Body Mass Index trends in men's Grand Tour cycling events from 1992-2022: Implications for athlete wellbeing and regulatory frameworks

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Abstract

Background: Weight-related issues and adverse weight-management behaviours are prominent concerns in elite-level sports, notably in competitions like men's road cycling. Whilst other sporting bodies have introduced measures based on Body Mass Index (BMI), no such provision exists in elite-level cycling, which is overseen by the Union Cycliste Internationale (UCI). However, these may be necessary to protect the short- and long-term health of riders and improve perceptions of the sport.

Methods: To ascertain the potential need for targeted policies, we gathered height and weight data from the ProCyclingStats website to investigate BMI trends for the top five male finishers between 1992-2022 in the General Classification (GC) category of the UCI's Grand Tours: the Giro d'Italia, the Tour de France, and the Vuelta a España.

Results: We calculated the BMI of 156 unique top five finishers in the GC of the Grand Tours with a total of n=445 BMI values (this includes riders who had multiple top five finishes in different races and years). Whilst singular data points varied, we observed overall declining mean BMI trends for these cyclists between 1992-2022.

Conclusion: Our results supplement existing anecdotal and scholarly evidence and suggest that lower BMIs are increasingly associated with top finishing positions in the GC of the men's Grand Tours. This could have substantial implications for athletes and regulators, since performance pressures could lead to detrimental weight-management practices that can harm short and long-term health and affect the sport's reputation. Accordingly, we propose that the UCI could consider multifactorial interventions, including prevention and awareness campaigns, screening programs, and BMI-based guidelines.

Background

Common in elite-level sports, weight-management issues can have varying implications for athletes' physical and mental health [1]. Although gender-based differences exist [2], adverse scenarios have been observed across different disciplines [e.g., 3,4]. Significantly, these may involve clinical and subclinical eating disorders (EDs), disordered eating, and associated conditions [5]. Per the Diagnostic and Statistical Manual of Mental Disorders 5th Edition (DSM-5), EDs encompass a range of clinical classifications and descriptions, incorporating threshold EDs (anorexia nervosa, bulimia nervosa, and binge eating disorder) and other specified feeding disorders or EDs [6]. Distinctive factors, like sporting environments and body dissatisfaction, can exacerbate individual attitudes and practices in athletes [2]. This is notable in disciplines where anthropometric characteristics, including body mass, can directly affect competitive performance levels. In these events, weight-related issues may be a prominent concern for athletes [7], leading some to adopt harmful behaviours that can align with ED symptomatology [2] or increase risks for additional physical and psychiatric morbidities (e.g., [8]).

Based on anecdotal and primary observations, male elite-level road cyclists may be vulnerable to weight-management problems due to performance pressures and the interactions between body mass, optimal weight, and competitive success [9]; the emphasis on aerodynamics and power-to-weight and mass ratios might precipitate or aggravate deleterious habits as competitors can frequently seek to attain a specific physique [10]. Riebl et al. noted that competing male riders had elevated scores on the Eating Attitudes Test-26 compared to the general population and many racers contended that EDs were somewhat common within the sport [11]. Additional studies into professional male cyclists demonstrate similar beliefs [12]. Filaire and colleagues noted that 46% of their sample of n=15 elite-level cyclists felt pressured to lost weight [13]. Moreover, as underscored by first-hand disclosures [14], detrimental sociocultural attitudes exist within the sport, such as "eating is cheating" [15], "win at all costs" [16], and "fat shaming" [17]. Equally, support teams have often required riders to follow strict diets intra-competition [18]. Taken together, these paradigms can all serve to heighten the normalisation of disordered eating and unhealthy nutritional regimes within the peloton, creating wider health risks and impinging upon the reputation of the sport.

The Union Cycliste Internationale (UCI) oversees men's elite-level road cycling, with racers and teams categorised by performance level. The premier division, UCI WorldTeams, features over five hundred male cyclists competing in World Tour events [19]. The men's World Tour has three major multi-stage races (the Grand Tours) that are widely deemed to be the most prestigious and demanding competitions. Consisting of the Giro d'Italia, the Tour de France, and the Vuelta a España, the Grand Tours offer more points than regular World Tour races. They are approximately three and a half thousand kilometres in length, with multiple stages involving climbing terrains and sizable elevation gain. Resultantly, it is now rare for a rider to participate in all Grand Tours in a single year. Within these competitions, points are awarded in several categories such as the best climbers (Mountains Classification) and fastest sprinters (Points Classification). Of these, the General Classification (GC) charts participants' cumulative race time and determines overall standings. To win the GC, riders need to have an effective team network and consistently demonstrate strong performances throughout. To that end, lower weight is commonly acknowledged as being an advantageous trait; for instance, Bradley Wiggins, the GC winner of the 2010 Giro d'Italia and the 2012 Tour de France stated: "compared to the 2007 Tour, the weight loss means I'm carrying the equivalent of six bags of sugar less up a mountain" [20].

In other sports where anthropometric characteristics can affect athletic performance, governing bodies have intervened to protect against unhealthy weight-management practices, whilst mindful of maintaining performance standards. For example, in 2004, the International Ski and Snowboard Federation (ISF) stipulated that ski length must be predicated on participants' Body Mass Index (BMI).[1] By limiting competitive advantages through the introduction of BMI-based criteria, the ISF's regulations have shown efficacy in countering EDs and severe problems related to low weight [22]. Nonetheless, the accuracy of BMIs as the foundation for these guidelines has been critiqued [23], as more generally has the validity and operationalisation of BMIs in clinical frameworks [24]. Albeit a disputed indicator for weight, BMIs are still widely utilised, notably by the World Health Organization [25]. For EDs, BMIs are embedded within the DSM-5 as severity markers for low weight, specifically: mild (BMI ≥ 17kg/m2), moderate (BMI 16-16.99 kg/m2), severe (BMI 15-15.99 kg/m2), and extreme (BMI < 15kg/m2) [6].

Given the relationship between sporting performance and weight in men's elite-level road cycling, alongside strong evidence of unhealthy behaviours and attitudes, it may be necessary for the UCI to consider potential regulatory solutions; for this reason, it is important to understand wider patterns to inform

effective policymaking that balances athlete health and competitive racing. Consequently, our study examines BMI data for the top five finishers in the GC category of the Grand Tours between 1992 and 2022, charting longitudinal trends.

[1] For 2022 ISF, rules see [21].

Methods

We collected secondary height and weight data from the men's Giro d'Italia, the Tour de France, and the Vuelta a España races for the top five GC finishers between 1992 and 2022. For data collection, we used a publicly available internet site, namely ProCyclingStats [26], which displays information on elite-level cycling from various sources, including individual riders, teams, and community contributors (email communication, October 2022). Using these height and weight figures, data were exported into Microsoft Excel and BMIs were calculated across each race. Within the 31-year period and accounting for those where information was not avaliable, we calculated BMI data from 156 unique top five GC finishers with a total of n=445 BMI values (this includes instances where individual riders had multiple top five finishes across the Grand Tours and timeframe). ProCyclingStats displays a single height and weight point for each cyclist, regardless of the year. Accordingly, annual mean values were built to account for this, which are displayed in our results. Following these calculations, charts were created and trend lines were plotted using Microsoft Excel.

Whilst our investigation does not involve direct human participation or primary data gathering, we sought approval from an ethical review board owing to the potential sensitivity of anthropometric data. The ethics commission of the Faculty of Philosophy and Human Sciences at the University of Bern granted ethical approval for this study on 11th January 2023.

Results

Based on the information we calculated, BMI data points are shown below for the top five riders in the Grand Tour events between 1992–2022. Overall figures from this timeframe are displayed in Table 1.

Table 1
Overview of BMI data between 1992–2022 for the top five finishers

BMI (1992–2022)	Grand Tours Total	Giro d'Italia	Tour de France	Vuelta a España
Mean	20.66	20.76	20.80	20.42
Standard Error	0.05	0.09	0.10	0.08
Median	20.66	20.52	20.96	20.31
Standard Deviation	1.09	1.08	1.21	0.92
Range	6.57	5.80	6.57	4.20
Minimum	17.92	18.29	17.92	18.52
Maximum	24.49	24.09	24.49	22.72
N BMI Values	445	148	152	145

Discussion

BMIs and sporting performance in the General Classification of Grand Tour Events

Our results show decreasing mean BMI trends for the top five men's road cyclists in the GC of the Grand Tours between 1992 and 2022. These findings suggest that lower BMIs are increasingly associated with top GC finishing positions and supplement similar anecdotal [20] and scholarly evidence [27, 28, 29]. For example, using a model based on the 2004 Tour de France, Torgler showed how a lower BMI substantially increased an athlete's probability of finishing in the final top twenty-five positions [27]. Likewise, Prinz and Wicker evaluated Tour de France performances between 2002 and 2004 and found that lower BMIs had a significant positive effect on the ranking of individual racers [28]. Additionally, results from Coupe and Gergaud reported that higher BMIs negatively influenced a cyclist's performance in the Tour de France as measured by both cumulative time and finishing position [29].

Researchers have discussed how lesser weight and body mass can be beneficial to cyclists seeking to gain a competitive advantage whilst riding considerable distances uphill [30, 31]. In Grand Tour events, courses encompass multiple segments with sizable elevation changes and mountain climbing terrains; as an example, the 2023 Tour de France will involve one section with over five thousand metres of elevation gain [32]. For athletes hoping to achieve success in alternative categories, like sprinters in the Points Classification, maintaining a lower body mass may be deemed less advantageous because of the importance of power over shorter distances and flatter sections [30, 31]. Accordingly, less mass may benefit the top finishers in the GC category that we investigated, where riders need to achieve consistent results, including uphill and mountain terrain. Nonetheless, in the authors' opinion, it could follow that the top GC competitors show higher BMI trends than those in the Mountains Category, as GC riders must also perform consistently in individual time trial stages that require sprinting [14]. This goes beyond the scope of the current study and more research is needed to understand these category-based differences.

Implications For Athlete Wellbeing

Although the mean BMIs across the Grand Tour races captured in our results (20.76 in the Giro d'Italia, 20.80 in the Tour de France, and 20.42 in the Vuela a España) do not meet severity criteria from the DSM-5 for EDs [6], declining BMI trends may raise questions about weight-related issues and athlete health. For us, these concerns could be increasingly pronounced since consistently low BMI has been noted as a risk factor for various medical conditions, such as depression [33], respiratory diseases [34], hypothermia [35], osteoporosis, and osteoporotic fracture [36]. For the latter, high incidences of low bone mineral density and higher possibilities for fractures has already been established amongst elite-level riders [37].

Owing to the performance-based associations of low weight and environmental and social influences, clinical and subclinical EDs and harmful weight-management behaviours may be prevalent within cycling [10]. Evidence indicates that elite-level riders can often adopt an extreme approach to weight loss, including disordered eating [11, 17], fasting [13], self-induced vomiting [9], the use of laxatives [13], and weight cycling in the lead up to competitions [38]. Significantly, such practices could render athletes vulnerable to comorbid physical and mental health conditions; alongside associations with clinical and subclinical ED presentations [39], adverse weight-management behaviours have been linked to low energy availability and increased risks for RED-S [9, 40], heart disease [8], obsessive compulsive disorder [41] substance use disorders [42], and exercise addiction [10]. Furthermore, there have been reports of support teams, medical staff, and other stakeholders closely monitoring racers' anthropometrics, body mass composition, and optimal weight, which has amplified weight-related pressures and injurious habits [9, 18, 43].

As unhealthy weight-management behaviours may be a widespread phenomenon, elite-level cyclists could conceivably not consider these practices to be pathological [11], inhibiting symptom recognition and health-seeking tendencies. This may be exacerbated by the enduring stigmatisation that surrounds ED symptoms in males [44] and challenges for primary care providers in detecting ED relevant symptoms [45]. In certain situations, weight-loss pressures have resulted in medicolegal repercussions for elite-level cyclists, who have consumed prohibited dietary supplements; one rider received a year-long doping ban for using the substance, methylhexanamine, which is prohibited by the World Anti-Doping Agency [16].

Equally, it is not just elite-level domains that are affected by these paradigms; detrimental eating habits have also been identified in junior competitions [9]. This is concerning as adolescent athletes could be impressionable, especially given elite-level riders may be considered to be role models; adolescent groups are highly vulnerable for developing harmful eating habits and ED symptoms [46]. Comparably, depicting cycling's "obsession with weight", media commentators have noted how amateur participants can exhibit "copycat" behaviours, associating low weight with sporting success and attempting to emulate the body composition of top-level riders [9, 43]. Analogously, when asked to provide advice to those "starting in the sport", a key recommendation from an elite-level rider was that "a very important thing is to be light" [47]. These aesthetic and cultural influences may render this a wider scale problem; here, images of elite-level riders with unhealthy weight profiles may impinge upon the connotations of the sport as offering "health benefits", which is an institutional goal of the UCI [48].

Towards Increased Regulatory Attention And Interventions

The declining BMI trends in our data and the evidence of harmful behaviours and attitudes in cycling suggest that multifactorial regulatory measures may be required. To that end, screening tools can help identify ED symptomatology in various sporting disciplines [7, 49], which could prove beneficial if implemented within elite-level cycling. Nonetheless, as Ribel et al. discuss, self-reported instruments might not necessarily be reliable because deleterious weight-management practices may be normalised [11] and diagnostic tools would need to be adapted to account for inherent gender biases [50]. Consequently, the UCI could consider compulsory regular weight and body composition screenings for riders and mandating obligatory follow-up measures for athletes outside of a healthy range. These may be particularly applicable intra-race, since cyclists can seek to drop weight prior to these events [38] under the assumption that they will return to a healthy BMI outside of competition.

To further address weight-based issues across elite-level domains and beyond, we believe that the UCI should also focus on modulating entrenched sociocultural perspectives through targeted prevention measures. These could be embedded in the organisation's new "health and wellbeing policy" that is a stated commitment in their 2030 Agenda [48]. Extending psychoeducation could allow riders to recognise risk factors, underlining the health consequences of the "win at all costs" dogma [16] and the performance-oriented culture that pervades the sport. Moreover, given that male EDs remain heavily stigmatised [44], culturally tailored information may be needed to effectively convey the short- and long-term dangers of harmful weight-loss practices [45]. Similarly, disseminating dietary materials and increasing access to counselling would be important, as limited nutritional knowledge in cyclists has been linked to the development of EDs [51]. Detailed education may be useful for support teams, including coaches and medical and nutritional staff; this is especially pertinent as previous research shows that elite-level coaches in other sports may not consider EDs to be a concern, lack sufficient education, or have difficulty distinguishing adverse behaviours [52]. Additionally, support teams may employ severe restriction diets for performance-enhancement reasons pre-race [18]. In our view, teams have a duty of care to their athletes and should take requisite steps to uphold their welfare.

Again with the aim of protecting rider's health, the UCI could take lessons from apposite initiatives in other disciplines and consider a lower weight limit for riders in relation to their height using evidence-based recommendations. For example, in 2019, the Fédération Internationale de l'Automobile, which regulates Formula One, amended the car and driver weight calculation by stipulating that a driver and their seat must weigh up to a minimum of 18kg; this was positively received by the community, as exemplified by one competitor: "I have been able to actually eat" [53]. Correspondingly, although they have elicited criticism for how they do not account for outlying body compositions [23], the ISF inaugurated successful BMI-based guidelines for ski length, enforcing equipment parameters to reduce weight-based advantages [22].

In cycling, there is already precedent for similar measures. For different reasons, in 2000, the UCI previously instituted a minimum weight for bicycles of 6.8kg [54]. This coincided with the uptake in carbon fibre frames, which the UCI feared would result in stress cracking and possibilities for accidents (and therefore

increased risks to athletes). The feasibility and efficacy of a newer BMI or weight-based policy for riders needs careful evaluation, specifically for its potential for encouraging weight cycling and its ergometric consequences. For the latter, detailed research is needed to understand how this could affect competition categories distinct from the GC. Nonetheless, discussions around this could provide a starting-basis for regulatory processes to address weight-management concerns in the sport. We believe that these dialogues might be increasingly necessary given our results and the evidence-base in the popular media and sports medicine literature around unhealthy weight-management practices across the peloton.

Limitations

Our analysis of secondary BMI data from men's Grand Tour events provides an insight into broad trends between 1992–2022. Thus, we believe it adds to ongoing dialogues around the association between low weight and performance in elite-level cycling, which have implications for athletes and regulators. Nonetheless, our study has several limitations.

Firstly, we only investigated male road cyclists in the GC of Grand Tour events and this limits the applicability of our findings to a specific subset of competitors. As a direction for additional research, future work could focus on disparate UCI events or different Classifications, to ascertain widespread trends. Likewise, we only included men's races, as comparative data in female events was not avaliable; two women's WorldTour stage races have only been recently established (the Tour de Frances Femmes in 2022 and Challenge by La Vuelta in 2020), thereby negating the possibility of conducting longitudinal analysis across three competitions. As there are gender-based differences in the exhibition of EDs and adverse weight-management behaviours [2], it would be important to chart historical BMI trends in women's elite-level road racing in the Giro d'Italia Femminile; this stage race has been running consecutively from 1988, although notably the 2021 edition lost UCI WorldTour status [55].

Equally, using BMIs to analyse weight-based issues may also entail limitations. General concerns have been noted about the validity of BMIs in sports medicine research since this metric measures ponderosity rather than fat and does not account for outlying body types [56]. However, we deemed BMI to be an appropriate indicator to gain a population-wide view and, from a psychiatric perspective, because BMIs are embedded within the DSM-5 as a severity marker for EDs [6]. Finally, we collated height and weight figures from a secondary data source, the ProCyclingStats website [26], and anthropometric data from fourteen cyclists were missing across the three Grand Tours. Moreover, ProCyclingStats only displays a single weight and height point for each rider and therefore may not accurately capture contemporaneous data. Despite this, we believe that our sample size of n = 156 unique cyclists (excluding duplicate top five entries across the Grand Tours and timeframe) over 31 years is sufficiently robust to identify broad patterns and mitigate against significant biases in our results.

Using ProCyclingStats as an information source may raise concerns about data reliability. We did not collect anthropometric data directly and information on the site is provided by individual riders, teams, and community contributions (email communication, October 2022); our findings should be interpreted with this limitation in mind. However, previous analyses have used ProCyclingStats as their information source [e.g., 57], and in lieu of verifiable primary data being avaliable over this time period, we deemed our approach to be suitable for gaining an insight into wider, longitudinal trends. We would welcome additional transparency from teams to provide more detailed analysis and specific evidence-based recommendations.

Conclusion

We calculated secondary BMI data for the top five cyclists competing in the UCI's Grand Tours between 1992–2022. Our results supplement extant evidence and indicate that lower BMIs are increasingly associated with the top GC Grand Tour finishers. As mean trends appear to be declining, this raises questions about protecting athlete's welfare, especially given that weight-related issues are a prevalent feature of elite-level cycling and the performance-oriented culture that surrounds the sport. Accordingly, we propose that the UCI could consider introducing additional regulatory measures, such as broader education campaigns, along with more proactive interventions, like screening programs or weight-based rules. Whilst further research is needed to inform the feasibility of these policies, we believe that the UCI have an institutional responsibility to explore all possible avenues for improving health within the peloton and reducing associated risks for competing athletes.

Declarations

Declaration of competing interests

The authors have no competing interests to declare.

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Figures

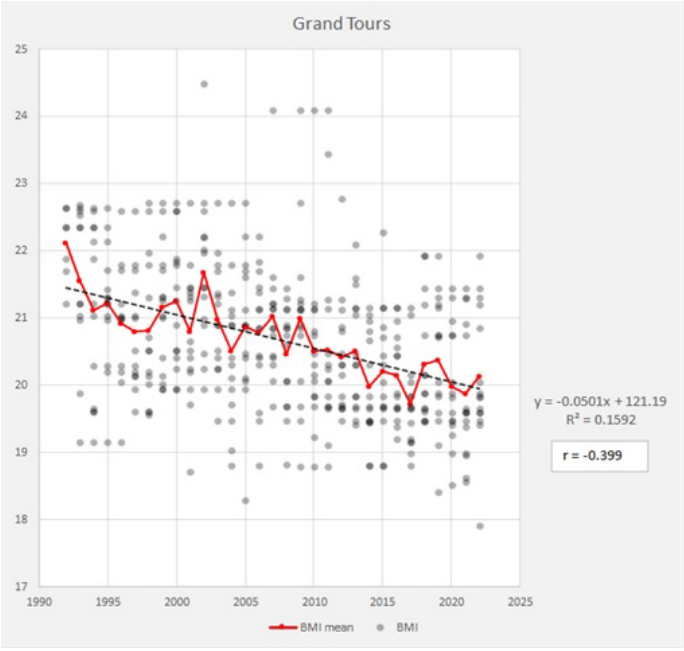

Figure 1

BMI Trends in the top five finishers across all Grand Tours 1992-2022

Figure 2

BMI Trends in the top five finishers in the Giro d'Italia 1992-2022

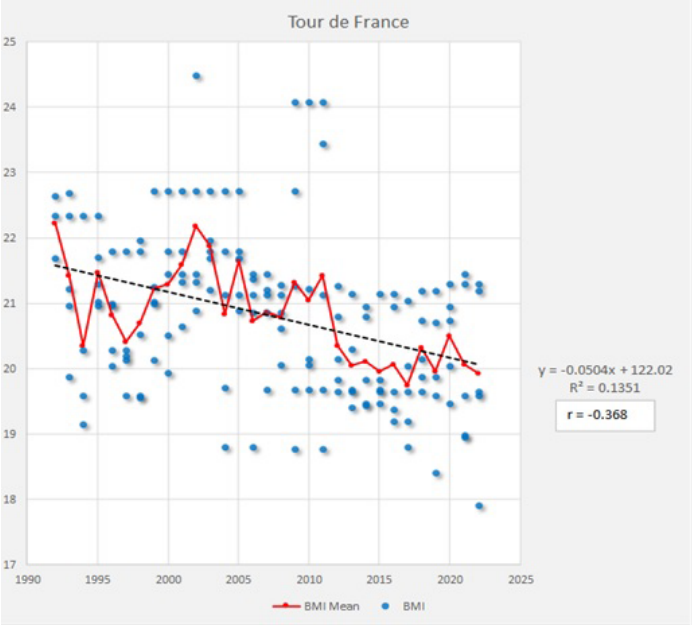

Figure 3

BMI Trends in the top five finishers in the Tour de France 1992-2022

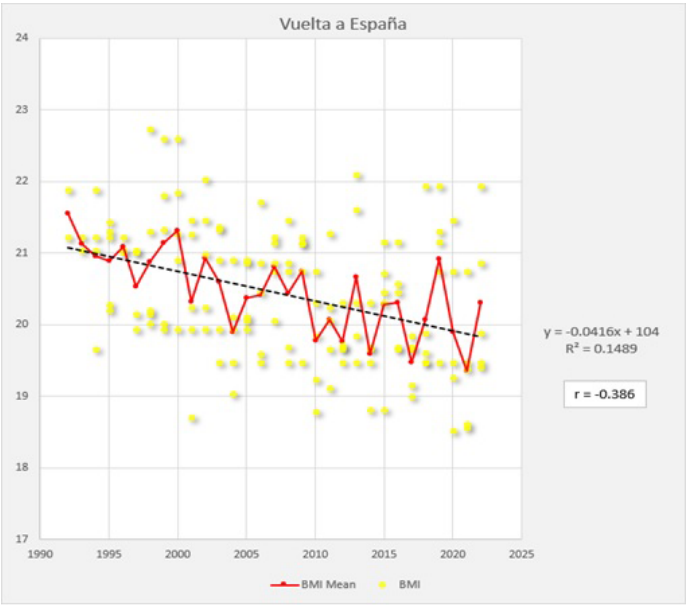

Figure 4

BMI Trends in the top five finishers in the Vuelta a España 1992-2022