrition education interventions in athletic populations. In comparison to the average 11.7% score improvement in the NKQ within this study, studies from Cholewa *et al.* (2015) and Doyle-Lucas and Davy (2011) reported greater increases of 14% and 24.5% respectively. Despite the significant increase of 24.5% in knowledge from Doyle-Lucas and Davy (2011) the knowledge assessment tool within their study was comprised of only 21 questions, meaning the relative impact per question was greater and the near 25% increase may be a matter of only four more correct

answers. The NKQ used within this thesis had 125 scoring points meaning the increase in percentage score would require more new correct answers. The Cholewa (2015) study along with Valliant *et al.* (2012) both utilised the 55-question Reilly & Maughan (2007) Sports Nutrition Questionnaire, it is an unpublished and limited-in-use tool therefore questions its validity. Both being team sport studies however, it was developed for use in team sport scenarios and may rationalise its selection. None of these studies however systematically developed their education intervention or considered grounding them in education or behaviour change theory. Therefore, although citing short-term improvements in knowledge, the lasting effects of these one-off interventions is unknown. Whilst the present study as part of this thesis can't yet claim to affect long-term knowledge and behaviour retention its creation was embedded within the BCW (Michie *et al.,* 2014) and is part of an on-going and continuous education strategy within the industry.

Despite the mean positive increase in knowledge of 11.7% within this study and a prospective significance value of p=0.01, the variability demonstrated with a 95% LCI and UCI range of 2.3-14% highlights the need for greater participant numbers to gain a better estimate of success. Similarly, despite an improvement in knowledge comparable to previous nutrition education research, whether or not this improvement is a meaningful change, that being "*a change that makes a difference to their life or their abilities that they can detect"* (Batterham and Atkinson, 2005)is still unknown.

As previously discussed within the thesis, greater education and nutrition knowledge doesn't necessarily translate into optimal dietary behaviour (Heaney *et al.,* 2011; Spronk *et al.,* 2014). Compared to baseline, the recorded dietary behaviours of the IG improve in certain areas, particularly a decrease in overall daily calorie and carbohydrate intake, and an increase in

protein consumption, three key behaviours for optimal weight management or loss if required in weight-making athletes (Morton *et al.,*2010; Wilson *et al.,* 2015). These changes may be due to messages relating to overall calorie intake and the manipulation of carbohydrates and proteins based on activity levels, promoting a 'fuel for the work required' (Impey *et al.,* 2016) approach being prioritised within the education they received. A similar but more moderate trend was also witnessed within the CG.

Although absolute carbohydrate intake was reduced within the IG, simple sugars or carbohydrates of high glycaemic index value were still elevated. Although necessary in moderation and used to fuel acute bouts of exercise, excess can be contradictory to weight management due to increases in stored muscle glycogen (and intercellular water), increased fat storage, and decreases of satiety (Wilson *et al.,*2014; Jenkins *et al.,* 1989) that may potentially lead to more frequent snacking. The maintained intake of high glycaemic index foods yet effective increase in levels of fibre could in part be attributed to increased fruit intake which contain both simple sugars and roughage, and done as part of taught practice of fuelling higher intensity fitness sessions. As an accurate activity diary wasn't provided for the post-intervention data this can't be determined if jockeys were displaying taught behaviours or maintaining existing habits of eating confectionary as snacks.

Fat intake in both groups improved, however both groups still consumed above the recommended guidelines for their specific population of 0.8-1.0g.kg.bw (Morton *et al.,* 2010; Wilson *et al.,* 2012, 2015). Importantly however, the ratio of saturated fats to mono and polyunsaturated fats improved more-so with the IG who maintained a similar overall fat intake however reduced the source content of saturated fats. Whilst the CG reduced overall

fat intake, saturated fat intake remained constant suggesting that their fat decrease was from reducing desirable fat sources such as oily fish, nuts and avocados therefore subsequently making their omega-3 to omega-6 ratio potentially worse overall.

Eating attitudes measured by the EAT-26 inventory were unchanged, with only minor score changes across both groups. This finding is consistent with several previous studies using this measurement tool within jockey populations (King and Mezey, 1987; Leydon and Wall, 2002; Caulfield and Karageorghis, 2009, Wilson *et al.,* 2015). These results indicate that despite improved knowledge and some improved dietary behaviours that are more aligned with professional weight-making athletes, deeper laying psychological perceptions of foods may require a longer time frame to alter. The use of specific psychological intervention functions therefore, alongside the nutrition education may help facilitate a better relationship with food generally. Alternatively, the low participant number of this study very likely compromises the power of the statistical analysis.

Conducting a sample size estimation with the data set was considered which would provide a recommendation for a future, larger study recruitment protocol. A key component when calculating a sample size estimation however is knowledge of smallest worthwhile effect or meaningful change (Batterham and Atkinson, 2005). Due to a lack of literature in the area, and what exists is made up of small sample sizes it is still unknown what the smallest worthwhile effect is within this population. Therefore, whilst future and continuing research is recommended, a proposed participant n-number based on sample size estimation calculation cannot.

In line with use of the BCW perhaps the most simple measure of its effectiveness – that being does it work in the real world – is to measure it against the APEASE criteria developed alongside the BCW to help with intervention function selection and assessment in relation to its context (Atkins and Michie, 2015). APEASE is an acronym relating to the Affordability (i.e. is it affordable or within the confines of its budget?), Practicality (is it logistically possible?), Effectiveness (does it work, or is it cost-effective?), Acceptability (will be accepted politically by the stakeholders?), Safety/Side-effects (is it safe?), and Equity (is it equal in that does it advantage some more than others?) of an intervention. The implementation of the co-developed platform can be considered Affordable. In its current form it requires no significant additional fiscal resources, more so an alternative approach to delivering education and providing better access to opportunity and support. It is Practical in the majority of its delivery as no additional infrastructure is required. The instance reported where the IG were unable to visit the labs of the university was one example of where one of the functions was impractical however the remainder were delivered without obstruction. Based on the measures discussed previously within this final study it appears the newly developed platform is effective in that both knowledge and behaviour has improved. Generally, the platform has been Accepted by the industry. This is acknowledged by the development of new regulations to support they're embedded beyond the life of this PhD and where instances of resistance occurred (discussed within the final reflections section) these were not to block the support to athletes, more a case of questioning the unknown. Finally, there are no Side-effects or Safety concerns with the new platform. Contrarily the purpose of the platform is to contribute to the negation of potentially harmful weight-making strategies and their own associated side effects. All content on the new platform can be delivered to all future jockeys irrespective of

age or gender, or code of racing they are licensed to compete under upholding its necessity for Equity.

Whilst the presented study has provided an insight into the effectiveness of a newly created sport-specific education platform for professional jockeys, it isn't without its clear limitations such as the participant recruitment size and the subsequent impact on statistical significance. With that in mind, it should be remembered that this was a pilot study with its purpose to trial and subsequently measure, in principle, the potential impact of the new platform and to practice the parts that make up its sum. Due to the licensing structure within the racing industry, only a maximum of eight jockeys are on a licensing course at one time, with three courses per year. One scheduled course only recruited two licensees therefore was not used in the study. To standardise the study as much as possible the we only used apprentice/flat licensee courses and used the same racing/licensing school on both occasions. The option to use participants at an alternative licensing school were available, however the whole education experience and culture between the establishments may be different and therefore produce difference results. The final recruited number of participants for this pilot study aligned itself with the 'rule of thumb' recommendations of twelve (Julious, 2005).

Similar to previous research, post-intervention assessments were conducted 10-weeks after baseline testing however to truly assess for longer term behaviour change this should be done again in a longitudinal manner. Although an ambition of the researcher, the time-constraints of the PhD mean this data was an unfeasible target to present in this thesis. With baseline and 10-week data already collected however, a continuing longitudinal study could be considered with potential future data collection points at six and twelve months and beyond to assess nutrition knowledge and dietary behaviour. The NQK used, although made up of validated and specific to sport questionnaires used in previous research, a bespoke validated

one for the target population would have been a more robust measurement tool. The time constraints of developing and validating a questionnaire however were too great and resources were needed to develop the education platform. Finally, acknowledging that food diaries (of any length, i.e. 1-7 day) are susceptible to under-reporting (Poslusna *et al.,* 2009) the time restraints placed on professional athletes generally make it difficult to capture food intake in many alternative ways, but specifically jockeys who lead a relentless daily routine highlighted within Figure 1 in Chapter 1 and in previous jockey research (Wilson *et al.,* 2012). Jockeys work and/or ride seven days per week therefore their 24-hour eating routine is often very similar and further justifies its use in this study.

Conclusion

Based on the results of this pilot study, the co-developed nutrition education platform may significantly improve nutrition knowledge and dietary behaviours relating to overall calorie, carbohydrate and protein intake, aligning nutrition intake closer to recommendations for jockeys, greater than the existing industry education provided. Psychometric analysis relating to eating attitudes remain unaffected. Confidence interval analysis indicated, as expected with pilot study participant numbers, noteworthy variance from mean findings. The study demonstrates in principle the efficacy of a co-developed education platform prompting the recommendation to embed the platform with the industry and continue data collection to assess more accurately in the future its impact on knowledge and behaviour with larger participant numbers to draw conclusions.

Reflections on the Research Journey: Trying to be the Pilot of an Effective Pilot

In pragmatic fashion, the methodological approach within this final study rightly switched from qualitative where I was attempting to construct meaning and understanding to develop this intervention, to quantitative where I was ultimately seeking to establish its level of effectiveness. This switch in approach accommodated my inner positivist, not that it had been rattling at the cage to be heard, but was there nonetheless given my entire education prior to PhD had delivered within a positivist environment. Up to this point I felt I had given 100% effort to deliver trustworthy qualitative/constructivist research, not taking any perceived easier routes, and being reflective in my practice to not inadvertently push positivist methods into the mix. Whilst conducting the research I was trying to simultaneously learn, understand, and appreciate qualitative traditions – one part of this was to use funds to attend the Qualitative Research in Sport & Exercise conference in Vancouver, Canada, to not only share my work, but to learn from others' work and talk to more purist and established researchers and practitioner-researchers in this field.

But, entering this third study, like I had done for the previous two in a qualitative context, I wanted to give a good account of myself and my quantitative researcher skills. An example of my positivist approach was my decision to use only apprentice (flat jockey) licensing courses when it may have been possible to access conditional (jump jockey) licensing courses also. Similarly, I chose only to utilise one of the two licensing schools, so it was delivered in the same environment both times. My motives for these decisions was, as a good positivist researcher would do, to eliminate as many variables as possible. It is only though critical discussion and reflection after the fact that this in some ways may have been a limitation to

the research. I had tried too hard. What I was ultimately trying to measure was 'effectiveness', that being does it work in the real world? In the real world both apprentice and conditional jockeys go through licensing, and both licenses are delivered in two different licensing schools. Not that I think the inclusion of either of these would change the outcome or trend of the results, but it would have made it more real. I am very aware that I am still learning as both a researcher, a practitioner, and how to combine these effectively to become a good researcher-practitioner. I felt this was a big lesson on my journey. Not that I am going to be too down on myself about it, the research done is still highly novel, and has proved to be impactful in real-world practices. The pragmatist in me knows I probably needed to make this kind of mistake in order to learn from it. I am better equipped now for future applied work in both conducting it myself and as a supervisor.

One final reflection, part way through this final study I felt like I was becoming a 'pest' by asking people working in the industry if we could try something different (i.e. the education platform) as a one-off, to pilot it. Because the platform is multi-faceted it meant asking several people to do something different in their own worlds. I found some people made things difficult, often 'kicking the can' and delaying processes even though they were free to reject or choose not to participate at all if they didn't want to. It's hard to be certain, but I came to the conclusion they want to help (the jockeys and the problems surrounding weight-making) hence their agreement and willingness to partake, I have no doubts in their love and affinity for the sport either. Yet at the same time they were hesitant. I believe they didn't want any significant changes to happen that may affect their own future potential workloads or methods of working. People don't always like change. Because I was the one asking the questions, or pushing for something to happen, I was never told I was a pest, but sometimes, I felt like one. Maybe this is normal for this type of work and other practitioner-researchers

in different contexts have the same experiences, then again maybe not. I guess I will learn for myself if this is a common feature through my own future experiences in a practitioner-researcher capacity.

Chapter 5

Discussion, Conclusions and Recommendations

STUDY AND AIMS	OBJECTIVES	OUTCOMES
STUDY 1 Explore the perspectives of key stakeholders within the horseracing industry on their perception of nutritional and weight making practices of professional jockeys	1. Determine dietary practices of jockeys and their perceptions of the factors that influence nutritional decisions and behaviour 2. Establish perceptions regarding the identity of jockeys as professional athletes 3. Identify the perception of jockeys and current weight-making strategies by other industry professionals (agents, trainers, coaches, racecourse clerks) 4. Determine the perceptions of existing food provision at race-courses	1. Widespread knowledge and perpetuation of archaic weight-making practices. 2. Contention over the athletic identity of jockeys and may influence nutrition behaviours. 3. Trainers and Agents have a strong influence on weight-making practices. 4. A systemic lack of nutrition education across the industry and need for redevelopment.
STUDY 2 Develop an industry-specific nutrition-education platform for professional jockeys	1. Use co-creation methods to obtain the conceptual thoughts and ideas from a range of stakeholders within the racing industry on the content and design of a nutrition education platform for professional jockeys 2. Identify potential barriers to the successful development and implementation of a nutrition education platform 3. Map concepts to a behaviour change theory model to ground in behaviour change science and construct interventions. 4. Design an industry and context specific nutrition education platform for jockeys	1. Licensing curriculum should be structured to deliver a real-world experiential approach. 2. Delivery needs to be by credible and reliable practitioners and/or current/ex jockeys. 3. Embed SES with licensing to normalise and promote its use 4. Continuing education needed post-licensing via social media, racing yards and racecourses. 5. Lack of funding and resistance from trainers key barriers.
STUDY 3 Implement, pilot, and evaluate the co-developed industry-specific education-platform direct into the horseracing industry	1. Pilot the developed education platform for one licensing cohort allowing new feature to be piloted and experienced 2. Preliminarily evaluate the effect of the new platform on nutrition knowledge via a NKQ 3. Preliminarily evaluate the effect of the new platform on dietary behaviour via EAT-26 and 24-hour recall analysis	1. Improvement in nutrition knowledge (11.7%±5.5 vs 3.6%±4.5; p=0.01) 2. Improved eating behaviour towards recommended g.kg in carbohydrate and protein intake (p=0.01, p=0.02) 3. No change in Fat intake (p=0.78)and EAT-26 scores (p=0.26).

Discussion

The aim of this thesis was to develop, implement, and evaluate the efficacy of an industry-specific nutrition education platform for professional horseracing. Following a literature review in Chapter One identifying the challenges faced by jockey athletes in weight management and their lifestyle as professional riders, in addition to the concepts that require consideration when embarking on the development of education interventions, three original research studies were presented through Chapters Three, Four, and Five. Each of these chapters sought to achieve the thesis objectives in establishing the factors behind traditional methods of making weight, and going on to successfully develop and pilot a new education platform using novel methods along the way. This chapter seeks to make sense and unite the three previous chapters through identifying and discussing their main findings. Through doing this, it seeks to make connections between studies and justify the logic and flow of the research journey. In doing this, the chapter draws conclusions and subsequently provides recommendations for both future research and applied application of findings. The chapter concludes with a short reflection from the researcher on the methods used within studies and his development as a researcher-practitioner.

Study one aimed to determine 'why' professional jockeys adhere to harmful weight-making strategies despite the growing number of research that highlights how to successfully manage (or lose) weight safely and permanently (i.e. not through acute weight or glycogen loss). A qualitative methodology explored opinions and perspectives from a range of key front-line racing stakeholders. As outlined in Chapter two, interviewing a range of stakeholder perspectives as well as jockey athletes was beneficial to the depth of the data and understanding of the issue. Management styles, ideologies, organisational culture, and

motivational climate coming from coaches (but in the context of racing this may include trainers and agents also) have been found important in the behaviours of athletes (Gould et al. 2002), yet there is a limited understanding of coaches' perspectives (Weinberg et al. 2011, Driska et al. 2012). This study sought the views of key stakeholder who play a direct role in the daily lives of jockeys, and therefore may directly contribute to the dietary practices, or if not, have direct insight what the key influences are. A similar successful approach was made by Cook *et al.* (2014) in the context of developing mental toughness in elite youth soccer athletes.

In attempting to recruit a diverse participant cohort made up of the key stakeholders that surround jockeys, engagement from racehorse trainers was noteworthy for further discussion. The recruitment process for trainers involved invitations to participate via email which is a now a common approach by researchers given its ease and lack of cost in reaching many potential participants simultaneously (Gortiz *et al.,* 2004). There is very limited research available on the effectiveness of emails to solicit research participants and what constitutes a suitable 'success rate' (Hansen and Pedersen, 2012) however three previous studies indicate it may yield suitable results. Bosnjak *et al.* (2008) reported significantly higher attainment via email versus SMS invitations (which was an alternative option within the PhD research), where Sappleton and Lourenco (2016) ran two separate studies trying to recruit business owners and career academics to participate in qualitative research. From a total of 651 emails in their initial study, 255 (39.2%) agreed to participate where study 2 portrayed a more moderate 16.5% success rate. Given that racehorse trainers are all considered business owners and on the whole are of comparative age to career academics (i.e. this wasn't a biased study using teenagers or young millennials), the research group of the present PhD were

hopeful of comparable response rates with trainers. In contrast however, there were only five initial respondents from an email database containing over 400 trainers with only three available to actively participate giving a <1% representation. The case could be argued that trainer's responses rate is low due to a high volume of emails they may receive each day, referred to as 'email overload' (Dabbish and Kraut, 2006). Given the emails were sent three times over a six-week recruitment window (over 1200 emails in total) in addition to some of the direct quotes from both jockeys and other members of the jockey network that some trainers may turn a blind eye to weight making practices and welfare of jockeys, it poses a genuine question whether trainers treat the issue with the level of attention it requires given the evidence related to the ill-effects that weight making has on health, wellbeing and riding performance (Wilson *et al.,* 2014). This concept, twinned with the ambiguity across all groups when asked about the notion led to a conclusion from Study 1 that there is a contention over the status of jockeys being considered as professional athletes, and as such aren't always treated and managed in the same manner seen as professionals from other sports. With this is mind, if there is a sense throughout the industry that jockeys are not professional athletes and are therefore not treated and managed like other professional athletes by their support network, we should perhaps not be surprised that many jockeys don't identify or make lifestyle choices we would consider aligned with that of a professional athlete.

The main finding from Study 1 related to a systemic lack of nutrition education throughout the industry, with the key emphasis being on jockeys not knowing how to successfully manage their weight over the duration of a season or career. In addition, not knowing how to safely reduce weight when necessary either acutely for a specific race, or generally to reduce overall

bodyweight if it has increased gradually or through a period away from competitive racing (i.e. through injury or a mid-season vacation).

At present, nutrition education is completed during a licensee jockey's tenure on their two-week licensing course alongside other mandatory modules that include but not limited to rules and regulations of racing, integrity and betting media training, veterinary support, and jockey coaching sessions. The nutrition module is apportioned to one morning or one afternoon period lasting approximately three hours. Upon completion of this, there is no mandatory requirement to engage with nutrition support personnel to either further educate themselves so as to develop their autonomy and understanding, or alternatively to try and receive dietary prescription or intervention. This in itself highlights a lack of education in terms of quantity, however when considered it is provided against a backdrop of 'noise' via a plethora of additional information from other modules, the quality of this education and the ability to be able to recall it is questionable also. In comparison to other leading horseracing jurisdictions where a license is granted only after successfully completing a two-year academy period such as Ireland, Australia, South Africa, and Japan where nutrition is covered longitudinally, the compressed UK model potentially compromises a young jockeys ability to retain crucial information relating to weight-management and optimal dietary practices. Jockeys from the aforementioned nations however still struggle with weight and face the same issues as UK jockeys (Dolan *et al.,* 2012; Labadorius *et al.,* 1993; Moore *et al.,* 2002) therefore the quality of nutrition education and industry cultural influences are likely similar worldwide (Wilson *et al.,* 2014). Data from within Study 1 provided quotes relating to more education or days at the school being needed for jockeys to learn and understand nutrition and weight-management more, however with the licensing structure unlikely to change, the

impactfulness and delivery method of provision is the aspect that requires attention. The current provision focuses predominantly on knowledge acquisition however lacks in developing practical skills and instilling motivation to practice optimal eating behaviours. As a result, many young jockeys start their careers with only basic knowledge, limited skills, and no additional motives to not follow the traditions of acute and rapid weight-making to compete. Naturally, the main recommendation from Study 1 was the development of an industry-specific nutrition education platform that not only addressed the needs of capability, opportunity, and motivation (Michie *et al.,* 2011), but one that also functioned in the real world within the parameters of the existing licensing and competitive racing calendar and structures of UK horseracing.

The aim of Study 2 was to act on the findings and recommendations of the initial study and develop an industry-specific nutrition education platform. In identifying within the literature review the shortfalls of previous education and behaviour change interventions in not grounding them in science, and instead opting for an ad-hoc or an ISLAGIATT approach (Eccles *et al.,* 2012), it was an objective of this study to ground the developed platform in theory via the COM-B model and BCW. In adopting this approach, the outcome for the end user would be a set of evidence-based industry and context specific intervention functions rather than hypothetical or general functions where the application would need to be contextualised later by the user. To make the context surrounding the intervention functions as valid as possible, a novel method within sport and exercise science research, namely co-creation was used. Recruiting multiple qualified stakeholders in the design and functionality of the intervention allowed for the platform to be developed not only in terms of what jockeys 'want' or 'need' to learn in the best environments, but also in consideration of potential industry barriers such

as funding, infrastructure and staffing. Adopting these approaches of co-creation via industry members and embedding their suggestions and outcomes to the COM-B model sought to provide the basis on which to develop a valid nutrition education platform with the best possible chance of success. This approach is in contrast to previous education interventions developed in performance sport settings (Doyle-Lucas and Davy*.,* 2011; Molina-Lopez *et al.*, 2013) and therefore a key novel feature of the thesis. Instead, the present thesis draws upon the more robust applied intervention design processes featured within medical and public health research programmes (Barker *et al.,* 2015; Fulton *et al.,* 2016; Jackson *et al.,* 2014).

As a result of engaging in a comprehensive development process, as depicted in Figure 7 within chapter 3 a multi-intervention education platform was created, with functions commencing during licensing and continuing into jockeys' riding careers. The diversity of this platform is unique in that it provides 'differentiation' in the learning modes, offering a combination of visual, cognitive, and practical elements of learning and engagement with content, a cornerstone principle in pedagogy and successful teaching (Petty, 2014; Reece and Walker, 2004). Previous nutrition-education interventions within sports have tended to focus on one method of teaching or knowledge transfer such as classroom seminars (Abood *et al.,* 2014) or DVD's (Doyle-Lucas and Davy, 2011). By applying a multi-faceted and differentiated education experience in addition to being co-created by the industry itself, the developed education platform hopes to be efficacious through its impactfulness and industrial relevance.

A fundamental element embedded into the licensing programme through the findings of Study 2 was to provide a lived-experience of professional and evidence-based weight

management that they could experientially learn (Ballantyne and Packer, 2009; Kolb, 1984) and continue the practices into their professional lives as apprentice or conditional jockeys. This was deemed a high impact feature of the education platform given its relevance to all three arms of the COM-B model. Through experientially engaging in the practice of both preparing and eating conducive foods satisfies both the knowledge and skills facets of their capability (C) requirements, yet in a 'low-risk' and supportive environment where the fear or consequence of set-backs is minimal and the opportunity to reflect, or be encouraged to reflect on failures is promoted (Guardino and Fullerton, 2010), something that may not exist in the real-world of professional sport. Whilst this aspect of the developed platform is logical in theory, the delivery of a conducive menu that spans five to six meals per day over a two week period by the existing catering departments undeniably requires a level of input and support from the research group / performance nutritionist. Consultation between the lead researcher, the Operations Manager of the licensing school, and the Head Chef (no previous history of performance / sport catering provision) developed a menu that aligned with the nutritional principles that required embedding into the curriculum (Wilson *et al.,* 2015) and sat within the operational and financial scopes of the licensing school. Upon completion of the body of research, the developed licensing menu was endorsed by the racing schools and is actively in operation within the industry, providing a tangible applied outcome of this research. A copy of the guidance documentation is attached with in Appendix 1b.

Through the development and delivery of the lived experience of eating during their licensing tenure alongside the support of the licensing course staff, it hypothetically provides the ideal physical and social opportunity (O) to engage in optimal dietary behaviours. Similarly, it was hoped that the adherence to a diet of increased eating frequency than normally accustomed to with positive outcomes by way of no weight gain despite eating more, or even weight loss

would affect motivation (M) to continue with the model of eating and adhere to similar food groups once graduated and competing professionally as a jockey.

A further major finding within Study 2 was that education and support relating to nutrition and weight-management is needed beyond the licensing course. Unlike the structure in foreign racing jurisdictions that can provide education over a two-year academy period and potentially better equip jockey athletes with skills and knowledge to autonomously maintain their competitive riding weights, the U.K. does not. Whilst face-to-face support beyond licensing was acknowledged as likely the most impactful intervention function and an area where growth is required, social media was believed to be the most necessary and likely most successful on an industrial scale. Group interviews within Study 2 discussed how the current relentless nature of racing's competitive calendar means support cannot often be accommodated in to the schedule of a competitive jockey due to the frequency of racing and the associated travel which causes fatigue and lack of sleep quality, similarly discussed in Landolt *et al.* (2017). At present within the sport is also a staffing crisis which has led to a shortage of stable staff in UK racing yards (Fidler, 2018) leading to racehorse trainers not permitting jockeys to seek or attend sports science support as they are required to work and fulfil stable duties and exercise ride horses (roles often done or spread further amongst stable staff). This narrative consolidates the finding within Study 1 which identified a key facilitator to poor nutrition may be racehorse trainers and their obstruction to both optimal nutrition generally and the nutrition support available to jockeys. The use of social media therefore was highlighted as the most advantageous as it is accessible by all whilst maintaining a two-way dynamic between the support service and the jockey. The use of commonly available and free platforms were preferred however the development of a custom-made or bespoke for

racing app may be beneficial where the functionality aligns itself with the other aspects of the racing industry such as racecourses, fixtures and other functions of the education intervention as has been shown to work successfully in a previous anti-smoking behaviour change project (Fulton *et al.,* 2016).

Study 3 was the execution and piloting of the culmination of work done through the previous two studies. It was felt the implementation of the developed education platform in a pilot study format was the best avenue given the recruitment of moderate participant numbers, dictated by industry and the limited number of apprentice licensing courses available per year. In adopting the pilot study approach the focus was on the successful implementation and practicing of methods and protocols in preparation for a potential continuation by industry or research beyond this PhD (Ross-McGill *et al.,* 2000). Additionally, testing for a proof of concept reporting all descriptive stats and focusing on confidence intervals rather than over-focussing on the reported p-values (Burrows *et al.,* 2001).

The main finding from Study 3 was the significant difference between the CG and IG knowledge scores from baseline to post intervention. The IG improved knowledge by more than three times that of the CG who recorded a modest improvement of knowledge. This indicated that the existing education is potentially beneficial but may only provide modest knowledge gains, whilst the piloted new platform may yield greater results. Confidence interval data within the groups showed a degree of variance in scores substantiating the rationale for pursuing a pilot study and reporting all LCI and UCI values. Had a pilot study approach not being followed, confidence intervals may have been overlooked in favour of underpowered p-values. The 11.7% improvement in IG knowledge scores, although

comparable and arguably weaker than improvements made in previous education intervention studies set within sport need to be taken in consideration of the 125-point assessment tool used. Previous research has opted for shorter NKQ's justifying their curtness for athlete convenience however also results in each question holding a greater relative percentage value. As a result of this, as different assessment tools were used to assess success of education interventions, direct comparisons between research outcomes is difficult.

The second main findings from Study 3 were the improved intakes of both carbohydrates and protein, moving intake values closer to that of the recommended values for weight-making athletes and in particular, jockeys. Whilst both CG and IG improved, this could be down to the value of addressing protein and carbohydrate intakes as a key message at licensing in both the existing and trialled education programme. Greater reported levels of success in the IG could be down to the continued nudges via the social media content of adhering to the key nutrition principles in addition to meal and snack ideas to help facilitate them. Whilst carbohydrate scores were still considered to contain elevated quantities of sugar it is normal to have more than the recommended 30g to meet the demands of training amongst athletic groups however the reported values still most likely outweighs the volume of high intensity day to day training work reported in previous literature (Wilson *et al.* 2013). It is hard to extrapolate solid conclusions either way from the post-intervention food diaries as both groups were self-reported and are notoriously open to user error (Burke and Deakin, 2010). The use of self-reported food diaries however were the only viable option given the research design and applied nature of the work. User error was minimised as much as possible by being given a detailed briefing verbally at the beginning of the study during their licensing course and once again nearing the completion through a combination of telephone calls and 'step

by step' guidance documents nearing the end of the 10-week period. The use of a 24-hour timeline visual to complete rather than a grid was provided in a hope to stimulate memory recall, however there is no literature to suggest this may occur, more so simply an alternative mode of completing a 24-hour recall diary. The use of novel dietary intake capturing such as Snap'n'Send (Costello *et al.*, 2018) which is in effect taking a photograph of each meal and sending it to the researcher-practitioner although effective in team sports is less so within professional horseracing. This approach was considered for use within the present research, however the restricted use of mobile phones on racing yards and more pertinently within the weighing rooms at racecourses poses a clear limitation for its use amongst jockeys there was decided against. As previously discussed within Chapter One, a one-day food capture was elected over longer three, five, or seven day periods due to a) the repetitive nature of a jockeys daily lifestyle (i.e. it is not common to have variation in training loads like observed in team sports and subsequent eating habits); b) the lack of time jockeys have to complete such administrative tasks (i.e. beyond one day may start to occur non-compliance); and c) this approach has been seen to be the best in previous jockey works that have collected dietary intake data (Wilson *et al.,* 2012, 2015).

The lack of change reported in EAT-26 scores is perhaps unsurprising given the same outcome in all previous works that have used the tool on a jockey population (Caulfield and Karageorhis, 2008; Leydon and Wall, 2002; Wilson *et al.,* 2015). Previous work has utilised it as a crude marker of attitudes towards food which was subsequently reported. The present study attempted to use the tool to measure if the co-developed education platform influenced EAT-26 scores. Whilst scores in both CG and IG did reduce slightly (a positive shift towards normal or positive attitude towards food) it did not indicate significance. The psychological association with food, especially in a weight-sensitive population is complex

and a 10-week period alone is unlikely to yield stark differences in score. Longitudinal assessment in future work could determine longer term changes in perceptions of food.

Conclusion

To conclude the research, this section brings together the key findings of the individual studies that make up the body of this thesis and contributed to achieving the works final outcome.

The adherence to nutrition and weight-making practices detrimental to both health and performance despite the emergence of novel and relevant research provided the rationale for the work. This, in addition to calls for better jockey nutrition education (Cotugna *et al.,* 2011; Wilson *et al.,* 2014). A mixed-methods approach was employed, a necessity to ensure the relevant paradigmatic approaches, modes of data collection, and analysis were attributed throughout. Studies 2 and 3 brought to life the initial findings from Study 1 that identified (amongst other areas), that a lack of nutrition education is a key determinant of some of the archaic weight management and nutrition strategies employed by jockeys. Study 1 clearly identified the need for a comprehensive education intervention to be developed and embedded into the industry. Study 2 through adapting methodologies used in alternative industries for product and education design implemented co-creation or co-design, and in doing so capturing the spawned ideas of a spectrum of support personnel that surround jockeys, including jockeys themselves. Using the robust COM-B and BCW models to map potential education and behaviour change functions allowed the development of an evidence-based, co-developed, industry specific education platform waiting to be implemented. Study 3 shifted the research approach from qualitative constructivist enquiry,

to quantitative methods in order to evaluate the efficacy of the developed platform. In doing so, it embodied the concept of mixed-methods research and methodological eclecticism by allowing the body of research as a whole to use multiple paradigms to best serve the purpose of the research (Hammersley, 1996; Tashakorie and Teddlie, 2008). Study 3 adopted the traditions and objectives of a pilot study, this final chapter in the research journey successfully trialled the intervention, highlighting its potential success in improving the eating and weight-making knowledge and behaviours of future jockeys.

Reflections on the Research Journey: Strengths, Limitations and Recommendations for Research and Industry

For a final time, this section visits the philosophical location of the researcher before exploring the strengths, limitations and avenues for further exploration.

To recap my position coming into this PhD, I held experiences from education as a lecturer of five years within Further Education and as a performance nutritionist specifically within horseracing for the previous two. I felt somewhat conflicted, I didn't quite know if I was 'too close' to both respective professions, and similarly wasn't certain with I was a researcher who practiced on the side, or was I practitioner who was conducting research. I came to realise that having experience from both education and nutrition in horseracing coming into this new role was a positive rather than a hindrance. I also came to realise that being a researcher-practitioner, was a) an actual thing, and b) provided me with the opportunity to engage in meaningful and potentially impactful research. My journey as documented in the previous reflective vignettes after each chapter hopefully provide examples of how my understanding of what a researcher-practitioner is developed, and how I as a researcher-practitioner working in professional horseracing evolved. I feel the strengths of combining two roles, or simultaneously using the access that each can respectively provide were realised in Studies 2 and 3 of this thesis where a better knowing of the horseracing industry aligned with my studying and reading in the area of co-creation and behaviour change since the commencement of the PhD produced a research-led but industry informed research design. In the section that proceeds I will go on to discuss the strengths and limitations of the thesis before offering recommendations in more detail but first I will finish with a final introspective

look at where I am now professionally and personally at the end of my PhD journey, and what becoming a more established researcher-practitioner means for me.

As with any PhD student, the last few months have been challenging during the 'writing up' period, but the challenge has been more than just that alone. I feel in comparison to *some* of my PhD peers that I am somewhat more stretched. I am a PhD student, I lecture, I am involved in other research projects, I am a nutritionist-practitioner within horseracing, and more recently within other sports too. A PhD alone is taxing on time, energy, and mental capacity, but when combined with the pressures and immediacy of professional sport (in that coaches or athletes often need your expertise or to produce something immediately) I am able to see quite easily how people could feel out of control, or 'in over their head' with work. I am beginning to learn that with the privileged position that being both a researcher (within a university) and a practitioner within high level sport comes a responsibility to not just one person or body, but to multiple where each expects the best from you. Not to mention my wife, friends and family who I still want to be the best husband, friend, son, brother for too. This is starting to sound quite negative despite not meaning to be. I am simply musing over the realisation that being both a researcher and a practitioner is hard work, or should I say is *going to be* hard work as I continue down this path post-PhD. I have been guilty in the past of believing that having a foot in each camp may be easier, but how wrong was I? I have come to learn that if you do it properly, being a researcher-practitioner is incredibly demanding. There are no short-cuts. Ultimately, that proposition makes me happy. Doing things thoroughly, and having the capacity to combine research and practice provide the opportunity for making a genuine difference to the lives and performance of the athletes, and personally I'm not sure there is anything more fulfilling than making a genuine positive difference to the lives of others.

Strengths of the Research

The overarching strength of the thesis is was the mixed-methods approach. Qualitative methods embodied the design of both Studies One and Two which will be discussed further on in this section. Its use identified perceptions and new knowledge in relation to weight-making in professional jockeys, and subsequently helped inform the direction and design of the research as it developed. Using qualitative processes through Study Two helped develop an intervention that allowed quantitative enquiry in Study Three to test is efficacy.

Conducting qualitative research within horseracing is novel and prior to the commencement of this body of work, had not been explored. Previous work, discussed in detail throughout Chapter One, has focussed heavily on quantitative based approaches seeking to determine the methods by which jockeys use to manage weight (e.g. Cotugna *et al.,* 2010; Dolan *et al.,* 2011) and the potential effects on health and performance (e.g. Greene *et al.,* 2013; Wilson *et al.,* 2013). No previous research had ever sought to question the motives behind these behaviours either from the perspective of the jockeys themselves or the support team that work closely with them. Study One within the present thesis was the first piece of literature to address this knowledge gap and provided insight into the dynamic relationship between jockey athletes and their support entourage, mainly racehorse trainers, as well as identifying key areas for further research including the necessity for improved nutrition education, and improved catering provision / eating environment at competition venues. Since then other qualitative work in racing has arisen relating to mental health, wellbeing and welfare (Landolt *et al.,* 2017; Porter, 2018)

Study One Part II used qualitative enquiry again to assess the quality and whether or not catering provision at competition venues were fit for purpose and met the needs of modern day jockey athletes. Previous literature on competition venue food provision has taken a

practitioner-led approach whereby provision quality was judged and critiqued by nutrition and dietetic professionals (Pelly, 2014), however not the opinions of athletes themselves. To our knowledge this is the first that has taken consideration from both the athlete population alongside qualified advice to redevelop food provision and successfully embed it within the sport.

Adopting novel methodologies such as co-creation in the design of an education-platform in professional sport appears unique. Its application and success in both education/curricula design and product development is well documented and provided a rationale for its use in this body of work. Given the previous ad hoc or ISLAGIATT approach (Eccles *et al.,* 2012) in intervention design, using co-creation and the industry stakeholders to inform the design should be recognised as a strength.

Similarly, entrenching the spawned ideas of co-creation workshops into a recognised behaviour change model to better inform the development of a multi-faceted education platform within professional sport appears novel and unique. Whilst the BCW has been used within the confines of a case-study within professional sport (Costello *et al.,* 2018), this appears to be the first used as part of a wider scale intervention within professional sport.

Study Three provides a quantitative study that indicates the co-created education platform may improve knowledge and eating behaviours. Its strengths lay in its transparency of delivering a pilot study and reporting pilot study outcomes and statistics, urging caution to drawing unnecessary conclusions based on a low-powered statistical significance value, instead offering grounded and industry specific recommendations regarding its use. Its second strength being in the study design, being able to pilot the platform on genuine licensing jockeys and using the control group as an alternative cohort of licensing jockeys who received the existing education.

The overriding strength of the body of work however is in the real-world applied impact it has had on the horseracing industry. Several functions of the piloted education platform are now voluntarily part of the jockeys two-week licensing course, improving the quality and experience for jockeys. The outcomes of this thesis are being discussed with the British Horseracing Authority and the licensing schools in expanding the provision to adopt the platform in its entirety to gain a better understanding of its effectiveness. In addition, the BHA and PJA have endorsed the new racecourse catering guidelines and from April 2019 an official rule change will come into effect by where racecourses need to provide an agreed level of nutrition provision. This is a key development given the amount of time jockeys spend at the races and promotes the availability of optimal food that serve their needs. In combination, a more robust and well-informed education in addition to reformation of the racecourse catering provides a genuine opportunity to improve the dietary behaviours and reduce the prevalence of archaic and dangerous weight-making practices amongst jockeys.

Limitations of the Research

The overarching challenge and limitation of this research was related to data collection occurring in applied settings. As such recruitment and data collection were hindered by the logistics of the relentless nature of the horseracing competition calendar. Similarly, research design had to be limited to the constraints of the infrastructure available within the industry with limited scope for 'blue sky thinking' if it was to be fit for purpose.

A key challenge of this research was the recruitment of stakeholders who work closely with jockeys, most prominently racehorse trainers. As discussed with earlier within this chapter, the response rate from this population was very low. As such, conclusions drawn with regards to their contribution to archaic weight-making are based upon the narrative of a very small

sample of trainers and upon the narrative from jockeys and other stakeholder groups. Greater representation from this group would increase the depth of knowledge surrounding them and as such the trustworthiness of any conclusions drawn.

Within Study Two, further insight could have been sourced from a group currently riding as professionals, and most preferably ones who were recently licensed (within the last two years). Although recruiting groups of industry stakeholders and actively licensing jockeys supported the robustness of the design, insight from a recently licensed cohort would have further benefited the design and would arguably be the most insightful group. A key point in the success of co-developed curricula studies was the inclusion of recent alumni as they have the benefit of hindsight in what could have been done better or what was missing. It could be argued that although the actively licensing jockeys can contribute valid points, they may not yet know what they want or need until they have been a jockey for a period of time.

Intervention or education functions that were decided through the co-development and mapping to the BCW although informed by industry had to work in the real world and therefore needed to conform to the pre-existing infrastructure available within the horseracing industry. For example, jockey licensing programmes can only last two-weeks, and although such a short period of time is unlikely to properly educate and invoke long term dietary behaviour changes, the developed platform had to conform within these parameters. One of the intervention functions was to complete a lab-visit field trip to experience and make use of sport and exercise science facilities however had to be cancelled for the pilot intervention group as was deemed unfeasible by course administrators.

Being able to properly measure the success of an education intervention relies on a valid measurement tool – this concept was discussed in detail with the literature review of Chapter One. A key limitation to Study Three and the overall thesis in being able to evaluate the

efficacy of the developed platform was not having a population specific nutrition knowledge tool. The development and validation of a new NKQ for jockeys far exceeded the time-scale capabilities of the research therefore a modified version of previously validated and widely used in research NKQs was used. Additionally, no process to measure an improvement in participant motivation was attempted despite alluding that motivation is key to behaviour throughout the thesis. Participants could have simply been asked to self-report how motivated they felt prior to and post intervention however such questions are limited to peoples own understanding of their psychological state or feel obliged to be biased for the purpose of research (Toure-Tillery and Fishback, 2014). To provide psychological coaching to assist answering such as question was beyond the scope of the present study. Future studies of similar design could align personal goal-setting alongside the education intervention in an attempt to measure motivation (Fishback and Ferguson, 2007). Alternatively, attempting to capture participants' subjective experiences whilst performing goal-related activities such as cooking classes, or engaging in the use of sports science technology to help facilitate weight management may shed light on their intrinsic motivation through tools such as Intrinsic Motivation Inventory could have been used as with previous research (Ryan, 1982; Ryan *et al.,* 1991).

Finally, the present thesis doesn't prove long term improvements and/or dietary behaviours. It evidences a transparent and systematic approach to the development of an education platform and provides proof in principle that it better educates and improves the short term dietary behaviours of jockeys, however lacks any longitudinal or follow-up data to confirm its efficacy in the long term.

Recommendations

Based on the key findings of the research and consideration of the strength and limitations discussed above, the concluding section offers direction and recommendations for future research and practice. These are offered to both further our knowledge and exploration through academic research, and suggest direct interventions within the horseracing industry. Within the industry recommendations, some are targeted at the administratve and governing bodies within the sport, where others are targeted at industry stakeholders who play a key role in the day to day lives of professional jockeys. In offering these recommendations it should be noted that although the sport of professional horseracing is rich in history and tradition, the study of its jockey athletes in comparison to other sports is still in its infancy, and the qualitative lines of enquiry adopted through this thesis are novel.

Jockey Licensing Education

Industry Recommendations

The first recommendation applies to both the academic community and the horseracing industry is to build upon the foundation the thesis provides and embed the provision within the blueprint of the sport, and assess its effectiveness. For industry, we propose the designed education platform is fully adopted and embedded within the sport, meaning the licensing courses at the two accredited jockey schools/colleges in the U.K. move towards implementing 'Phase 1' of the model illustrated within Figure 8 of Chapter 3, and 'Phase 2' is facilitated by the industry stakeholders. Subsequent to the pilot study, both racing schools in the U.K. are adopting most elements of the education platform on a voluntary basis given the licensing jockey feedback from the study. The basis of change is implementing the immersive experience of evidence-based dietary intake by restructuring meal times and food content

around the rest of the licensing curriculum. An example of applied work done with one of the racing schools as an outcome of the PhD research can be seen in Appendix 1b.

Research Recommendations

For academia, to measure the effectiveness of the developed education platform on a wider and industrial scale, the continuation of collecting pre and post intervention data with newly licensing jockeys should occur. This will allow a more accurate picture to emerge on the impact of the platform on both knowledge and short-term behaviour change. Finally, in relation to the implementation of the platform, to assess if the platform is effective in long-term behaviour change, longitudinal data with jockey athletes who commence as a licensee and go on to become professional jockeys should be collected, with the focus on eating and weight-making behaviours and nutrition knowledge.

Recommendations: Racecourse Catering

Industry Recommendations

Given the daily competition schedule that professional jockeys maintain, and the continuous increase in race meetings per year, a reform of racecourse catering is recommended. As identified within Study 1, jockeys spend up to seven days per week at racecourses and is often their main opportunity to eat between arduous periods of travelling. As such food provision should be improved to reflect their needs, namely being conducive for health, weight management, and riding performance. This industry recommendation lends itself to accommodating part of 'Phase 2' of the developed education platform. Educating and/or adequately training catering staff who interact directly with jockeys at race meetings is also

advised given the theme relating to staff satisfaction within Study 1. This recommendation was put to horseracing's national governing body (BHA) ahead of submission of this thesis and has already been endorsed. From April 2019, a rule change will come into effect whereby the 60 professional U.K. racecourses will be required to adhere to Racecourse Minimum Catering Guidelines (2019). The development of this legislation is an applied outcome of the research (Appendix 1a) and was developed by the researcher and subsequently endorsed by the BHA, PJA and LJMU. It has since been adopted and implemented in Ireland and South Africa racing jurisdictions.

Recommendations: Racehorse Trainers

During the progress of the present research, a strong theme which continually featured through both Study 1 and Study 2 was the influence of racehorse trainers on the actions, behaviours, and overall wellbeing of jockeys. Whilst the remit of the present research was focussed on the development of an education platform and its surrounding infrastructure for jockey athletes, the control that racehorse trainers possess over riders was consistent throughout. The nonchalant concern from trainers regarding jockey's weight management appears to stem from a combination of lack of knowledge of the impact on an athletes health and ability to race-ride, and a contention over whether they view jockeys as professional athletes. The welfare of jockeys and stable staff is a very contemporary issue and is understood to be the main factor in a lack of interest in young people coming into, and taking up the sport (Bodkin, 2018; Harding, 2019). With this in mind, although jockeys have been the focus of racing research over the past decade and the purpose of the present thesis was to develop a platform to better educate and equip jockeys with the knowledge, skills, opportunity, and mindset to manage their weights professionally, if trainers continue to be a

barrier to optimal practice and behaviours, the scope of research and support should diversify to include trainers also. With this considered, the final recommendations are based on racehorse trainers.

Industry and Research Recommendations

Firstly, develop an education model for racehorse trainers focussed on the weight management and implications of archaic practice on athlete health. This could extend to practical application in the workplace or yard to facilitate optimal practices. This suggested education could be delivered as part of new trainers' licensing course, and for existing trainers, an online platform/CPD that covers the content could be completed as a condition of license renewal. Such CPD could also be extended to yard management members of staff such as assistant trainers and head persons who often run the yard on a ground or 'front line' level. Similarly, during the research journey of the present thesis, some excellent practice was also heard from within racing yards however no platform currently exists to share best practice. The industry should seek to recognise exemplary provision and develop a forum for which to disseminate so optimal practices can become more widespread and facilitate a healthier and more professional way of making weight. Similar to the approach with the present thesis, this could be conducted in an applied practitioner-researcher capacity, or conducted direct within the industry itself.

These recommendations will be realised by a £185,00 two-year post-doctoral position funded by The Racing Foundation in collaboration with Liverpool John Moores University and supported by the British Horseracing Authority and the National Trainers Federation. The project is titled 'An Education and Support Intervention for Racehorse Trainers to Improve Jockey and Stable Staff Welfare and Embed Athletic Lifestyle and Culture'.

To summarise, the presented thesis has reported a novel approach to developing an industry specific nutrition education platform, and in doing so achieving the set aims and objectives. Using qualitative enquiry, the first to do so within professional horseracing, it established a rationale for the development of education resource. Employing innovative techniques to ensure the creation of a fit for purpose platform, this was succeeded by a successful pilot study indicating improved knowledge and dietary behaviours. This thesis demonstrates novel mixed-methodologies with horseracing and jockey literature, and a provides a blueprint for how action research can be successfully applied in professional sport.

References

Abood, D.A., Black, D.R., and Birnbaum, R.D.(2004). Nutrition education intervention for college female athletes. *Journal of Nutrition Education Beahvior,* 36, 135-139

Ackland, T.R., Lohman, T.G., Sundgot-Borgen, J., Maughan, R.J., Meyer, N.L., Stewart, A.D., and Muller, W. (2012). Current status of body composition assessment in sport: Review and position statement on behalf of the ad hoc research working group on body composition health and performance, under the auspices of the I.O.C. Medical Commission. *Sports Medicine*, 42, 227–249.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, *50*(2), 179-211.

Alexander, K.E., Brijnath, B., and Mazza, D. (2014). Barriers and enablers to delivery of the Healthy Kids Check: an analysis informed by the theoretical domains framework and COM-B model. *Implementation Science,* 9, 60

Akdere, M. (2003). The action research paradigm: an alternative approach in negotiation. *Systemic Practice and Action Research*, 16(5), 339-354

Alsaffar, A.A. (2012). Validation of a general nutrition knowledge questionnaire in a Turkish student sample. *Public Health Nutrition*, 15(11), 2074-2085.

Angrosino, M. (2007). *Doing ethnographic observational research*. London: Sage

Atkins, L., and Michie, S. (2015). Designing interventions to change eating behaviours. *Proceedings of the Nutrition Society*, 74(2), 164-170.

Atkinson, R. (1998). *The life story interview.* London: Sage

Ballantyne, R., and Packer, J. (2009). Introducing a fifth pedagogy: Experience-based strategies for facilitating learning in natural environments. *Environmental Education Research*, *15*(2), 243-262.

Barker, F., Atkins, L., and de Lusignan, S. (2015). Applying the COM-B behaviour model and behaviour change wheel to develop an intervention to improve hearing-aid use in adult auditory rehabilitation. *International Journal of Audiology,* Online 1-9

Batterham, A. M., and Atkinson, G. (2005). How big does my sample need to be? A primer on the murky world of sample size estimation. *Physical Therapy in Sport*, 6(3), 153-163.

Bauhofer, A., Stinner, B., Plaul, U., Torossian, A., Middeke, M., Celik, I., Koller, M. and Lorenz, W. (2001). Quality of life and the McPeek recovery index as a new outcome concept for sepsis trials tested in a pilot study of granulocyte colony-stimulating factor in patients with colorectal cancer. *British Journal of Surgery*, *88*(8), 1138-1150.

Becker, H. S. (1986). *Doing things together.* Evanston: Northwestern University Press.

Beedie, C.J., Terry, P.C., and Lane, A.M. (2000). The profile of mood states and athletic performance: Two meta-analyses. *Journal of Applied Sport Psychology*, 12(1), 49-68.

Bingham, S. (1987). The dietary assessment of individuals; methods, accuracy, new techniques and recommendations. *Nutrition Abstracts and Reviews*. 57, 705–42

Birkenhead, K.L. and Slater, G. (2015). A Review of Factors Influencing Athletes' Food Choices, *Sports Medicine,* 45, 1511-1522

Blake, G.M., and Fogelman, I. (2007). The role of DXA bone density scans in the diagnosis and treatment of osteoporosis. *Postgraduate Medical Journal.* 83(982), 509-517

Blix, E., Perski, A., Berglund, H., & Savic, I. (2013). Long-term occupational stress is associated with regional reductions in brain tissue volumes. *PLoS One*, *8*(6).

Bodkin, H. (2018). Jockey Recruitment Crisis [online] available at: https://www.telegraph.co.uk/news/2018/07/21/jockey-recruitment-crisis-generation-british-stable-hands-tall/ (accessed 10/01/2019)

Bosnjak, M., Neubarth, W., Couper, M. P., Bandilla, W., and Kaczmirek, L. (2008). Prenotification in web-based access panel surveys: The influence of mobile text messaging versus e-mail on response rates and sample composition. *Social Science Computer Review*, 26, 213–223

Bovill, C. (2014). An investigation of co-created curricula within higher education in the UK, Ireland and the USA. *Innovation in Education and Teaching International,* 51(1) 15-25

Bovill, C., Morss, K., and Bulley, C. J. (2009). Should students participate in curriculum design? Discussion arising from a first year curriculum design project and a literature review. *Pedagogic Research in Maximizing Education*, 3, 17–26.

Brinker, T. J., Holzapfel, J., Baudson, T. G., Sies, K., Jakob, L., Baumert, H. M., & Fries, F. N. (2016). Photoaging smartphone app promoting poster campaign to reduce smoking prevalence in secondary schools: the Smokerface Randomized Trial: design and baseline characteristics. *BMJ Open*, *6*(11)

Bunn, V. J., Watling, R. M., Ashby, D., and Smyth, R. L. (1998). Feasibility study for a randomized controlled trial of oral calorie supplements in children with cystic fibrosis. In *Proceedings of 22nd European Cystic Fibrosis Conference Berlin*

Burke, L. M. (2008). Sports nutrition and Australian football. *International journal of sport nutrition and exercise metabolism*, *18*(1), 96-98.

Burke, L., Cox, G. (2009). Nutrition in combat sports. In: Kordi, R., Maffulli, N., Wroble, R.R., and Wallace, W.A. *Combat Sports Medicine*. 1st edition. London: Springer, pp. 1-20.

Burke, L., and Deakin, V. (2010). *Clinical Sports Nutrition*: 4th Edition. North Ryde, McGraw Hill

Burke, L.M., Hawley, J.A., Wong, S.H., and Jeukendrup, A.E. (2011). Carbohydrates for training and competition. *Journal of Sports Sciences*, 29(1), 17-27

Burkhart, S. J., & Pelly, F. E. (2013). Athletes' opinions of food provision at the 2010 Delhi Commonwealth Games: The influence of culture and sport. *International journal of sport nutrition and exercise metabolism*, *23*(1), 11-23.

Burkhart, S.J., and Pelly, F.E. (2013). Athlete use and opinion of point of choice nutrition labels at a major international competition. *Appetite,* 70, 6-13.

Burrows, R. F., Gan, E. T., Gallus, A. S., Wallace, E. M., and Burrows, E. A. (2001). A randomised double-blind placebo controlled trial of low molecular weight heparin as prophylaxis in preventing venous thrombolic events after caesarean section: a pilot study. *BJOG: An International Journal of Obstetrics & Gynaecology*, *108*(8), 835-839.

Cahill, K., Lancaster, T., & Green, N. (2010). Stage-based interventions for smoking cessation. *The Cochrane Library*.

Campbell M., Fitzpatrick R., Haines A., Kinmonth A.L., Sandercock P., *et al.* (2000). Framework for design and evaluation of complex interventions to improve health. *British Medical Journal,* 321, 694–696

Campbell, D. T., and Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin*, *56*(2), 81.

Carfoot, S., Dickson, R., and Williamson, P. R. (2002). Breastfeeding: The effects of skin-to-skin care trial (BEST), Pilot study. In *Celebrating Health Research: The Annual R & D Conference*, Manchester, UK

Casa, D.J. Armstrong, L.E., Hillma, S.K., Montain, S.J., and Reiff, R.V. (2000). National Athletic Trainers' Association: Position Statement: Fluid replacement for athletes. *Journal of Athletic Training.* 35, 212-224

Caulfield, M.J., and Karageorghis, C.I. (2008). Psychological effects of rapid weight loss and attitudes towards eating among professional jockeys. *Journal of Sports Science*. 26(9), 877–83

Chaabene, H., Tabben, M., Mkaouer, B., Franchini, E., and Negra, Y. (2015). Amateur boxing: physical and physiological attributes. *Sports Medicine*. 45(3), 337-352

Cheung, Y. T. D., Chan, C. H. H., Lai, C. K. J., Chan, W. F. V., Wang, M. P., Li, H. C. W., ... & Lam, T. H. (2015). Using WhatsApp and Facebook online social groups for smoking relapse prevention for recent quitters: A pilot pragmatic cluster randomized controlled trial. *Journal of Medical Internet Research*, 17(10).

Cholewa, J.M., Landreth, A., Beam, S., Jones, T., and MacDonald, C.J. (2015). The effects of a sports nutrition education intervention on nutritional status, sport nutrition knowledge, body composition, and performance in NCAA Division I baseball players. *Journal of the International Society of Sports Nutrition*, 2(1), 44

Close, G. L., Kasper, A. M., and Morton, J. P. (2018). From paper to podium: quantifying the translational potential of performance nutrition research. *Sports Medicine*, 1-13.

Clough and Nutbrown (2012). *A student's guide to methodology*. Third Edition. Sage: London

Collins, R., Evans-Jones, K., & O'Connor, H. L. (2013). Reflections on three neophyte sport and exercise psychologists' developing philosophies for practice. *The Sport Psychologist*, *27*(4), 399-409.

Cook, C., Crust, L., Littlewood, M., Nesti, M., & Allen-Collinson, J. (2014). 'What it takes': perceptions of mental toughness and its development in an English Premier League Soccer Academy. *Qualitative Research in Sport, Exercise and Health*, *6*(3), 329-347.

Costello, N., Deighton, K., Dyson, J., McKenna, J., and Jones, B. (2017). Snap-N-Send: A valid and reliable method for assessing the energy intake of elite adolescent athletes. *European Journal of Sport Science*, 17(8), 1044-1055.

Costello, N., Mckenna, J., Sutton, L., Deighton, K., and Jones, B. (2018). Case study: Using Contemporary Behaviour Change Science to Design and Implement an Effective Nutritional Intervention within Professional Rugby League. *International Journal of Sports Nutrition and Exercise Metabolism, in press.*

Cotugna, N., Snider, O.S., and Windish, J. (2011). Nutrition assessment of horseracing athletes. *Journal of Community Health*. 36(2), 261–4

Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., and Petticrew, M. (2008). Developing and evaluating complex interventions: The New Medical Research Council Guidance. *British Medical Journal*, 337

Creswell, J.W. (2003). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches,* 2 edition. Sage, Thousand Oaks

Croll J.K., Neumark-Sztainer D., Story M., Wall M., Perry C., and Harnack L. (2006). Adolescents involved in weight-related and power team sports have better eating patterns and nutrient intakes than non-sport-involved adolescents. *Journal of the American Dietetic Association,* 106, 709-717

Cullen, S., O'Louglhin, G., McGoldrick, A., Smyth, B., May, G., and Warrington, G. (2015a). Physiological demands of flat horse racing jockeys. *Journal of Strength and Conditioning Research,* 29 (11), 3060-3066

Cullen, S., Donohoe, A., McGoldrick, A., McCaffrey, N., Davenport, C., Byrne, B., Donaghy, C., Tormey, W., Smith, D., and Warrington, G. (2015). Physiological and health characteristics of ex-jockeys. *Journal of Science and Medicine in Sport*. 1182

Curtis, K. E., Lahiri, S., and Brown, K. E. (2015). Targeting parents for childhood weight management: development of a theory-driven and user-centered healthy eating app. *JMIR mHealth and uHealth*, *3*(2), 1-18

Dabbish, L. A., & Kraut, R. E. (2006, November). Email overload at work: an analysis of factors associated with email strain. In *Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work* (pp. 431-440). ACM.

Denscombe, M. (2008) 'Communities of practice: a research paradigm for the mixed methods approach', *Journal of Mixed Methods Research*, 2(3), 270-283

Denzin, N.K. (1978). *The research act: A theoretical introduction to research methods*. New Brunswick: Aldine Transaction

Denzin, N.K., and Lincoln, Y.S. (1994). *Handbook of qualitative research*. London: Sage

Denzin, N.K. and Lincoln, Y.S. (2005). Introduction: The discipline and practice of qualitative research. In N.Denzin and Y.Lincoln (Eds.), *Handbook of qualitative research (3^{rD} edition).* London: Sage

Devlin, B.L. and Belski, R. (2015). Exploring General and Sports Nutrition and Food Knowledge in Elite Male Australian Athletes. *International Journal of Sports Nutrition and Exercise Metabolism,* 25, 225-232

Dolan, E., Crabtree, N., McGoldrick, A., Ashley, D.T., McCaffrey, N., and Warrington, G.D. (2011b). Weight regulation and bone mass: a comparison between professional jockeys,

elite amateur boxers. And age gender and BMI matched controls. *Journal of Bone Mineral Metabolism.* 30, 164-170

Dolan, E., O'Connor, H., and McGoldrick, A. (2011a). Nutritional, lifestyle, and weight control practices of professional jockeys. *Journal of Sports Sciences*. 29(8), 791–9

Dolan, E., Cullen, S., McGoldrick, A., and Warrington, G.D. (2013). The impact of making weight on physiological and cognitive processes in elite jockeys. *International Journal of Sport Nutrition and Exercise Metabolism*. 23, 399–408

Dolan, E., McGoldrick, A., and Davenport, C. (2012). An altered hormonal profile and elevated rate of bone loss are associated with low bone mass in professional horse-racing jockeys. *Journal of Bone Mineral Metabolism*. 30(5), 534–42

Dougherty, D. (1992). A practice-centred model of organizational renewal through product innovation. *Strategic Management Journal*, 13(1), 77-92.

Douglas, J.L., Price, M., and Peters, D.M. (2012). A systematic review of physical fitness, physiological demands and biomechanical performance in equestrian athletes. *Comparative Exercise Physiology*, 8(1), 53-62.

Doyle-Lucas, A.F., and Davy, B.M. (2011). Development and evaluation of an educational intervention program for pre-professional adolescent ballet dancers nutrition for optimal performance. *Journal of Dance Medicine and Science.* 15(2), 65-75

Driska, A., Kamphoff, C., and Armentrout, S. (2012). Elite swimming coaches' perceptions of mental toughness. *The Sport Psychologist*, 26, 186–206.

Duffy, M. E., & Henkel, K. E. (2016). Words on walls: Passive eating disorder education. *Eating disorders*, *24*(2), 148-160.

Easterby-Smith, M, Thorpe, R. and Jackson, P. (2008) "*Management Research"* 3rd ed, London: SAGE

Eccles M.P., Grimshaw J.M., MacLennan G., Bonetti D., Glidewell L., *et al*. (2012). Explaining clinical behaviors using multiple theoretical models. *Implementation Science*, 7, 99.

Elliot, J. (1991). *Action research for educational change*. Buckingham: Open University Press

Entrialgo, M., & Iglesias, V. (2018). Are the Intentions to Entrepreneurship of Men and Women Shaped Differently? The Impact of Entrepreneurial Role-Model Exposure and Entrepreneurship Education. *Entrepreneurship Research Journal*, 8(1), 1-14.

Evans, L., Hardy, L., and Fleming, S. (2000). Intervention strategies with injured athletes: An action research study. *The Sport Psychologist*, *14*(2), 188-206.

Failla, O., Bogoni, M., Porro, D., and Stringari, G. (1996). Soil and leaf analysis: Effect of pedo-climatic, cultural and genetic factors on their calibration and interpretation. In *International Symposium on Mineral Nutrition of Deciduous Fruit Trees,* 448, 225-232

Fallon, K.E. (2008). The clinical utility of screening of biochemical parameters in elite athletes - Analysis of 100 cases. *British Journal of Sports Medicine*, 42(5), 334-337

Ferro-Lebres, V., Moreira, P., and Ribeiro, J.C. (2014). Adaptation, update and validation of the general nutrition questionnaire in a Portuguese adolescent sample. *Ecology of Food and Nutrition*, 53(5), 528-542.

Fidler, K. (2018). Staffing crisis: how racing can pull together to combat the falling numbers [Online] available at: https://www.racingpost.com/news/staffing-crisis-how-racing-can-pull-together-to-combat-the-falling-numbers/337834 [accessed 27/11/2018].

Filby, M., Jackson, C., and Turner, M. (2012). Only falls and horses: accidents and injuries in racehorse training. *Occupational Medicine*, 62(5), 343-349.

Fishbach, A., & Ferguson, M. F. (2007). The goal construct in social psychology. In A. W. Kruglanski & E. T. Higgins (Eds*.), Social Psychology: Handbook of Basic Principles*. New York: Guilford

Fulton, E.A., Brown, K.E., Kwah, K.L. and Wild, S. (2016). StopApp: Using the behaviour change wheel to develop an app to increase uptake and attendance at NHS stop smoking services. *Healthcare,* 4, 31

Furber M.W., Roberts, J.D., and Roberts, M.G. (2017). A valid and reliable nutrition knowledge questionnaire for track and field athletes. *BMC Nutrition,* 3, 36

Galesic, M., and Bosnjak, M. (2009). Effects of questionnaire length on participation and indicators of response quality in a web survey. *Public Opinion Quarterly*, 73(2), 349-360.

Garner, D.M., Olmsted, M.P., Bohr, Y., and Garfinkel, P.E. (1982). The eating attitudes test: psychometric features and clinical correlates. *Psychological Medicine*, 12(4), 871-878.

Garner, D.M., and Garfinkel, P.E. (1979). The eating attitudes test: an index of the symptoms of anorexia nervosa. *Psychology in Medicine.* 9(2), 273-279

Goritz, A. S. (2004). Recruitment for online access panels. *International Journal of Market Research*, *46*(4), 411-425.

Gould, D., Dieffenbach, K., and Moffett, A. (2002). Psychological talent and its development in Olympic champions. *Journal of Applied Sports Psychology,* 14, 177–210.

Gratton, C., and Jones, I. (2004). *Research Methods for Sport Studies.* London: Routledge

Greene, J.C. (2007). *Mixing methods and social inquiry*. San Francisco: Jossey-Bass

Greene, D.A., Naughton, G.A., and Jander, C.B. (2013). Bone health of apprentice jockeys using peripheral quantitative computed tomography. *International Journal of Sports Medicine*. 34(8), 688–94

Greenwood, D. J., and Levin, M. (2006). *Introduction to action research: Social research for social change*. London: Sage

Guadalupe-Grau, A., Fuentes, T., Guerra, B., and Calbet J.A. (2009). Exercise and bone mass in adults. *Sports Medicine,* 39(6), 439-68

Guardino, C. A., and Fullerton, E. (2010). Changing behaviors by changing the classroom environment. *Teaching Exceptional Children*, *42*(6), 8-13.

Guba, E. G., and Lincoln, Y. S. (1989). *Fourth generation evaluation*. Newbury Park: Sage.

Hammersley, M. (1996). The relationship between qualitative and quantitative research: Paradigm loyalty versus methodological eclecticism. In Richardson, J.T.E (Ed.) *Handbook of qualitative research methods for psychology and the social sciences.* Leicester: BPS Books

Hansen, K. M., and Pedersen, R. T. (2012). Efficiency of different recruitment strategies for web panels. *International Journal of Public Opinion Research*, 24, 238–249.

Harding, J. (2019). Dan Skelton issues urgent call for industry response to staff shortage [online] available at: https://www.racingpost.com/news/dan-skelton-issues-urgent-call-for-industry-response-to-staff-shortage/360173 (accessed 11/01/2019)

Hardy, M.,A. (1993). *Regression with dummy variables*. London: Sage

Harley, N. (2015). Jockey fined over food tweet. *The Telegraph.* 16 May [Online]. Available at: https://www.telegraph.co.uk/news/uknews/11610651/Jockey-fined-over-food-tweet.html (Accessed 28 March 2018)

Harrison, J., Hopkins, W.G., MacFarlane, D.J., and Worsley, A. (1991). Nutrition knowledge and dietary habits of elite and non-elite athletes. *Australian Journal of Nutrition anD Dietetics*. 48, 124–7

Heaney, S., O'Connor. H., Michael, S., Gifford, J., and Nauighton, G. (2011) Nutrition knowledge in athletes: A systematic review. *International Journal of Sports Nutrition and Exercise Metabolism,* 21, 248-261

Hendrie, G.A., Cox, D.N., and Coveney, J. (2008). Validation of the general nutrition knowledge questionnaire in an Australian community sample. *Nutrition & Dietetics*, 65(1), 72-77.

Herman, C. P., Roth, D. A., & Polivy, J. (2003). Effects of the presence of others on food intake: A normative interpretation. *Psychological bulletin*, *129*(6), 873.

Hill, J. (2002). *Sport, leisure and culture in twentieth century Britain*. Basingstoke: Palgrave

Hitchens, P., Blizzard, L., and Jones, G. (2011). Are physiological attributes of jockeys predictors of falls? A pilot study. *BMJ Open.* 1(1)

Holm-Denoma, J.M., Scaringi, V., Gordon, K.H., Van Orden, K.A., and Joiner, T.E. (2009) Eating disorder symptoms among undergraduate varsity athletes, club athletes, independent exercisers, and non-exercisers. *International Journal of Eating Disorders*. 42(1), 47–53

Hopkins, D. (1993). A teacher's guide to classroom research. 2nd Edition. Open University Press: Michigan

Howe, K. R. (1988). Against the quantitative-qualitative incompatibility thesis or dogmas die hard. *Educational Researcher*, *17*(8), 10-16.

Huggins, M. (2010). *Horseracing and the British 1919-39*. Manchester University Press.

Impey, S. G., Hearris, M. A., Hammond, K. M., Bartlett, J. D., Louis, J., Close, G. L., and Morton, J. P. (2018). Fuel for the work required: A theoretical framework for carbohydrate periodization and the glycogen threshold hypothesis. *Sports Medicine*, *48*(5), 1031-1048.

Jack, K., Hamshire, C., & Chambers, A. (2017). The influence of role models in undergraduate nurse education. *Journal of clinical nursing*, *26*(23-24), 4707-4715.

Jackson, C., Eliasson, L., Barber, N., and Weinman, J. (2014). Applying COM-B to medication adherence: A suggested framework or research and interventions. *The European Health Psychologist,* 16(1), 7-17

Jackson, K.A., Sanchez-Santos, M.T., MacKinnon, A.L., Turner, A., Kuznik, K., Ellis, S., ... & Arden, N.K. (2017). Bone density and body composition in newly licenced professional jockeys. *Osteoporosis International*, 28(9), 2675-2682.

Jenkins, D.J., Wolever, T.M., and Vuksan V. (1989). Nibbling versus gorging: metabolic advantages of increased meal frequency. *New England Journal of Medicine*. 321(14), 929–34

Jensen, K., and Bennett, L. (2016). Enhancing teaching and learning through dialogue: a student and staff partnership model. *International Journal for Academic Development*, 21(1), 41-53.

Jo, Y.H., Talmage, D.A., and Role, L.W. (2002). Nicotinic receptor-mediated effects on appetite and food intake. *Journal of neurobiology.* 53(4), 618-632

Jockey Education and Training Scheme. (2017). *Jockey Matters* [Online]. Available at: http://www.jets-uk.org/jockeys/jockey-matters (Accessed: 10 Feb 2018)

Johnson, R. B., Onwuegbuzie, A. J., and Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, *1*(2), 112-133.

Johnson, R. B., and Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14-26.

Jones, B. (2018). *Researchers are from Mars, practitioners are from Venus* [Online]. Available at: https://www.catapultsports.com/blog/research-practice-professor-ben-jones (Accessed: 16th Jan 2019)

Julious, S.A. (2005). Sample size of 12 per group rule of thumb for a pilot study. *The Journal of Applied Statistics in the Pharmaceutical Industry,* 4(4), 287-291.

Kanis, J.A., Johnell, O., Oden, A., Dawson, A., De Laet, C., and Jonsson, B. (2001). Ten year probabilities of osteporotic fractures according to BMD and diagnostic thresholds. *Osteoporosis International.* 12, 989-995

Kaye, W.H., Bulik, C.M., Thornton, L., Barbarish, N., and Masters, K. (2004). Comorbidity of anxiety disorders with anorexia and bulimia nervosa. *American Journal of Psychiatry.*161 (12), 2215-2221

Kemmis, S., and McTaggart, R. (1988). *The action research planner*. Geelong: Deakin University Press

King, M.B., and Mezey, G. (1987). Eating behaviour of male racing jockeys. *Psychology in Medicine*. 17(1), 249–53

Kliemann, N., Wardle, J., Johnson, F., and Croker, H. (2016). Reliability and validity of a revised version of the General Nutrition Knowledge Questionnaire. *European Journal of Clinical Nutrition*, 70(10), 1174-1186

Kolb, D. (1984). Experiential learning as the science of learning and development. Englewood Cliffs, New Jersey: Prentice Hall.

Krathwohl, D.R. (2004). *Methods of educational and social science research: An integrated approach*. 2nd Edition. Long Grove: Waveland

Kuckertz, A. (2013). Entrepreneurship Education - Status Quo and Prospective Developments. *Journal of Entrepreneurship Education*, 16, 59-71.

Labadarios, D., Kotze, J., and Momberg, D. (1993). Jockeys and their practices in South Africa. *World Review of Nutrition and Dietetics*. 71, 97–114

Lancaster, G. A., Dodd, S., and Williamson, P. R. (2004). Design and analysis of pilot studies: recommendations for good practice. *Journal of Evaluation in Clinical Practice*, *10*(2), 307-312.

Landolt, K., O'Halloran, P., Hale, M.W., Horan, B., Kinsella, G., Kingsley, M., and Wright, B. J. (2017). Identifying the sources of stress and rewards in a group of Australian apprentice jockeys. *Qualitative Research in Sport, Exercise and Health*, 9(5), 583-599.

Lane, A.M., Terry, P.C., and Beedie, C.J. (2001) Mood and performance: test of a conceptual model with a focus on depressed mood. *Psychology in Sport and Exercise.* 2(3), 157-172

Langan-Evans, C., Crighton, B., Kasper, A., Martin, D., and Wilson, G. (2017). Current practices in weight making sport, *The Sport and Exercise Scientist*, 54, 8-9

Lees, J. (2014). Racing second best attended sport in 2014 [online] available at: http://www.racingpost.com/news/horse-racing/royal-ascot-cheltenham-festival-epsom-derby-grand-national-ascot-racing-second-best-attended-sport-in-2014/1789508/#newsArchiveTabs=last7DaysNews [Accessed 02/11/2016]

Lewin, K. (1946). Action research and minority problems, *Journal of Social Issues.* 2(4), 34-46

Leydon, M.A., and Wall, C. (2002). New Zealand jockeys' dietary habits and their potential impact on health. *International Journal of Sport Nutrition and Exercise Metabolism*, 12, 220–237

Lindsay, P., Breckon, J.D., Thomas, O., & Maynard, I.W. (2007). In pursuit of congruence: A personal reflection on methods and philosophy in applied practice. *The Sport Psychologist, 21,* 335–352.

Littlewood, M. (2005). *The impact of foreign player acquisition on the development and progression of young players in elite level English professional football*, PhD Thesis, Liverpool John Moores University, Liverpool

Littlewood, M., Morton, J., and Drust, B. (2014). Sink or Swim In Knowles, Z., Gilbourse, D., Cropley, B & Digdill, L. (Eds.) *Reflective practice in thesportand exercise sciences..* London: Routledge

Long, D., Perry, C., Unruh, S.A., Lewis, N., and Stanek-Krogstrand, K. (2011). Personal food systems of male collegiate football players: a grounded theory investigation. *Journal of Athletic Training*. 46(6), 688–95.

Longstreet, W.S. (1982). Action research: A paradigm *The Educational Forum*, 46(2), 135-158

Loucks, A.B. (2004). Energy balance and body composition in sports and exercise. *Journal of Sports Sciences*, 22(1), 1-14.

Loucks, A., Kiens, B., and Wright H.H. (2011). Energy availability in athletes. *Journal of Sports Science*. 29(1), 7–15.

Lowe, M.R., and Butryn, M.L. (2007). Hedonic hunger: a new dimension of appetite? *Physiology & Behavior*, 91(4), 432-439.

McArdle, W.D., Katch, F.I., and Katch, V.L. (2010). *Exercise physiology: nutrition, energy, and human performance*. Baltimore: Lippincott Williams & Wilkins.

McCulloch, A. (2009). The student as co-producer: learning from public administration about the student–university relationship. *Studies in Higher Education*, 34(2), 171-183.

Madill, A., and Gough, B. (2008). Qualitative research and its place in psychological science. *Psychological Methods*, 13(3), 254.

Martin, D. (2017). A nutritionist and an educator in professional horseracing: using reflection to create 'My process'. *Reflective Practice*, *18*(5), 589-599.

Martin, J. J. (2011). Qualitative research in sport and exercise psychology: Observations of a non-qualitative researcher. *Qualitative Research in Sport, Exercise and Health*, 3(3), 335-348.

Marx, J.J., Klawitter, B., Faldum, A., Eicke, B. M., Haertle, B., Dieterich, M., & Nedelmann, M. (2010). Gender-specific differences in stroke knowledge, stroke risk perception and the effects of an educational multimedia campaign. *Journal of neurology*, 257(3), 367-374.

Marx, J. J., Nedelmann, M., Haertle, B., Dieterich, M., & Eicke, B. M. (2008). An educational multimedia campaign has differential effects on public stroke knowledge and care-seeking behaviour. *Journal of neurology*, *255*(3), 378-384.

Melin, A., Torstveit, M.K., Burke, L., Marks, S., and Sundgot-Borgen, J. (2014). Disordered eating and eating disorders in aquatic sports. *International Journal of Sports Nutrition and Exercise Metabolism.* 24, 450-459

Michie, S., van Stralen, M. M., and West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, 6, 42-42.

Michie, S., Atkins, L., and West, R. (2014). *The behaviour Change Wheel: A Guide to Designing Interventions*. London: Silverback

Miyata, G., Meguid, M.M., Fetissov, S.O., Torelli, G.F., and Kim ,H.J. (1999). Nicotine's effect on hypothalamic neurotransmitters and appetite regulation. *Surgery,* 126(2), 255–63.

Moore, J.M., Timperio, A.F., and Crawford, D.A. (2002). Weight management and weight loss strategies of professional jockeys. *International Journal of Sport Nutrition and Exercise Metabolism*. 12(1), 1–13

Morgan, W.P., O'Connor, P.J., Ellickson, K.A., and Bradley, P.W. (1988). Personality structure, mood states, and performance in elite male distance runners. *International Journal of Sport Psychology*. 19(4), 247-263

Morton, J.P. and Fell, M.J. (2016). Nutritional strategies for the Tour de France. *Aspetar Sports Medical Journal,* 446-452

Morton, J.P., Robertson, C., Sutton, L., and MacLaren, D.P. (2010). Making the weight: A case study from professional boxing. *International Journal of Sport Nutrition and Exercise Metabolism, 20,* 80–85

Murphy, R.C., Nixon, S., Brooman, S., & Fearon, D. (2017). “I am wary of giving too much power to students:” Addressing the “but” in the Principle of Staff-Student Partnership, *International Journal for Students as Partners*, 1 (1), 1-16

Mötteli, S., Barbey, J., Keller, C., Bucher, T., and Siegrist, M. (2017). Development and validation of a brief instrument to measure knowledge about the energy content of meals. *Journal of Nutrition Education and Behavior*, 49(3), 257-263.

Mountjoy, M., Sundgot-Borgen, J, Burke, L. (2014). The IOC consensus statement: Beyond the female athlete triad – relative energy deficiency in sport (RED-S), *British Journal of Sports Medicine,* 48, 491-497

Mountjoy, M., Sundgot-Borgen, J.K., Burke, L.M., Ackerman, K.E., Blauwet, C., Constantini, N., ... & Sherman, R.T. (2018). IOC consensus statement on relative energy deficiency in sport (RED-S): 2018 update. *British Journal of Sports Medicine*, 52(11), 687-697.

Murphy, R., Nixon, S., Brooman, S., and Fearon, D. (2017) I am wary of giving too much power to students:" Addressing the "but" in the Principle of Staff-Student Partnership. *International Journal for Students as Partners,* 1(1), 1-16

Napolitano, M. A., Hayes, S., Bennett, G. G., Ives, A. K., & Foster, G. D. (2013). Using Facebook and text messaging to deliver a weight loss program to college students. *Obesity*, 21(1), 25-31.

Newman, N., Fletcher, R., Kalogeropoulos, A., Levy, D. A., & Nielsen, R. K. (2017). *Reuters Institute Digital News Report 2017.* Oxford: Reuters

Nour, M., Chen, J., & Allman-Farinelli, M. (2016). Efficacy and external validity of electronic and mobile phone-based interventions promoting vegetable intake in young adults: systematic review and meta-analysis. *Journal of Medical Internet Research*, 18(4).

O'Brien, R. (2001). An Overview of the Methodological Approach of Action Research. *in* Roberto Richardson (Ed.) *Theory and Practice of Action Research.* João Pessoa

O'Reilly, J., Cheng, H.L., and Poon, E.T.C. (2017). New insights in professional horse racing; "in-race" heart rate data, elevated fracture risk, hydration, nutritional and lifestyle analysis of elite professional jockeys. *Journal of Sports Sciences*, 35(5), 441-448

O'Reilly, K. (2012). *Ethnographic methods (2nd Edition).* London: Routledge

Office for National Statistics. (2017). Internet users in the UK: 2017. *Office for National Statistics*

Ono, M., Kennedy, E., Reeves, S., and Cronin, L. (2012). Nutrition and culture in professional football. A mixed method approach. *Appetite*, 58(1), 98-104.

Oppliger, R.A., Case, H.S., Horswill, C.A., Landry, G.L., and Shelter, A.C. (1996). American college of sports medicine position stand. Weight loss in wrestlers. *Medicine and Science in Sports and Exercise*. 28(6), 4-8

Pagoto, S., Waring, M. E., May, C. N., Ding, E. Y., Kunz, W. H., Hayes, R., & Oleski, J. L. (2016). Adapting behavioral interventions for social media delivery. *Journal of Medical Internet Research*, 18(1).

Parmenter, K., and Wardle, J. (1999). Development of a general nutrition knowledge questionnaire for adults. *European Journal of Clinical Nutrition,* 53, 298-308

Pelly, F., King, T., and O'Connor H. (2006). Factors influencing food choice of elite athletes at an international competition dining hall. In: *2nd Australian Association for Exercise and Sports Science conference, 2006*, Sydney, Australia

Pelly, F, O'Connor, H., Denyer, G., and Caterson, I. (2009). Catering for the Athletes Village at the Sydney 2000 Olympic Games: The Role of Sports Dietitians, *International Journal of Sport Nutrition and Exercise Metabolism,* 19, 340-354

Pelly, F., Meyer, N.L., Pearce, J., Burkhart, S.J. and Burke, L.M. (2014). Evaluation of Food Provision and Nutrition Support at the London 2012 Olympic Games: The Opinion of Sports Nutrition Experts, *International Journal of Sport Nutrition and Exercise Metabolism*, 24, 674 -683

Perry, R. B. (2009). Role modelling excellence in clinical nursing practice. *Nurse Education in Practice*, 9(1), 36-44.

Petty, G. (2004). *Teaching today: A practical guide*. Nelson Thornes.

Porter, S. J. (2018). *A culture in crisis: The psychosocial challenges faced by apprentice/conditional jockeys in the United Kingdom horseracing industry.* MSc Thesis, Liverpool John Moores University, Liverpool

Poslusna K, Ruprich J, de Vries JHM, Jakubikova M, and van't Veer P. (2009). Misreporting of energy and micronutrient intake estimated by food records and 24 hour recalls, control and adjustment methods in practice. *British Journal of Nutrition*, 101: S73–S85

PricewaterhouseCoopers. (2012). Social media "likes" healthcare: from marketing to social business. *PricewaterhouseCooper*

Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion*, *12*(1), 38-48.

Professional Jockeys Association. (2016). *Eight principles of racing nutrition.* Newbury, PJA

Public Health England. (2015). *Why 5%, An explanation of the SACN'S recommendations about sugar and health*. Public Health England, London.

Rahman, H., & Day, J. (2015). Involving the entrepreneurial role model: a possible development for entrepreneurship education. *Journal of Entrepreneurship Education*, 18(1), 86.

Reason, P. and Bradbury, H. (2001). The SAGE Handbook of Action Research. Participative Inquiry and Practice. 1st Edition. London: Sage

Reason, P. and Bradbury, H. (2006). *Handbook of Action Research*. London: Sage

Reilly, C., & Maughan, R. (2007). The development of a reliable and validated questionnaire to asses sports nutrition knowledge. Loughborough University, Loughborough, UK. *Unpublished manuscript*.

Rolstad, S., Adler, J., and Rydén, A. (2011). Response burden and questionnaire length: is shorter better? A review and meta-analysis. *Value in Health*, 14(8), 1101-1108.

Rosendahl, J., Bormann, B., Aschenbrenner, K., and Aschenbrenner, F. (2009). Dieting and disordered eating in German high school athletes and non-athletes. *Scandinavian Journal of Medicine and Science in Sports*. 19(5): 731–739

Rorty, R. (1999) *Philosophy and Social Hope*. Penguin, London.

Ross S., Grant A., Counsell C., Gillespie W., Russell I. and Prescott R. (1999). Barriers to participation in randomized controlled trials: a systematic review. *Journal of Clinical Epidemiology,* 52, 1143–1156.

Ross-McGill H., Hewison J., Hirst J., Dowswell T., Holt A., Brunskill P. and Thornton J.G. (2000). Antenatal home blood pressure monitoring: a pilot randomized controlled trial. *British Journal of Obstetrics and Gynaecology.* 107, 217–221.

Rueda, M.A., Halley, W.L., and Gilschrist, M.D. (2010). Fall and injury incidence rates of jockeys while racing in Ireland, France and Britain. *Injury.* 41(5), 533-539

Ryan, R. M. (1982). Control and information in the intrapersonal sphere – An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology*, 43, 450–461.

Ryan, R. M., Koestner, R., & Deci, E. L. (1991). Ego-involved persistence – When free-choice behavior is not intrinsically motivated. *Motivation and Emotion*, 15, 185–205.

Sappleton, N., and Lourenço, F. (2016). Email subject lines and response rates to invitations to participate in a web survey and a face-to-face interview: the sound of silence. *International Journal of Social Research Methodology*, *19*(5), 611-622.

Scientific Advisory Committee on Nutrition. (2015). *Carbohydrates and Health*. TSO, Norwich

Shatto, B., & Erwin, K. (2017). Teaching Millennials and Generation Z: Bridging the Generational Divide. *Creative nursing*, 23(1), 24.

Siegrist, J. (2001). A theory of occupational stress. In J. Dunham (Ed.), *Stress in the workplace: Past, present and future* (pp. 52-66). Philadelphia, PA, US: Whurr Publishers.

Slater, G. J., Rice, A. J., Sharpe, K., Jenkins, D., and Hahn, A. G. (2007). Influence of nutrient intake after weigh-in on lightweight rowing performance. *Medicine & Science in Sports & Exercise*, 39(1), 184-191

Smart, L.R., and Bisogni, C.A. (2001). Personal food systems of male college hockey players. *Appetite.* 37(1), 57–70

Smith, R. (2016). New Head of Nutrition Gives Liverpool a Taste of Premier League Success. *The New York Times*

Sobal, J., and Bisogni, C. A. (2009). Constructing food choice decisions. *Annals of Behavioural Medicine*, *38*(1), 37-46.

Sparkes, A.C. and Smith, B. (2009). Judging the quality of qualitative inquiry: criteriology and relativism in action. *Psychology of sport and exercise*, 10 (5), 491–497.

Sparkes, A.C. (1998). Validity in qualitative inquiry and the problem of criteria: Implications for sport psychology. *The Sport Psychologist*, 12(4), 363-386.

Sparkes, A.C. and Smith, B. (2014). *Qualitative research methods in sport, exercise, and health: from process to product*. New York: Routledge.

Spendlove, J.K., Henaey, S.E., Gifford, J.A. Pivan, T., Deyner, G.S., and O'Connor, H.T. (2012). Evaluation of general nutrition knowledge in elite Australian athletes. *British Journal of Nutrition,* 12, 1871-1880

Sport England. *Active People Survey 10, 2015-2016.* London: Sport England

Spronk, I., Kullen, C., Burdon, C., and O'Connor, H. (2014). Relationship between nutrition knowledge and dietary intake. *British Journal of Nutrition*, 111(10), 1713–26

Steckel, R. (2009). Heights and human welfare: developments and new directions. *Explorations in Economic History*. 46, 1–23

Stevinson, C., & Ernst, E. (2000). A pilot study of Hypericum perforatum for the treatment of premenstrual syndrome. *International Journal of Obstetrics & Gynaecology*, *107*(7), 870-876.

Streiner, D. L., Norman, G. R., and Cairney, J. (2015). *Health measurement scales: a practical guide to their development and use*. 5th Edition. Oxford: Oxford University Press

Stringer, E.T. (2014). *Action Research*. 4th Edition. London: Sage

Sundgot-Borgen, J., and Garthe, I. (2011). Elite athletes in aesthetic and Olympic weight-class sports and the challenge of body weight and body compositions. *Journal of Sports Sciences, 29*(1),101–114

Sundgot-Borgen, J., and Larsen, S. (1993). Pathogenic weight-control methods and self-reported eating disorders in female elite athletes and controls. *Scandinavian Journal of Medicine and Science in Sports*, 3(3), 150–155

Sundgot-Borgen, J., Meyer, N.L., Lohman, T.G., Ackland, T.R., Maughan, R.J., Stewart, A.D., and Muller, W. (2013). How to minimise the health risks to athletes who compete in weight-sensitive sports review and position statement on behalf of the Ad Hoc Research Working Group on Body Composition, Health and Performance, under the auspices of the IOC Medical Commission. *British Journal of Sports Medicine.* 47, 1012–1022

Tashakkori, A., and Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches*. Thousand Oaks: Sage.

Teddlie, C. and Tashakkori, A. (2009) *Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behavioral Sciences*, Sage, Thousand Oaks, CA.

Teddlie, C., and Tashakkori, A. (2011). Mixed methods research. *The Sage handbook of qualitative research*, Thousand Oaks: Sage.

Terry, P.C., Lane, A.M., and Lane, H.J. (1999). Development and validation of a mood measure for adolescents. *Journal of Sports Science*. 17(11), 861–72

Tester, E., Sutton, L., and Duckworth, L. (2011). Evaluation of nutrition knowledge and dietary intake of male academy rugby union players undertaking a nutrition education program. *British Journal of Sports Medicine.* 45, 15

Torstveit, M.K., and Sundgot-Borgen, J. (2005). The female athlete triad exists in both elite athletes and controls. *Medicine and Science in Sports and Exercise*. 37(9), 1449–1459.

Trakman, G.L. Forsyth, A., Hoye, R., and Belski, R. (2017). The nutrition for sport knowledge questionnaire (NSKQ): Development and validation using classical test theory and Rasch analysis. *Journal of the International Society of Sports Nutrition,* 14, 26

Touré-Tillery, M., & Fishbach, A. (2014). How to measure motivation: A guide for the experimental social psychologist. *Social and Personality Psychology Compass*, *8*(7), 328-341.

Tripp, D. (2005). Action research: a methodological introduction. *Education and Research,* 31(3), 443-466

Turner, M., McCrory, P., and Halley, W. (2002). Injuries in professional horseracing in Great Britain and the Republic of Ireland during 1992–2000. *British Journal of Sports Medicine*. 36(6), 403–409

Valliant, M.W., Emplaincourt, H.P., Wenzel, R.K., and Garner, B.H. (2012) Nutrition education by a registered dietician improves dietary intake and nutrition knowledge of a NCAA female volleyball team. *Nutrients.* 4(6), 506-516

Voss, N. (2017). 'They Just Want To Ride': Small Changes In Scale Of Weights Have Big Impact On Jockeys' Health. *Paulick Report,* 2 Aug [Online]. Available at: https://www.paulickreport.com/news/ray-s-paddock/just-want-ride-small-changes-scale-weights-big-impact-jockeys-health (Accessed: 29 May 2018)

Waldron-Lynch, F., Murray, B.F., and Brady, J.J. (2010). High bone turnover in Irish professional jockeys. *Osteoporosis International*. 21(3), 521–525

Walsh, N. P., Gleeson, M., Pyne, D. B., Nieman, D. C., Dhabhar, F. S., Shephard, R. J., Oliver, S. J., Bermon, S., and Kajeniene, A. (2011). Position statement. Part two: Maintaining immune health. *Exercise Immunology Review.* 17, 64-103.

Walsh, R., and Koelsch, L. (2012). Building across fault lines in qualitative research. *The Humaist Psychologist.* 40, 380-390

Warrington, G., Dolan, E., and McGoldrick, A. (2009). Chronic weight control impacts on physiological function and bone health in elite jockeys. *Journal of Sports Sciences*. 27(6), 543–50

Weinberg, R., Butt, J., and Culp, B. (2011). Coaches' view of mental toughness and how it is built. *International Journal of Sport and Exercise Psychology*, 9, 156–172.

West, R. (2005). Time for a change: putting the Transtheoretical (Stages of Change) Model to rest. *Addiction*, *100*(8), 1036-1039.

Whitaker, E. (2018). One rasher or two: what do jockeys eat to make the weight? [online] available at: https://www.racingpost.com/news/one-rasher-or-two-what-do-jockeys-survive-on-to-make-the-weight/310244 [accessed: 5th June 2018]

Whitaker, E. (2017). PJA highlights sources of help to riders after Swift's retirement [online] available at: https://www.racingpost.com/news/pja-highlights-sources-of-help-to-riders-after-jockey-s-retirement/282085 [accessed 4th June 2018]

Willett, W.C., and Stampfer, M.J. (2013). Current evidence on healthy eating. *Annual Review of Public Health*, 34, 77–95.

Whitehead, J., and McNiff, J. (2006). *Action research living theory.* London, Sage

Wilson, G., Chester, N., Eubank, M., Morton, J.P., and Close, G.L. (2012). An alternate dietary strategy to make weight improves mood, decreases body fat and removes the necessity for dehydration: a case-study from a professional jockey. *International Journal Sport Nutrition and Exercise Metabolism*. 22(3), 225-31

Wilson. G., Drust, B., Morton, J., and Close, G. (2014). Weight-making strategies in professional jockeys: Implications for physical and mental health and well-being. *Sports Medicine*. 44, 785–796

Wilson, G., Hawken, M.B., Poole, I., Sparks, A., Bennett, S., Drust, B., Morton, J., and Close, G.L. (2013a) Rapid weight-loss impairs simulated riding performance and strength in jockeys: Implications for making-weight. *Journal of Sports Sciences*. 32, 383–391

Wilson, G., Pritchard, P.P., Papageorgiou, C., Phillips, S., Kumar, P., Routledge, H., Morton, J.P., and Close, G.L. (2015). Fasted exercise and increased dietary protein reduces body fat and improves strength in jockeys. *International Journal of Sports Medicine*. 36(12), 1008-1014

Wilson, G., Sparks, S.A., Drust, B., Morton, J.P., and Close, G.L. (2013b). Assessment of energy expenditure in elite jockeys during simulated race-riding and a working day: implications for making weight. *Applied Physiology Nutrition and Metabolism*. 38(4), 415–20

Wilson, G.W., Lucas, D., Hambly, C., Speakman, J.R., Morton, J.P. and Close, G.L. (2018a) Energy expenditure in professional flat jockeys using doubly labelled water during the racing season: Implications for body weight management. *European Journal of Sport Science,* 18(2) 235-242

Wilson, G.W*.,* Martin, D., Morton, J.P. and Close, G.L. (2018b). Male Flat Jockeys Do Not Display Deteriorations in Bone Density or Resting Metabolic Rate in Accordance With Race Riding Experience: Implications for RED-S. *International Journal of Sports Nutrition and Exercise Metabolism, in press*

Yanchar, S. C., and Williams, D. D. (2006). Reconsidering the compatibility thesis and eclecticism: Five proposed guidelines for method use. *Educational Researcher*, 35(9), 3-12.

Zinn, C., Schofield, G., and Wall, C. (2005). Development of a psychometrically valid and reliable sports nutrition knowledge questionnaire. *Journal of Science and Medicine in Sport,* 3, 346-351

Appendix 1:
Applied Impact of PhD Research on Industry Practice

Appendix 1a – Racecourse Catering Guidelines

Based on the research findings and recommendations of Study 1 Part II located within Chapter 2 which focussed on the exploration of views relating to racecourse food provision, new racecourse catering guidelines were developed and embedded into the industry and are presented below. Key recommendations from Study 1 Part II suggested the development of minimum standards and guidance for racecourse officials and catering staff to ensure the provision of foods on racedays were conducive to health, weight-management and riding performance. Given the relentless racing calendar spanning 362 days of the year, and hosting over 1500 individual race meetings (over 10,000 actual races) the research group and the industry nutrition team felt this was a strategy that could have a significant impact on the eating behaviours of jockeys and facilitate better weight management and health.

Using the data collected as guidance, the researcher created a draft version of the catering guidelines which were then reviewed by industry SENr Performance Nutritionists, the NGB's Chief Medical Advisor, and a sample of professional jockeys. Minor relevant amendment were made before the final version was subsequently accepted and endorsed by the British Horseracing Authority.

The guidelines were officially rolled out in April 2018 on a 12-month transition phase, allowing all 59 UK Racecourses under the governance of the BHA to take a full calendar year (which is made up of one complete flat and one complete jump season) to make necessary amendments to their catering provision. This one year period is also an on-going consultation period for racecourses to identify and report any real-world issues in implementing the

guidelines for consideration by the research and industry nutrition group to make any amendments. In April 2019 the catering guidelines will become legislative and make up part of the BHA's General Instructions to racecourses.

This development represents a significant achievement in developing a research-led and evidence-based rule change within the sport, with the impact being felt everyday by the jockey athletes racing the length and breadth of the U.K. The guidelines have been requested for use in two foreign racing jurisdictions (Ireland and South Africa) meaning the applied impact of the research-led guidelines may reach international status.

Appendix 1b- Jockey Licensing School Menu / Catering Redevelopment

One aspect of the developed education platform was for the licensing schools to provide a lived experience of how to embed best nutrition practice and principles. This involved licensing jockeys whilst on their course adopting a diet that followed the principles of Wilson *et al.* (2012, 2015) and in real terms requires jockeys to consume a protein rich diet ideally spread over three main meals and snacks between. Further details of this diet are documented in Chapter 3, Study 2 and Chapter 4, Study 4 of the thesis. Upon having to embed this nutrition schedule for their licensing jockeys and seeing a) the benefit it had upon their licensees, and b) the cost-effectiveness, racing schools asked to have a redeveloped catering policy and menu.

The information below as Appendix 1b is extracted from a wider guidance document provided to a UK licensing racing school that is embodied by the nutrition principles that are taught to jockeys, and reflects the provision that would also be provided at the UK's 59 racecourses when adopting the new catering guidelines (Appendix 1a). This development and impact on industry is significant. It provides a clear statement and blueprint to young licensing jockeys on optimal eating strategies that they will 'live' for the duration of the two week licensing programme.

Appendix 2:
Example Education Material from New Education Platform

Appendix 3:
Example Interview and Group Interview Questions

Interview Questions – Agents / Trainers / Coaches (Study 1)

Using a semi-structured approach, the main questions (or similar) will be asked, with the points beneath each one potential areas to navigate during the interview.

1. Are you aware of / work with jockeys who have to make weight?
    i. How often?
    ii. What method(s) are you aware of?
    iii. What impact physically/mentally have you witnessed it have on jockeys?

2. What is your opinion of the rapid weight-loss methods employed by many jockeys?
    i. A necessity of the sport / a necessary evil?
    ii. A fundamental part of the sport?
    iii. They are reckless methods which are unnecessary if approached properly?

3. Other sports people such as boxers, MMA, rowers etc. "make weight" too however the main issues seem to be within horseracing – how do you perceive jockeys when compared to other sports people?
    i. Do you see them as athletes?
    ii. What's the difference between a jockey and other professional sports people?

4. What do you think about the food provided at racecourses?
    i. Are *you* happy with type / quality of foods available?
    ii. Do you think jockeys are happy with the type/quality?
    iii. Do you think the food promotes weight management?
    iv. Do you think a change is needed – what?

Interview Questions – Clerks of Course / Catering Managers (Study 1)

Using a semi-structured approach, the main questions (or similar) will be asked, with the points beneath each one potential areas to navigate during the interview.

1. Are you aware of / work with jockeys who have to make weight?
    i. How often?
    ii. What method(s) are you aware of?
    iii. What impact physically/mentally have you witnessed it have on jockeys?

2. What is your opinion of the rapid weight-loss methods employed by many jockeys?
    i. A necessity of the sport / a necessary evil?
    ii. A fundamental part of the sport?
    iii. They are reckless methods which are unnecessary if approached properly?

3. Other sports people such as boxers, MMA, rowers etc. "make weight" too however the main issues seem to be within horseracing – how do you perceive jockeys when compared to other sports people?
    i. Do you see them as athletes?
    ii. What's the difference between a jockey and other professional sports people?

4. What do you think about the food provided at racecourses generally?
    i. Are *you* happy with type / quality of foods available?
    ii. Do you think jockeys are happy with the type/quality?
    iii. Do you think the food promotes weight management?
    iv. Do you think a change is needed – what?

5. What do you think about the food provided at your racecourse?
    i. Are *you* happy with type / quality of foods available?
    ii. Do you think jockeys are happy with the type/quality?
    iii. Do you think a change is needed – what?

Maybe switch Q4 and Q5

6. What dictates what you offer to jockeys on race days?
    i. Cost / financial feasibility
    ii. Jockey feedback (positive or negative)

iii. Health / wellbeing of jockeys

Interview Questions – Jockey (Study 1)

Using a semi-structured approach, the main questions (or similar) will be asked, with the points beneath each one potential areas to navigate during the interview.

1. Do you currently have to make-weight?
    i. How often?
    ii. What method(s) do you use?
    iii. How hard do you find it mentally and physically on your body?

2. Other sports people such as boxers, MMA, rowers etc. "make weight" too however the main issues seem to be within horseracing – how do you compare yourself as a jockey to other sports people?
    i. Do you see yourself as an athlete?
    ii. What's the difference between a jockey and other professional sports people?

3. Describe to me your current dietary habits.
    i. Breakfast through to bed
    ii. Why do you eat this food at this time?

4. What influences the foods that you eat?
    i. Peers / weighing room
    ii. Cost / time
    iii. Riding weight required

5. What do you think about the food provided at racecourses?
    i. Are you happy with type / quality of foods available?
    ii. Do you think it helps you make or maintain your riding weights?
    iii. Do you think the food on offer effects performance, good or bad?
    iv. Do you think a change is needed – what?

Group Interview Questions – 'Jockey Athlete' Working Group (Study 2)

Using a semi-structured approach, the main questions (or similar) will be asked, with the points beneath each one potential areas to navigate during the group interview.

1. What do you think of the co-creation concept in the design of this education platform?
    a. Useful / not useful
    b. More / less / no difference to relevance of platform

2. What content do you feel needs to be included and addressed in the education platform?
    a. Weight-making / dangers of dehydration / benefits of…
    b. Practical skills? E.g. Cooking skills, calculating energy requirements, food labels
    c. Main priorities and why

3. How should the content be delivered to jockeys?
    a. Classroom / active / videos / posters
    b. Use of mobile phones and technology

4. What format should the platform take?
    a. How many 'sessions' / how many days/weeks
    b. Duration of sessions
    c. Group size / 1:1 sessions
    d. Locations
    e. Remote learning (no / little contact in terms of sessions)

5. What barriers to the successful implementation of this platform do you foresee?
    a. Racing calendar?
    b. Resistance from trainers?
    c. Resistance from agents?
    d. Organisational resistance – BHA/IJF/PJA/NRC/BRS?

6. How can we overcome or compromise to alleviate these barriers?

Group Interview Questions – Jockeys (Study 2)

Using a semi-structured approach, the main questions (or similar) will be asked, with the points beneath each one potential areas to navigate during the group interview.

1. What do you think of the co-creation concept in the design of this education platform?
    a. Useful / not useful
    b. More / less / no difference to relevance of platform

2. As jockeys, what content do you feel needs to be included in the education platform?
    a. Weight-making / dangers of dehydration / benefits of…
    b. Practical skills? E.g. Cooking skills, calculating energy requirements, food labels
    c. Main priorities and why

3. As jockeys, how would this content be best delivered to you?
    a. Classroom / active sessions / videos / posters
    b. Use of mobile phones and technology

4. Taking into account the lifestyle demands of being a jockey, what format should the platform take?
    a. How many 'sessions' / how many days/weeks – should it be continuous?
    b. Duration of sessions
    c. Group size / 1:1 sessions and opportunities
    d. Locations

5. What barriers to the successful implementation of this platform do you foresee?
    a. Racing calendar?
    b. Resistance from trainers?
    c. Resistance from agents?
    d. Organisational resistance – BHA/IJF/PJA/NRC/BRS?

6. How can we overcome or compromise to alleviate these barriers?

Appendix 4:
Nutrition Knowledge Questionnaire

General and Sport Nutrition Knowledge Questionnaire (for Jockeys)

Fill out the questions below to the best of your knowledge. Please DO NOT GUESS, if you are unsure of an answer please tick the 'UNSURE' box.

Q1: How old are you in years:

Q2: What is your gender?
Male ☐
Female ☐

Q3: What nationality are you?
UK ☐
Ireland ☐
Other

Q4: What is your highest level of education?
Primary School
GCSE's (less than 5 x A-C's or 4-9's)
GCSE's (5 or more A-C's or 4-9's)
BTEC / A-Levels at College
University (I completed/am enrolled in a bachelor/undergraduate degree)
University (I completed/am enrolled in post-graduate study)

Q5: Have you ever completed any formal studies or qualifications in human nutrition?
Yes
No

Q6: How many years have you been riding horses/ponies for? (Specifically in Horseracing – NOT equestrian sports i.e. showjumping or eventing)
Yes
No

Q7: Have you ever played any other sports at a professional, semi-professional, or in a professional academy prior to horseracing, i.e. football, boxing etc?
Yes
No

Q8: Have any of these individuals ever given you advice regarding your diet? Tick all that apply.
Other Jockeys
Jockey Coach

S&C coach (at Jack Berry or Oaksey House)
Nutritionist / Dietician (via PJA or Liverpool John Moores University)
Doctor / GP
Friends / Family

Q9: Rank the top 3 sources of information you rely on regarding nutrition (put number 1, 2, 3 next to the top three)
_____ Strength and Conditioning Coach
_____ Jockey Coach
_____ Nutritionist / Dietician
_____ Doctor / GP
_____ Family/Friend
_____ Internet Search
_____ Mass Media (Magazine, Radio, TV)
_____ Social Media (Facebook, Twitter, Instagram)
_____ Other Jockeys

Q10: Does the sporting organisation you are part of provide you with access to nutrition information or nutritionists/dietitians?
Nutrition information only
Nutrition information and access to nutritionists / dietitians
Neither of the above

Q11: Do you think that the sporting organisations should provide members with access to nutrition information or nutritionists/dietitians?
Yes, Nutrition information only (no need for direct access to nutritionists / dieticians)
Yes, Nutrition information and access to nutritionists / dietitians
No, Neither of the above are necessary

CARBOHYDRATE QUESTIONS

1. In general are these foods High or Low in carbohydrate? *(Please tick one box per food – <u>IF YOU ARE UNSURE PLEASE DON'T GUESS, TICK UNSURE</u>).*

	High	Low	Unsure
Beef	☐	☐	☐
Pasta	☐	☐	☐
Cabbage	☐	☐	☐
Weetabix	☐	☐	☐
Chocolate spread	☐	☐	☐
Lentils	☐	☐	☐
Wholemeal bread	☐	☐	☐
Chicken	☐	☐	☐
Jelly babies	☐		

2. Which of the following phrases best describes the glycaemic index? *(Please tick one box).*

The amount of carbohydrate a food contains	☐
The extent to which carbohydrate food raises blood sugar levels	☐
The extent to which protein food raises blood sugar levels	☐
The extent to which carbohydrate food raises blood pressure	☐
Unsure	☐

3. As a jockey, is it best to eat a diet rich in High or Low glycaemic index carbohydrates *(Please tick one box).*

High	Low	Unsure
☐	☐	☐

4. Which of these foods are classified as High or Low in the glycaemic index? *(Please tick one box per food).*

	High	Low	Unsure
Porridge oats	☐	☐	☐
Chick Peas	☐	☐	☐
Sweets (e.g. Gummi Bears)	☐	☐	☐
Dark chocolate (>70%coca)	☐	☐	☐
Honey	☐	☐	☐
Peanut butter	☐	☐	☐
Basmati rice	☐	☐	☐
Jacket potato	☐	☐	☐

5. Brown sugar is a lower calorie alternative the white sugar *(Please tick one box)*

True ☐ False ☐ Unsure ☐

6. A high carbohydrate diet helps to reduce protein breakdown in the body.

Agree ☐ Disagree ☐ Unsure ☐

7. Carbohydrate eaten in excess of needs can lead to fat gain.

Agree ☐ Disagree ☐ Unsure ☐

PROTEIN QUESTIONS

1. Would you agree or disagree with the following statements? (*Tick one box per question)*.

a) When running/jogging the body uses protein as its main energy source.

Agree ☐ Disagree ☐ Unsure ☐

b) Chicken is a very good source of energy to help fuel high intensity exercise.

Agree ☐ Disagree ☐ Unsure ☐

2. Are the following foods High or Low in protein? *(Tick one box per food)*

	High	Low	Unsure
Chicken	☐	☐	☐
Kidney beans	☐	☐	☐
Potato	☐	☐	☐
Spaghetti	☐	☐	☐
Tuna	☐	☐	☐
Egg	☐	☐	☐
Peanut butter	☐	☐	☐
Spinach	☐	☐	☐
Cornflakes	☐	☐	☐
Malt Loaf	☐	☐	☐

3. What is the main use(s) for protein in the body? (*Please tick one box)*.

Energy source ☐
Growth and repair ☐
Protect muscle from wasting during calorie restriction ☐
All of the above ☐
Unsure ☐

4. How much protein is there in the following food items? *(please tick one box per question)*

1 pint of skimmed milk

0.6 grams	6 grams	12 grams	40 grams	Unsure
☐	☐	☐	☐	☐

250 g tin of tuna

10 grams	20 grams	35 grams	50 grams	Unsure
☐	☐	☐	☐	☐

1 slice of brown/wholemeal bread

0 grams	2 grams	5 grams	8 grams	Unsure
☐	☐	☐	☐	☐

5. In general how much protein (grams) should an average 54kg (8st 7lbs) jockey eat per day? *(Please tick one box)*

54 – 65 grams ☐
76 – 87 grams ☐
108 – 135 grams ☐
160 – 216 grams ☐
Unsure ☐

6. There is more protein in a glass of whole milk compared to skimmed milk? (*True or false?).*

True ☐ False ☐ Unsure ☐

7. Which of the following contains the most protein? (*Please tick one box)*.

2 boiled eggs ☐
Grilled chicken breast ☐
Hanful of almonds ☐
All similar protein content ☐
Unsure ☐

FAT QUESTIONS

1. For improvements in health, what type of fat do experts recommend should be reduced in the diet? *(Please tick one box*).

- ☐ Monosaturated fat
- ☐ Polyunsaturated fat
- ☐ Saturated fat
- ☐ Unsure

2. Are these foods high in saturated or polyunsaturated fat *(Please tick one box per food)?*

	Saturated	Polyunsaturated	Unsure
Pumpkin Seeds	☐	☐	☐
Pork Chop	☐	☐	☐
Butter	☐	☐	☐
Olive Oil	☐	☐	☐
Mackerel	☐	☐	☐
Packet of Crisps	☐	☐	☐

3. Do you think these foods are High or Low in fat? *(Please tick one box per item).*

	High	Low	Unsure
Orange	☐	☐	☐
Avocado	☐	☐	☐
Cottage cheese	☐	☐	☐
White bread	☐	☐	☐
Peanuts	☐	☐	☐
Sunflower seeds	☐	☐	☐
Jam	☐	☐	☐
Banana	☐	☐	☐

VITAMINS AND MINERALS

1. Do you agree or disagree with the following statements *(Please tick one box per question)*

a) 500 ml of orange juice has the same number of calories as 500ml of orange squash.

Agree ☐ Disagree ☐ Unsure ☐

b) There is more calcium in a glass of whole milk than skimmed milk.

True ☐ False ☐ Unsure ☐

2. What is the role of antioxidants in the body? (*Please tick one box)*

Help with energy production	☐
Help prevent and repair cell damage	☐
Increase metabolic rate	☐
Improve hydration status	☐
Unsure	☐

3. In general the following foods are naturally rich in antioxidant. *(True or false).*

	True	False	Unsure
Red Meat (beef)	☐	☐	☐
White Fish (cod)	☐	☐	☐
Fruit	☐	☐	☐
Vegetables	☐	☐	☐
Dairy	☐	☐	☐
Unsure	☐	☐	☐

4. If you want to eat something that is rich in Vitamin C, which of the following foods would you eat? (*Please tick one box per question*)

a)	Oranges	☐	Beef	☐	Unsure ☐
b)	Red pepper	☐	Spinach	☐	Unsure ☐
c)	Cod	☐	Baked beans	☐	Unsure ☐

5. If you want to eat something that is rich in calcium, which of the following foods would you eat? (*Please tick one box per question*)

a)	Spinach	☐	Chicken	☐	Unsure ☐
b)	Skimmed Milk	☐	Sunflower seeds	☐	Unsure ☐
c)	Potato	☐	Cheddar cheese	☐	Unsure ☐

6. Which cooking method is best to help maintain the vitamin and minerals content within vegetables. (*Please tick one box)*.

Steam	☐
Boil	☐
Fry	☐
Grill	☐
	☐

Unsure

7. B vitamins are important for exercise because they help with: (*Please tick one box)*.

Hydration status ☐
Energy Production ☐
Immunity ☐
All of the above ☐
Unsure ☐

8. Which Vitamin is essential for good bone health: (*Please tick one box)*.

Vitamin A ☐
Vitamin B12 ☐
Vitamin D ☐
Vitamin E ☐
Unsure ☐

9. Which Mineral is essential for good bone health: (*Please tick one box)*.

Mangnesium ☐
Calcium ☐
Potassium ☐
Iron ☐
Unsure ☐

GENERAL NUTRITION

1. Cutting out 10 grams of carbohydrate from your diet will result in greater weight loss than cutting out 10 grams of fat. (*Please tick one box)*.

True ☐ False ☐ Unsure ☐

2. During the day when you're at rest, which is the predominant energy source the body uses? *(Please tick one box)*.

Carbohydrate ☐
Protein ☐
Fat ☐
Unsure ☐

3. How many calories are there in 1 gram of each of the following nutrients? (*Please tick one box for each nutrient)*

	Carbohydrate	Protein	Fat	Alcohol
2 kcal	☐	☐	☐	☐
4 kcal	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
		☐	☐	☐
		☐	☐	☐

7 kcal
9 kcal
13 kcal
Unsure ☐

4. Does one glass of orange squash count towards the government recommended '5 a day'? (*Please tick one box)*

Yes ☐
No ☐
Unsure ☐

5. If you are trying to lose weight and want to have a snack what would be best the best food to snack on? (*Please tick one box per question)*.

a)	Peanut butter on a bagel	☐	or	Tuna sandwich	☐
b)	100 g chicken wrap	☐	or	100 g pork pie	☐
c)	150 g Tomato salad	☐	or	100 g rice pudding	☐
d)	Cottage cheese and berries (50 grams)	☐	or	Cheddar Cheese and crackers (50 grams)	☐

6. The following are potential strategies to help someone reduce bodyweight. Please tick if you agree, disagree, or you're unsure:

a) Eat more low-energy and high fibre foods such as vegetables
Agree ☐ Disagree ☐ Unsure ☐

b) Swap butter for margarine
Agree ☐ Disagree ☐ Unsure ☐

c) Exchange snacks such as flapjacks for Greek yoghurt and berries
Agree ☐ Disagree ☐ Unsure ☐

d) Choose lower glycaemic index carbohydrates
Agree ☐ Disagree ☐ Unsure ☐

7. When weight loss is desired, athletes (jockeys) should: (*Please tick one box)*

Decrease carbohydrate intake to less than 50g per day ☐
Decrease fat intake to less than 20g per day ☐
Decrease kcal by decreasing carbohyrates & fats specific to own body ☐
Unsure ☐

8. To ensure they meet energy needs for health and weight goals, jockey should: (*Please tick one box)*

Have a diet according to their own age, gender, body size and lifestyle ☐
Eat to appetite (eat when hungry, don't if not) ☐
Eat 2000 calories per day ☐
Unsure ☐

9. When consumed / drank, alcohol contains calories ad therefore can lead to weight gain? (*Please tick one box)*.

Agree ☐ Disagree ☐ Unsure ☐

HYDRATION

1. In general, how much fluid should you drink on average per day? (Please tick one box)

0 – 0.99 litres ☐
1 – 1.99 litres ☐
2 – 2.99 litres ☐
3 – 3.99 litres ☐
4 – 4.99 litres ☐
Unsure ☐

2. In general, at what percentage of dehydration would you start to see a decrease in exercise (or riding) performance? (*Please tick one box).*

0.5 % ☐
2 % ☐
4 % ☐
6 % ☐
8 % ☐
Unsure ☐

3. A small amount of sodium added to fluid will help increase water absorption and improve hydration status? (*Please tick one box).*

True ☐ False ☐ Unsure ☐

4. In the first 2 hours after exercise how much fluid should you aim to drink?

10 % of sweat loss ☐
50 % of sweat loss ☐
75 % of sweat loss ☐
100 % of sweat loss ☐
150 % of sweat loss ☐

JOCKEY PERFORMANCE AND SUPPLEMENTATION

Please note, if you have not heard of any of the supplements listed below or are unsure of how they work, please tick the UNSURE box.

1. A high protein meal 1 hour before competing in a race is recommended to enhance performance. *(Please tick one box)*

True ☐ False ☐ Unsure ☐

2. Which of the following drinks contains the highest amount of carbohydrate? (P*lease Tick one box)*

500 ml Coke ☐
500 ml Powerade ☐
500 ml full fat milk ☐
500 ml orange squash ☐
Unsure ☐

3. In general, what would be the best item to snack on in the 30 minutes pre exercise? *(Please tick one box per question).*

a) Jelly babies	☐	or	Peanuts	☐
b) Chocolate	☐	or	Banana	☐
c) Sunflower seeds	☐	or	½ a white bread jam sandwich	☐
d) Cereal Bar	☐	or	50g low fat crisps	☐

4. For a jockey trying to lose weight, how much protein should they be eating per day (g/kg BM = grams per kilogram of body mass). *(Please tick one box)*.

0.5 – 0.9 g.kg BM ☐
1.0 – 1.4 g.kg BM ☐
1.5 – 2.0 g.kg BM ☐
2.1 – 2.5 g.kg BM ☐
2.6 – 3.0 g.kg BM ☐
Unsure ☐

5. If using a whey protein supplement, how much protein (in grams) do guidelines state should be consumed in one serving? *(Please tick one box)*.

10 – 17 g ☐
☐
☐
☐

18 – 24 g
25 – 30 g
31 - 37 g
38 – 45g ☐
Unsure ☐

6. For a jockey trying to lose weight, how much carbohydrate should they be eating per day (g/kg BM = grams per kilogram of body mass). *(Please tick one box)*.

1.5– 2.5 g.kg BM ☐
2.6 – 3.5 g.kg BM ☐
3.6 – 4.5 g.kg BM ☐
4.6 – 5.5 g.kg BM ☐
5.6 – 6.0 g.kg BM ☐
Unsure ☐

7. Ideally, what percentage body fat would a world-class jockey have? *(Please tick one box per discipline)*

3-5% ☐
6-7% ☐
8-10% ☐
11-14% ☐
14-16% ☐

8. Is it always beneficial to have a isotonic sports drink (e.g. Lucozade) in the 60 minutes before racing? *(Please tick one box)*

Yes ☐
No ☐
Unsure ☐

9. What food group is made up of amino acids? *(Please tick one box)*

Carbohydrate ☐
Protein ☐
Fat ☐
Unsure ☐

10. Which Amino Acid is responsible for muscle growth AND protection from muscle loss during calorie restriction? *(Please tick one box)*

Leucine ☐
Arginine ☐
Valine ☐

Unsure ☐

11. Supplementing with caffeine may result in an increase in riding performance? (*Tick as many as relevant)*.

True ☐ False ☐ Unsure ☐

12. If using caffeine, what is the necessary dosage needed to improve performance? (*Please tick one box)*.

1mg per kg bodyweight ☐
2-3mg per kg ☐
4-5mg per kg ☐
6-8mg per kg ☐
Unsure ☐

13. Which method of caffeine intake has the quickest effect on the body? (*Please tick one box)*.

Coffee / Espresso ☐
Red Bull / Monster etc. ☐
Caffeine Gum ☐
Pro Plus (Caffeine pills) ☐
Unsure ☐

14. As a jockey, having the lowest weight possible benefits riding performance?

True ☐ False ☐ Unsure ☐

15. Which do you think is the best lunch option for a jockey trying to lose fat. Assume they have ridden out all morning and are at home for lunch: *(please tick one box)*

A protein shake and 4 eggs ☐
Beans on 2 slices of toast and piece of fruit ☐
Grilled chicken breast, side salad and greek yoghurt ☐
Nothing – skip lunch and wait for dinner ☐
Unsure ☐

16. Which do you think is the best lunch option for a jockey trying to stay the same weight. Assume they have ridden out all morning and are at home for lunch: *(please tick one box)*

Tinned tuna, ½ baked potato, side salad, fruit piece ☐
Beans on 2 slices of toast and piece of fruit ☐
Lasagne and garlic bread ☐
Nothing – skip lunch and wait for dinner ☐

Unsure ☐

PRACTICAL FOOD KNOWLEDGE

1. Which potato side dish contain the least fat: *(please tick one box)*

Potato Salad (Boiled baby potates mixed in mayo) ☐
Mashed Potato (boiled potatoes with butter and milk) ☐
Baked Potato (oven baked with skin on) ☐
Unsure ☐

2. Which cheese has the least fat content: *(please tick one box)*

Cream Cheese (e.g. Philadeplhia or similar) ☐
Hard Cheese (e.g. Wensleydale) ☐
Cottage Cheese ☐
Unsure ☐

3. Which sandwich has the least calories: *(please tick one box)*

Ham Sandwich ☐
Chicken Nuggets Sandiwch ☐
Both Similar ☐
Unsure ☐

4. Which meal contains the fewest calories: *(please tick one box)*

Cod fillet, boiled potatoes and broccoli ☐
Vegetarian burger, pasta and peas ☐
Both Similar ☐
Unsure ☐

5. Which of these wraps has lowest fat content: *(please tick one box)*

Chicken wrap with salad and avocado/guacamole ☐
Chicken wrap with salad and tomato salsa ☐
Chicken wrap with salad and sour cream ☐
Unsure ☐

6. Which snack contains the least fat content: *(please tick one box)*

Puff pastry éclair ☐
Ice Cream ☐
Greek Yoghurt ☐

Unsure ☐

7. Which drink contains the least sugar: *(please tick one box)*

Lucozade Energy ☐
Fresh Orange Juice ☐
Both Similar ☐
Unsure ☐

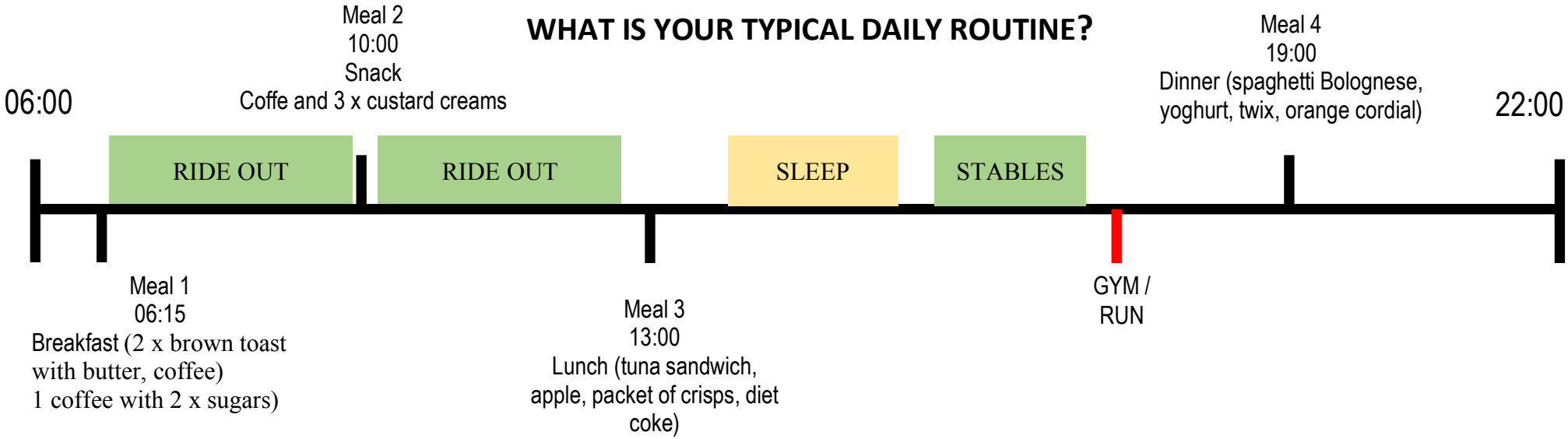
8. Which meal has the least calories: *(please tick one box)*

Fish, rice and green beans ☐
Chicken breast, pasta and carrots ☐
Both Similar ☐
Unsure ☐

9. Which meat dish contains the least fat: *(please tick one box)*

Lamb chops with roast potatoes and broccoli ☐
Minced beef with roast potatoes and broccoli ☐
Chicken breast with roast potatoes and broccoli ☐
Unsure ☐

WHAT IS YOUR TYPICAL DAILY ROUTINE?



ON THE NEXT PAGE, COMPLETE YOUR OWN TIMELINE THAT REFLECTS A TYPICAL DAY IN YOUR LIFE WHEN AT WORK.
INCLUDE:

TIMES YOU GENERALLY WAKE UP AND GO TO BED
TIMES YOU EAT AND EXAMPLES OF WHAT FOOD YOU EAT
ADD IN ANY EXERCISE THAT YOU DO
GIVE AS MUCH DETAIL AS POSSIBLE!

WAKE UP
TIME:

SLEEP
TIME: