TRAINING MODIFICATIONS IN ENDURANCE ATHLETES DUE TO COVID-19 RESTRICTIONS

by

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Chapter 1: Introduction

The coronavirus disease 2019 (COVID-19) abruptly altered daily life by rapidly spreading worldwide and becoming a pandemic. As of April 25, 2022, over 510 million individuals have been infected (Ritchie et al., 2020). This virus, spread primarily through respiratory droplets with close contact with other individuals, quickly became known by its characteristic symptoms of dry cough, shortness of breath, and fever (Wiersinga et al., 2020). Due to the high transmission rate, risk for severe illness, hospitalization, and mortality, as well as the novel nature of the disease, nationwide guidelines and restrictions were put in place to decrease the spread. Social distancing, mask-requirements, and mandatory lockdowns, isolations and quarantines, became the new norm, causing a sudden disruption in nearly every individual's daily life (*COVID-19 Strategy Update*, 2020).

Due to widespread safety measures, people involved in physical activity and sport no longer had access to the same equipment or facilities. Sports and physical activity organizations ceased practice and therefore competitions. Restrictions were placed upon sporting events at a national level, such as the National Basketball Association (NBA) and National Football League (NFL), as well as an international level, the Tokyo 2020 Olympics. While there is not robust literature on the affect COVID-19 on athletes practice habits, multiple studies reported mixed results related to the COVID-19 restrictions and athletes daily routines and training regimens. These studies reported that while athletes were able to continue training in some form, they were training at lower intensities, lesser frequency, a shorter duration per session, or focusing on non-sport specific movements (Facer-Childs et al., 2021; Fikenzer et al., 2021; Romdhani et al., 2021; Washif et al., 2022). These studies however reported data from endurance and non-endurance athletes (Facer-Childs et al., 2021; Romdhani et al., 2021; Washif et al., 2022) or a single sport (Fikenzer et al., 2021). A smaller study conducted by Leo et al. with 12 elite U23

cyclists (under 23 years) demonstrated that these athletes were able to maintain their physical fitness measures (maximal oxygen uptake, sprint and graded exercise peak power) and training characteristics despite lockdowns (Leo et al., 2021). Finally, a study examining mental health in professional US endurance athletes noted an increase in exercise duration despite a higher prevalence of depression and anxiety during lockdown during COVID-19 restrictions (Roche et al., 2021). Understanding how training routines change is important as literature has shown the detrimental impacts a sudden change in training can have on an athlete's preparation for competition and risk for injury during the return-to-play period. For example, in the 2011 NFL lockout, Achilles tendon injury incidence surpassed the any previous annual total, 12 cases, within a 33-day window (17-days preseason conditioning, and 2 weeks preseason competition; Myer et al., 2011). A similar increase in injury risk was seen with German soccer players in the Bundesliga league after returning from the 2020 COVID-19 lockdowns (Seshadri et al., 2021). A 3.12 times higher risk of injury was seen, when controlling for number of games each player played compared to injuries occurrences before lockdown (Platt et al., 2021). Furthermore, Major League Baseball players saw a two-fold increase in injury risk compared to injuries seen two seasons prior to COVID-19 lockdown. These three studies noted a decrease in either training intensity, volume, frequency, total duration, or a combination of these factors. This lead to inadequate preparation during the return to play phase, highlighting the importance of understanding those at risk for potentially career altering or career ending injuries due to similar training changes.

The purpose of this study was to determine association between the characteristics of endurance athletes and changes in training due to the COVID-19 pandemic. An electronic questionnaire (Qualtrics, Provo, UT) was sent to endurance athletes around the globe from June 2020 to February 2021. The questionnaire asked the athletes to report demographic data and

descriptive data including: age, sex, education level, socioeconomic status, endurance sport of choice, classification, current or prior coaching status, current or prior program, prior race success. Since no literature concerning the effects of COVID-19 safety measures on training patterns in endurance athletes had been published prior to the distribution of the questionnaire, no formal hypothesis was crafted for this study. This analysis was descriptive and exploratory in nature. An initial understanding of the above stated association can help athletes, coaches, and other sports professionals understand what factors are associated with training changes and therefore should be considered when planning return-to-play strategies.

Chapter 2: Literature review

During the time this questionnaire was distributed and being studied, other institutions conducted similar inquiries concurrently. Given the novel nature of the virus, a myriad preventative measures were taken to slow the spread of the virus. This review will include a brief overview of what has been uncovered about the virus, the mitigation strategies and its effects on sports and physical activity, and findings of other studies that looked at how the virus and safety measures affected different athlete populations.

2.1 Coronavirus Disease 2019 (COVID-19) and Community Mitigation Strategies.

Coronavirus Disease 2019, known in its long form as severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2) was traced back in an outbreak in Wuhan, People's Republic of China, in December 2019. Since then, the virus has spread worldwide, has been designated by the World Health Organization as a global pandemic, and as of April 25, 2022, nearly 510 million cases, and a little over 6.25 million deaths (Chilamakuri & Agarwal, 2021; Worldometer.info, Dover, Delaware, U.S.A.). A vast majority of individuals who contract the virus experience respiratory illness, such as cough, loss of taste or smell, and do not require intensive treatment (World Health Organization, n.d.-a). However, individuals can become much more seriously infected, requiring hospitalization. Those with underlying comorbidities such as diabetes, hypertension, cardiovascular diseases, and older populations (age >50 years old) are noted to be at higher risk for developing a serious illness from the COVID-19 virus (Cowling & Aiello, 2020).

Virus spread was identified as airborne droplets, which are easily spread by close person-to-person contact. Given the initial uncontrollable spread and high degree of uncertainty dealing with this virus, community wide mitigation measures were taken to help decrease the spread.

These include school and workplace closures, shutdown of mass gatherings, required use of a face mask, quarantine and isolation of those infected. Those sectors that were able to switch to a remote or work-from home method of conducting business to minimize spread of the virus (Chilamakuri & Agarwal, 2021).

In the past year, vaccinations for the virus became available in America through companies such as Pfizer/BioNTech and Moderna. Worldwide, over 150 vaccines have reached clinical development and are being given to help decrease the severity of infection and decrease the spread of disease (World Health Organization, n.d.-b). Given these risk mitigation strategies, we will now discuss how these affected physical activity and sports.

2.2 COVID-19 Restrictions Impact on Exercise and Training

With the lockdowns and other public safety measures placed on individuals due to the COVID-19 pandemic, a large majority of those engaged in exercise and training were required to make changes to their regimens. The following section provides an overview of the impact these public safety measures on various training variables, such as intensity, frequency, session duration, and sports specificity. This section will also examine the impact a sudden cessation or decrease in these variables can have on those engaged in regular exercise and training how this is relevant to the study at hand.

2.2.1 Washif et al. 2022

This study examined 12,526 athletes worldwide via an online questionnaire to compare training behaviors before and during lockdown (Washif et al., 2022). This questionnaire was distributed from May 17 to July 5, 2020, and looked at training knowledge, beliefs, and modifications related to COVID-19 lockdowns. Athletes were included in this study if they were ≥18 years of age, elite or sub-elite classification in their sport, and experienced a lockdown that

restricted their public access to exercise/training facilities. A majority (83%) of athletes targeted maintenance of general fitness. Training frequency decreased from 5-7 session per week before lockdowns to fewer than 5 sessions per week during lockdown. An overall decrease in session duration as well as training intensity was also noted. Athlete classification was strongly related to their ability to maintain access to training facilities. Fewer than 40% of athletes were able to maintain sport-specific activities during lockdowns, with a greater proportion seen in higher class athletes. More athletes also trained alone more than with a partner, group, or team. Higher class athletes also regarded "coaching by correspondence" (remote-coaching) as sufficient to maintain their training during lockdowns more compared to the lower-class athletes.

2.2.2 Pillay et al. 2020

Pillay et al. examined 692 elite and sub-elite athletes in South Africa during the last week of April 2020, when the country experienced the highest level (Alert Level 5) of Lockdown (Pillay et al., 2020). A Google Forms questionnaire was created to study the athletes' maintenance of physical activity, sleep, nutrition, mental health, and perception of return-to sport during COVID-19 lockdown. The researchers noted poorer sleep quality, worsened nutrition habits, loss of motivation to exercise and lockdown fatigue in these athletes. More athletes trained alone, rather than with a trainer in-person or online. Many athletes reported using body weight and cardio exercises, and training outside at a reduced intensity and duration of <60min. Athletes also expressed they preferred sedentary behaviors (e.g., watching television or video gaming) during their leisure time rather than active behaviors (e.g., spring cleaning, outdoor games with kids)

2.2.3 Roche et al., 2021

Roche et al. examined questionnaire data of 131 US Professional Endurance athletes to examine changes in mental health from before (Jan 1 – March 14, 2020) and during (March 15-Aug 25, 2020) COVID-19 restrictions (Roche et al., 2021). They also examined training changes in a sub-cohort of 112 participants who provided activity data from Strava. The researchers noted that the athletes had little interest in doing things, anxious, down/depressed, and felt that mental health affected their motivation to train/exercise. Despite these negative changes in their mental health, athletes training data described that daily training duration increased during lockdown (92min/day to 103min/day), and no significant changes in exercise intensity, relative effort, or session average heart rate were noted. This study noted that more than 30% of the athletes were training alone every day, and almost half decreased the time training with partners or their team compared to before COVID-19 restrictions.

2.2.4 Leo et al., 2021

Leo and colleagues examined 12 U23 elite cyclists to see how COVID-19 restrictions affected training load and physiological performance measures over the course of 90 days (30 days before, 30 days during, and 30 days after COVID-19 restrictions; Leo et al., 2021). Training characteristics were assessed before, during and after restrictions. This included duration, distance, and frequency per week, all logged on their online training platform (Trainingpeaks). The researchers assessed maximum oxygen uptake (VO2Max), power output at ventilatory threshold (VT), peak sprint and graded exercise power output and other measures 30 days before and 30 days after lockdown. The researchers found no significant differences in training volume, frequency, or intensity in the three timepoint related to COVID-19 restrictions. Nor were significant physiological performance differences discovered before and after COVID-19

restrictions. This study notes that 10 of the 12 participants lived in European countries where they could continue their normal training habits, with some mobility restrictions, but were not forced to train indoors.

2.2.5 Fikenzer et al., 2021

Fikenzer et al. took a more objective approach and looked at the effects of COVID lockdowns on performance metrics for 10 male German handball athletes (body mass 96±6kg, height 192±8cm; Fikenzer et al., 2021). This study compared VO2Max measurements from a graded exercise test when athletes were in pre-season (July 2019) to that taken after an 8-week lockdown (May 2020). A shuttle run test was also taken pre-season, midseason (Jan 2020), and after the 8-week lockdown. Athletes were provided an 8-week exercise plan to continue training at home during lockdown. This training program was sufficient in preserving VO2Max and cycle ergometry power output after the 8-week lockdown. However, the non-supervised 8-week home training was not sufficient to maintain endurance capacity measured with the shuttle run test, seen by a decrease in distance ran following lockdowns.

2.2.6 Romdhani et al., 2021

Romdhani et al. also looked at the impact of COVID-19 lockdown on sleep quality and training related habits in 3911 athletes from 49 different countries (Romdhani et al., 2021). These athletes (age 18-61 years), elite, and non-elite, who had gone through at least 2 weeks of lockdown completed a multipart questionnaire. Athletes were asked to recall their current sleep and training habits and a time 1-month prior to lockdowns (deemed baseline). The researchers compared these values to look at differences between age, sex, athlete classification, as well as individual vs. team sport and associations between changes in sleep and training. Overall, researchers saw a disruption in circadian rhythm, increased sleep time, higher psychological

strain, and poorer diet in these athletes. Athletes also reported training fewer sessions per week (average 4.96 days per week before to 3.34 days per week during).

2.2.7 Facer-Childs et al., 2021

Facer-Childs et al. collected questionnaire data on elite and sub-elite athletes in Australia (n=565) across multiple sports to also determine the impact of COVID-19 lockdown on athlete sleep, mental health, and training (Facer-Childs et al., 2021). Responses were collected between May 1 and Jun 1, 2020 and were distributed online. Athletes were in lockdown for at least 1 month and were asked questions regarding their behavior "over [that] past month." A vast majority (78.9%) of athletes reported a disruption in physical activity. Significant reductions in training frequency were also seen during lockdown. As seen with the previous studies, there was a shift away from team training toward more individual training. Athletes who found exercising more difficult during lockdown reported exercising for less time during lockdown as well.

2.2.8 Markotegi et al., 2021

This study conducted by Markotegi et al., while not looking at an athletic population, examined the differences in anthropometric, physical fitness, cardiovascular, quality of life, and depression/anxiety measures for those engaged in group-based multicomponent exercise (MPE; Markotegi et al., 2021)

in 17 adults (Age 80.48±4.64 years) from October 2018 to October 2020 (Markotegi et al., 2021). This MPE included strength, flexibility, and balance training, and was split into 4 phases: 1) First MPE season: October 2018-June 2019, 2) summer rest: July 2019-September 2019, 3) Second MPE season: October 2019-Feb 2020, 4) Cessation of activities due to COVID lockdowns: March 2020-Septemeber 2020. Metrics such as resting heart rate and blood pressure, waist-hip ratio, gait speed, arm-curl repetitions in 30 seconds, static balance, hand grip, Gold

Bergy Depression Scale, Tilburg frailty indicator, and loneliness scale significantly improved between the first MPE season, worsened during the summer rest, improved again during the second MPE season, and worsened during lockdowns to a similar or worse degree as they had during the summer rest phase.

2.3 Impact of Abrupt Training Cessation on Return-to-Play

While training modifications due to COVID is a relatively novel topic, and there is a natural paucity of research on the subject, the National Football League (NFL) lockout of 2011 can provide some information of the effects of abrupt training cessation and inadequate return-to-play training (Myer et al., 2011). During this lockout period (March 11 – July 25th), professional football players were unable to see their team medical staff, neither access nor train at their team facilities, and were unable to communicate with their coaches. This severely limited athlete's ability to take part in their normal 14-week conditioning training preparation for preseason competition. Rather, the athletes were given a 17-day window (July 27th – August 11th) to prepare for preseason competition. This report compared the incidence of Achilles tendon injury (ATI) before and after the 2011 lockout, noted 10 ATIs during the first 12 days of the 17-day training camp and an additional 2 within the first 2 weeks of preseason competition. These 12 ATIs had already exceeded previously reported ATIs that normally occur over the normal NFL season. Given the inadequate preparation with coaching staff increasing training volume, intensity, and frequency with this truncated training schedule, increased the risk of sport-related injuries for these NFL players. A more recent report, examining the Bundesliga German Soccer League players injury rates following COVID-19 lockdowns saw a similar trend upon return to play (Seshadri et al., 2021). A 3.12 times higher rate of injury was noted, when number of games played was controlled for, following lockdowns (from May 16, 2020 to Jun 27, 2020) compared to pre-lockdown. The study on Major League Baseball (MLB) players also

noted an increased injury risk of nearly double compared with that of 2 seasons prior to COVID-19 (Platt et al., 2021). Both the study on German soccer players and MLB players as well as the ATI incidence following the 2011 NFL lockout provide evidence for the negative, potentially career altering or even career ending impacts inadequate preparation from training cessation can have. Given the scope of the current study is to examine the difference in changes in training, understanding the characteristics of the athletes more likely to notice a decrease or cessation of training is crucial for return to play planning.

As seen with these studies the COVID-19 lockdowns imposed a substantial decrease on athlete's training frequency, session duration, intensity, volume, and/or sports specificity. As noted with the NFL 2011 lockout and the more recent MLB and Bundesliga soccer players, a decrease in training can lead to inadequate preparation, emphasizing the importance of understanding characteristics of these athletes and associated changes to training. This can provide a more individualized approach to athletes, coaches, and other sports professionals as COVID related training restrictions eventually are lifted and athletes have access to resume their training as done previously. As COVID restrictions in many places have been lifted at the time of this writing, this information may also help provide considerations for response to future scenarios where these athletes experience an abrupt and prolonged alterations to their training.

Chapter 3: Methods

3.1 Experimental Design

An electronic questionnaire (Qualtrics, Provo, UT) was distributed to endurance athletes from June 2020 to March 2021 to determine whether or not their training had changed due to the COVID-19 pandemic. The questionnaire was distributed using social media, email, and word of mouth. A contact list of groups/teams associated with national endurance sports organization (e.g., USA Triathlon, USA Cycling, etc.) was compiled from publicly available information online. Participants were recruited from both within and outside the United States. The Texas Christian University Institutional Review Board (IRB) approved the study and all participants electronically signed an informed consent prior to completing the questionnaire. Participants were entered into a drawing to win 1 of 15 $100 gift cards for completing the questionnaire.

3.2 Participants

Individuals who completed the questionnaire were included if they were at least 18 years old and self-identified as an endurance athlete. Endurance was defined as activities that involve prolonged rhythmic exercise mainly powered by oxidative phosphorylation (Booth et al., 2015). Participants were excluded if they self-reported they were <18 years of age, participated in a non-endurance activity, or failed to complete demographic sections in the questionnaire.

3.3 Questionnaire

The questionnaire consisted of 12 demographic questions regarding participant age, height, weight, sex, race, ethnicity, country of origin, current state and country of residence, occupation, highest education level, and income. There were 26 questions asked regarding sport background, including primary sport of choice and sport sub-type (e.g., running: cross-country, road, track), current/former classification (professional, current collegiate, former collegiate, or

recreational), podium placement in the past year, experience working under a coach, experience following a training program, weekly training frequency, training session duration, and time of day preferences. The questionnaire can be found in appendix A. There were 3 questions asked about COVID related changes to training. If a participant indicated that, 'yes,' training had changed due to COVID-19, follow up questions were asked to determine directionality of change (train less/more than before, at higher/lower intensities than before, longer/shorter per duration. A free-text cell was also included to allow individuals to provide nuance in how and why training changes occurred.

3.4 Statistical Analysis

All statistical analysis was performed in SPSS version 26 (software, IBM, Armonk, NY). Pearson Chi-Square ($\chi 2$) tests to determine whether training changes due to COVID-19 were associated with sex, age, household income, education, athlete classification (professional, current collegiate, former collegiate, recreational), current or former training program use, current or former training with a coach, or race placement in the past year. Alpha level for the χ 2 analysis was set to 0.05. A significant $\chi 2$ indicated that the proportion of athletes whose training changed due to COVID-19 is different for that variable in comparison to the changes noted in the sub-cohort who provided a valid response to that question. If a significant difference in between the responses a demographic or training characteristic was found, adjusted standardizes residuals were examined to determine significant group differences. A significant adjusted standardizes residual was set at ≥ 1.96 or ≤ -1.96. Age was grouped by decades up to 71-80 years. Participants' age 18, 19, or 20 years were grouped with 21-30 years. Statistical analysis for sport of choice was modified by grouping paracycling (n=1), Nordic skiing (n=1), race walking (n=1), wheelchair racing (n=1) into the "Other" category (n=7) as these groups were not large enough ($n<8$) for χ 2 analysis. Responses for sex was modified in a similar manner: the participants

(n=31) who selected “other” for sex typed their name when prompted to specify and the participant (n=1) who selected “non-binary” were excluded from the sex and training changes $\chi 2$ analyses due to an invalid response and inadequate group size, respectively.

Chapter 4: Results

A total of 331 endurance athletes responded to the question whether training had changed due to COVID. Out of this group, 219 (66.2%) reported that their training had changed due to the COVID-19 pandemic and the other 112 (33.8%) reported no changes in their training. Significant differences assessed by standardized adjusted residuals for significant $\chi 2$ analyses are reported compared to this proportion when all participant responses were valid for that variable (when n=331). Those that are not compared to this value are due to an invalid or missing response to the demographic or training question (when n<331). Training changes for those sub-cohorts will be provided for applicable demographic or training question for comparison. Demographic data of the athletes are shown in table 1. A majority of athletes were male (53.0 %, n=158), toward the younger age groups 18-30 years (33.4%) and 31-40 years (22.7%).

		Did your training change due to COVID-19 Pandemic?	
Variables	Total (n=331)	Yes (n=219)	No (n=112)
Age			
18-30	114 (34.4%)	85 (38.8%)	29 (25.9%)
31-40	75 (22.7%)	42 (19.2%)	33 (29.5%)
41-50	72 (21.8%)	51 (23.3%)	21 (18.8%)
51-60	38 (11.5%)	22 (10.0%)	16 (14.3%)
61-70	26 (7.9%)	16 (7.3%)	10 (8.9%)
71-80	4 (1.2%)	1 (0.5%)	3 (2.7%)
Missing	2 (0.6%)		
Sex			
Female	158 (47.7%)	115 (52.5%)	43 (38.4%)
Male	140 (42.3%)	84 (38.4%)	56 (50.0%)
Non-binary	1 (0.3%)	1 (0.5%)	0 (0%)
Invalid	31 (9.4%)	19 (8.7%)	12 (10.7%)
Classification			
Current Professional	18 (5.4%)	13 (5.9%)	5 (4.5%)
Current Collegiate	42 (12.7%)	34 (15.5%)	8 (7.1%)
Former Collegiate	51 (15.4%)	34 (15.5%)	17 (15.2%)
Recreational	220 (66.5%)	138 (63.0%)	82 (73.2%)
Primary Sport			
Cycling	69 (20.8%)	39 (17.8%)	30 (26.8%)
Running	123 (37.2%)	68 (31.1%)	55 (49.1%)
Rowing	13 (3.9%)	11 (5%)	2 (1.8%)
Swimming	8 (2.4%)	6 (2.7%)	2 (1.8%)
Triathlon	106 (32%)	87 (39.7%)	19 (17%)
Other	12 (3.6%)	8 (3.7%)	4 (3.6%)
Household Income			
Less than $20,000	22 (6.6%)	12 (5.5%)	10 (8.9%)
$20,000 to $34,999	16 (4.8%)	11 (5.0%)	5 (4.5%)
$35,000 to $49,999	13 (3.9%)	7 (3.2%)	6 (5.4%)
$50,000 to $74,999	36 (10.9%)	24 (11.0%)	12 (10.7%)
$75,000 to $99,999	32 (9.7%)	26 (11.9%)	6 (5.4%)
Over $100,000	175 (52.9%)	113 (51.6%)	62 (55.4%)
Prefer not to answer	37 (11.2%)	26 (11.9%)	11 (9.8%)
Education			
Some High School	1 (0.3%)	1 (0.5%)	0 (0%)
High School Diploma (9-12 years)	8 (2.4%)	6 (2.7%)	2 (1.8%)
Vocational Training (after high school)	5 (1.5%)	1 (0.5%)	4 (3.6%)
Some College (less than 4 years)	56 (16.9%)	36 (16.4%)	20 (17.9%)
Bachelor's Degree	109 (32.9%)	70 (32.0%)	39 (34.8%)
Graduate Degree	151 (45.6%)	104 (47.5%)	47 (42.0%)
Missing	1 (0.3%)		

Table 1 *Participant characteristics*

4.1 Chi-Squared Analyses

4.1.1 Age

The proportion of athletes who reported changes in training due to COVID differed significantly by age, Pearson $\chi2$= 12.1, p=0.033 (df=5, n=329). Based on the standardized adjusted residual analysis, those 18-30 years (n=114) reported that their training had changed at a higher proportion (74.5%) compared to the proportion of training changes reported by those with a valid response (66.0%). Those in the 31-40-year category (n=75) reported that their training had not changed at a higher proportion (44.0%). Two responses were considered invalid: age of 226 years and a non-number response.

4.1.2 Sex

Comparison of changes in training due to COVID differed significantly by sex, Pearson $\chi2$ = 5.469, p= 0.019 (df=1, n=298). Standardized adjusted residual analysis indicated that female athletes reported their training had changed at a significantly higher proportion (72.8%) compared to training changes reported by those with a valid response (66.8%). A significantly larger proportion of male athletes reported no changes to their training (40.0%) compared to the whole cohort with a valid response.

4.1.3 Education Level

No significant association was noted by $\chi2$ analysis between training changes and education level, $\chi2$ = 6.307, p= 0.278 (df=5, n=330).

4.1.4 Socioeconomic Status

No significant association was noted by $\chi2$ analysis between training changes and annual household income, $\chi2$ = 5.989, p= 0.424 (df=6, n=331).

4.1.5. Primary Endurance Sport

A significant association was found between training changes and primary endurance sport $\chi 2 = 23.613$, $p<.001$ (df=5, n=331). Standardized adjusted residual analysis showed that significantly more athletes who trained for triathlon changed training (82.1%) compared to training changes all participants (66.2%). Significantly fewer runners reported training changes (55%). Cycling trended toward significance (standardized residual of 1.9) with a higher proportion of athletes reporting no changes to their training (43%).

4.1.6 Athlete classification

No significant association was noted by $\chi 2$ analysis between training changes and athlete classification, $\chi 2 = 5.564$, $p= 0.135$ (df=3, n=331).

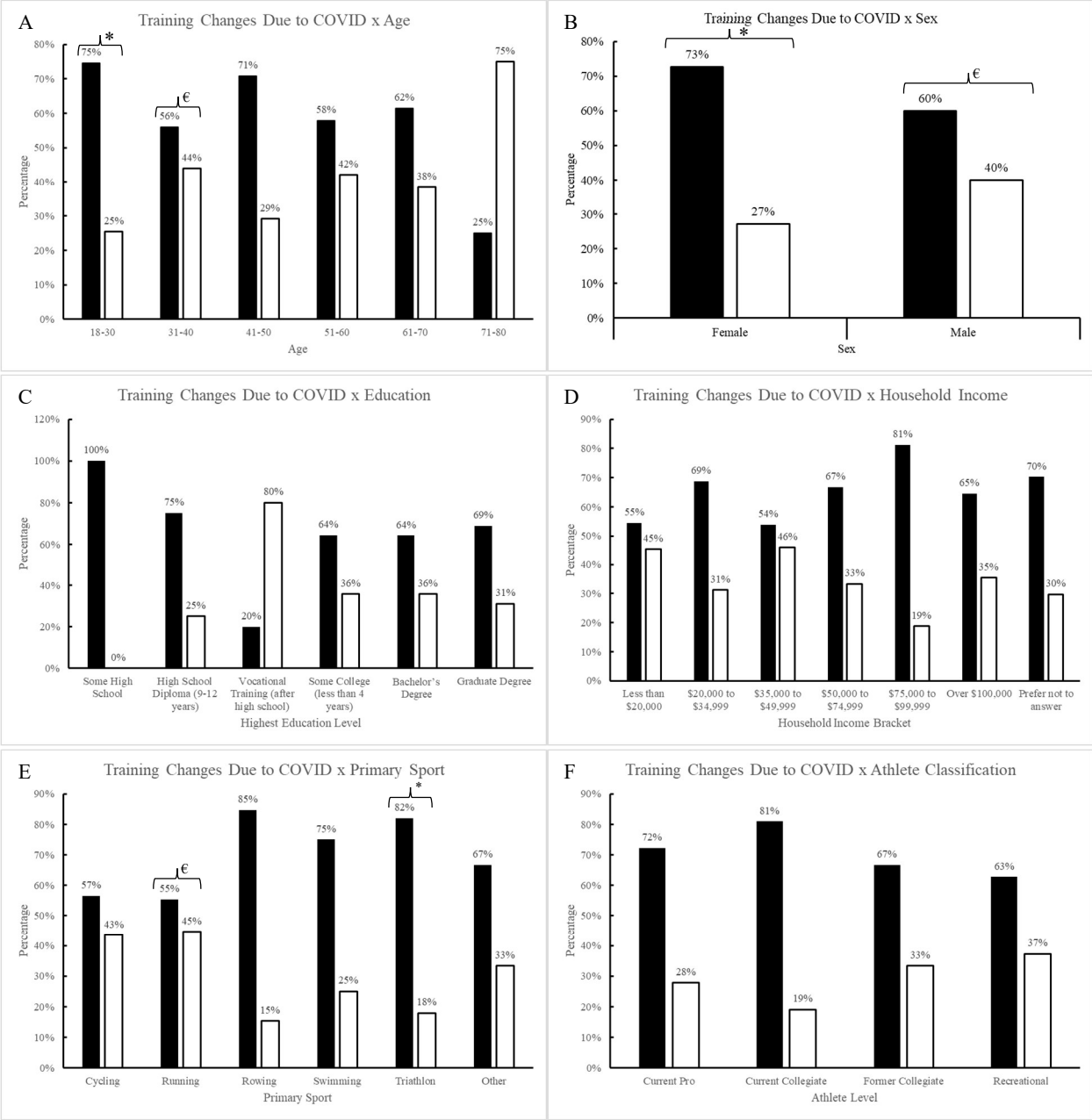

Figure 1 Proportion of training changes due to COVID by (A) Age, (B) Sex, (C) Education Level, (D) Household Income, (E) Primary Sport, (F) Athlete Classification. Black – yes, training changed, White – no, training did not change.
* Indicates this group training significantly changed more compared to the whole group based on standardized adjusted residuals
€ Indicates this group training significantly changed less compared to the whole group based on standardized adjusted residuals

4.1.7 Coaching status

No significant association was noted by $\chi 2$ analysis between training changes and those who are currently training with a coach, $\chi 2 = 2.788$, $p= 0.095$ (df=1, n=331). However, a significant association was found between training changes and whether or not an athletes worked with a coach in the past, $\chi 2 = 5.180$, $p= 0.023$ (df=1, n=206). Those who reported that they have worked with a coach in the past reported that their training had changed at a higher proportion (70.8%) compared to the sub-cohort with a valid response (62.6%). A smaller proportion of athletes who reported they have not worked with a coach in the past experienced changes in their training due to the pandemic (55.5%) compared to training changes reported by the sub-cohort with a valid response (62.5%).

4.1.8 Program Participation

No significant association was noted by $\chi 2$ analysis between training changes and those who are currently following a training program, $\chi 2 = 0.095$, $p= 0.758$ (df=1, n=331). A significant association was found between training changes and whether or not an athlete has worked on a program in the past $\chi 2 = 10.852$, $p= 0.001$ (df=1, n=134). Those who reported they have followed a training program reported at a higher proportion that training had changed due to the pandemic (72.4%) compared to training changes reported by the sub-cohort with a valid response (64.1%). Significantly more athletes who have not followed a program in the past reported no changes to their training (58%) compared to training changes reported by the sub-cohort with a valid response (35.8%).

4.1.9 Prior Race Success

No significant association was noted by $\chi 2$ analysis between training changes and whether or not the athlete had placed in the top 3 overall in any race in the past year, $\chi 2 = 0.120$,

p= 0.729 (df=1, n=330). Additionally, there was not a significant association found by $\chi 2$ analysis between training changes and whether or not the athlete had placed in the top 3 in their age group/division in the past year, $\chi 2 = 0.022$, p= 0.883 (df=1, n=331).

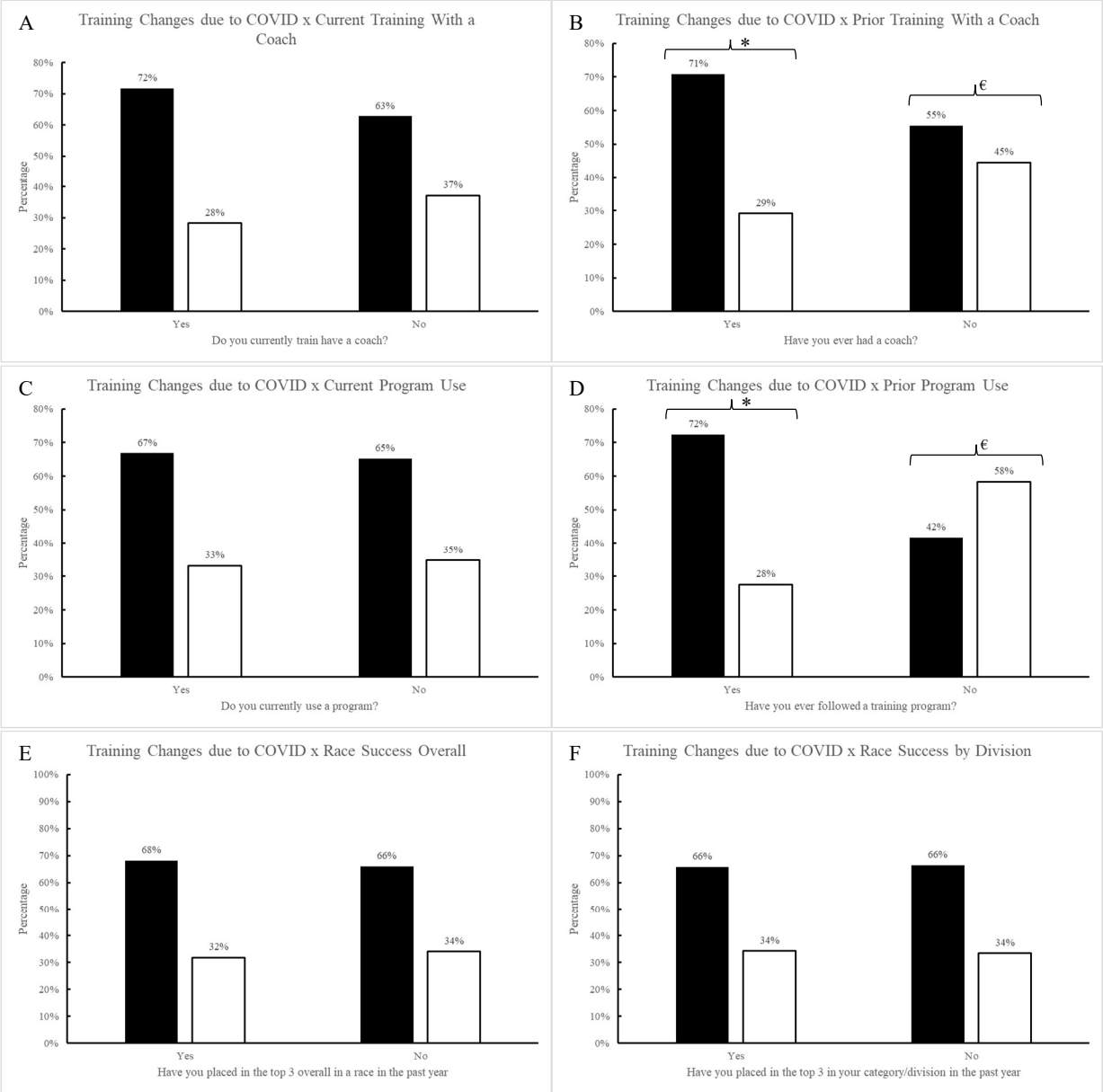

Figure 2 Proportion of training changes due to COVID by (A) Current Training with a coach, (B) Prior training with a coach, (C) Current use of a training program, (D) Prior use of a training program, (E) overall race success in the prior year, (F) race success in athlete's division/category. Black – yes, training changed, White – no, training did not change.
* Indicates this group training significantly changed more compared to the whole group based on standardized adjusted residuals
€ Indicates this group training significantly changed less compared to the whole group based on standardized adjusted residuals

How has your training changed due to the COVID-19 pandemic?	Count (%)
I train less than before	88 (40.2%)
I train more than before	55 (25.1%)
I train at lower intensities than before	73 (33.3%)
I train at higher intensities than before	14 (6.4%)
Individual sessions are shorter than before	41 (18.7%)
Individual sessions are longer than before	23 (10.5%)
Other	39 (17.8%)
Missing[¥]	3 (1.4%)
Invalid[†]	2 (0.9%)
Why has your training changed due to the COVID-19 pandemic?	
I cannot access facilities I normally use for training	136 (62.1%)
Group training sessions are no longer an option	93 (42.5%)
My work situation has changed and I have less time	33 (15.1%)
My work situation has changed and I have more time	38 (17.4%)
My work situation has changed and my hours are less flexible	21 (9.6%)
My work situation has changed and my hours are more flexible	63 (28.8%)
Other	32 (14.6%)
Missing[¥]	0 (0%)
Invalid[†]	1 (0.5%)

Table 2 *Frequency tables for responses to how and why training changed due to the COVID-19 pandemic. These questions were only asked as a follow-up to those who responded "Yes" to the initial question of whether or not training had changed.*
¥ Athlete selected that training had changed but did not select any responses indicating how or why train
† Athlete selected two mutually exclusive and opposing responses (i.e., "I train at lower intensities than before" and "I train at higher intensities than before

4.2 Free Text responses on how and why training changed

The free text responses also included insight on how (n=39) and why (n=32) training changed outside of the anticipated responses (Table 2). While the participant responses fit into the preset non-free-text responses for the other question, but analysis is kept as the way it was received. Common themes for how training changed include more solo training (n=7) and decreased access to the usual training facilities (n=12). Athletes that reported they increased the frequency of solo training voiced they trained less with their teams/partners due to new conflicting schedules or concerns with social distancing. Athletes also reported that access to training facilities or equipment had changed. Particularly noticeable, athletes who selected swimming and triathlon as their primary endurance sport of choice voiced they either swam less or stopped swimming altogether (n=9). This was due to either lack of access to indoor pool or concerns of training in crowds in outside pools. Similarly, cyclists and runners commonly reported modifying their routes to avoid contact with other people. A few cyclists reported they increased the frequency of indoor training using a virtual cycling trainer to avoid contact with people on outside routes (n=2). Athletes also reported that they modified their supplementary strength training due to gym closures to either more accessible home training or more training of their primary endurance sport (n=3).

Common reasons for why training changed due to the COVID-19 pandemic included decreased motivation (n=4), less race-oriented training (n=13), safety concerns about COVID-19 (e.g., mask wearing, social distancing; n=6), and changes in responsibilities outside of training (n=5). With the pandemic, athletes reported they had no races to train for and as a result, they decreased their training intensity or had less motivation to keep up with training. With less group-training and more solo-training, athletes also voiced less motivation to train. And finally, with changes in the athlete's work, school, or home responsibilities, or that the athlete's family,

athletes reported less overall time for training due to increased responsibilities outside of training (n=4). Of notes, some athletes did report an increase in training (n=3), saying they were just getting back into training (n-1) or returning from an injury (n=1), or they now had increased availability due to decreased responsibilities for work (n=1).

Chapter 5: Discussion

5.1. Discussion

The primary purpose of this study was to determine the demographic and training characteristics of endurance athletes associated with changes in training due to the COVID-19 pandemic. Analysis of this questionnaire data indicated that athlete age, sex, primary endurance sport, and prior coaching or prior use of a training program was significantly associated with changes in training. Factors that did not show significance included athlete education level, annual household income, athletes' classification, current coaching status or use of a training program, or success in a race in the past year. It is important to take these factors into consideration when designing proper return-to-play strategies to ensure a safe transition back to normal training.

The youngest group (18-30 years) in the cohort showed a significantly larger proportion of a change in training compared to the other five groups. Those in the second youngest (31-40 years) showed a significantly larger portion of being able to maintain their normal training compared to the other five groups. It is particularly important these two ages groups are also of particular interest to ensure training changes are adequately responded to as endurance age for prime endurance athlete is around 20-40 years old (Allen & Hopkins, 2015; Rüst et al., 2012; Tanaka & Seals, 2008).

Sex differences were also noted with males reporting at a larger proportion that training was unchanged due to the pandemic and females reporting at a larger proportion that training had changed. Pillay et al and Romdhani et al. also noted sex differences with females experiencing more adverse effects on mental health and higher proportion of anxiety and depression symptoms compared to males during the COVID-19 lockdowns (Pillay et al., 2020; Romdhani et

al., 2021). While this study is limited in understanding whether the sex difference in training changes were beneficial or undesirable, it is important to acknowledge they exists and should be a factor to consider when designing return-to-play strategies.

Athletes engaged in running reported a smaller proportion of change in training due to COVID -19. While factors that helped athletes maintain their normal pre-lockdown was not examined in this study, COVID-19 safety precautions may have had a smaller degree of impact on outdoor activities such as running as well as cycling, another sport which noted a trend towards a significant proportion of athletes reporting no changes in training due to the pandemic. Based on the free-text responses, athletes that experienced training changes reported more solo-training and changes in training routes, suggesting that training was continued. This may indicate a maintenance of normal training regimens but conclusions on the impact of lockdowns on training intensity, frequency, volume, and other training metrics are better determined with more objective metrics, such as GPS training trackers. Triathletes noted a higher proportion of changes due to COVID-19, with the open-ended response overwhelmingly suggesting that closures of indoor pools and inaccessibility of outdoor bodies of water to train in limited their ability to train the swimming discipline. These athletes also reported that this increased their focus on the running and cycling disciplines. Thus, as access to pools and other bodies of waters increases, training should be adequately progressed to minimize injury risk as in triathletes. Of note, this change in training focus for triathletes further indicates that those engaged in cycling and running were able to maintain their training routines.

Finally, the two factors, prior coaching and prior use of a training program, were noted to have a higher proportion of change in training compared to their counter parts. Conclusions from this calculation are limited as the wording of the question did not clarify whether or not athletes discontinued their training with a coach or a program due to the pandemic or the two factors

were mutually exclusive. Nonetheless, utilizing a training program and/or receiving training from a coach can help athletes progress and stay on track with training and may help maximize progress in their sport (Losch et al., 2016; McClaran, 2003).

5.2 Limitations:

While this study was able to determine whether or not these endurance athletes experienced changes in their training due to the COVID-19 pandemic, directionality of the changes athlete's experienced was not readily available from this questionnaire. Follow up questions were asked; however, these questions were prompted as optional questions rather than a required question to move forward with the survey. Even though nearly every participant responded with at least one reasons why training had changed, an alternate method of questioning the athletes would allow us to determine the directionality of change. Rather than a "select all that apply" option for the "how-" and "why-" training changed, questions could have been posed as an increase, decrease, or stayed the same with regards to the variables at hand (e.g., intensity per session, duration per session, time outside of work, flexibility of daily schedule). Doing so would have provided better insight on the actual training changes experienced rather than the non-directional response received for this study, and would have also helped prevent invalid responses such as those that indicated a specific training variable both increased and decreased. Another alternate method that would provide more objective data, is to use fitness tracking data, such as Strava or Garmin, to compare training data pre-, intra-, and post-lockdowns.

This study did have a large sample size of 331 participants who responded to the question whether or not training changed due to the pandemic. While this increases the generalizability of the findings to endurance athletes of all levels (professional, collegiate, and recreational),

compared to other studies that were conducted at the same time, this sample size is relatively small in nature. The study by Washif et al. examined 12,526 athletes, Romdhani et al. 3911 athletes, 692 athletes in the survey study from Pillay et al., and 565 participants in the Facer-Childs study (Facer-Childs et al., 2021; Pillay et al., 2020; Romdhani et al., 2021; Washif et al., 2022). It should be noted these four studies included both endurance and non-endurance athletes. This study did have more total endurance athletes than the 131 professional endurance athletes surveyed in Roche et al., however this study was only completed by 18 professional athletes (Roche et al., 2021). Having a larger sample size, the results may have been less skewed in terms of athlete classification, annual household income, and highest completed education level. In regards to athlete classification, Fikenzer et al. and Leo et al. noted that the professional athletes in their studies were able to either maintain their session volume, frequency, or intensity, or even increase session duration (Fikenzer et al., 2021; Leo et al., 2021). Professional athletes in other sports also had access to training "bubbles" camps, allowing athletes access to regular training facilities and professional support staff (Washif et al., 2021). This observation may have been noted in this study with a higher response rate from professional endurance athletes.

Due to the unprecedent nature of the pandemic, a cross sectional nature study design was used to determine whether or not training had changed. The studies by Roche et al. and Romdhani et al. utilized a recall design to compare pre- and intra-/post- lockdown training (Roche et al., 2021; Romdhani et al., 2021). This design is subject to recency bias but may provide more insight to the degree of changes the athletes experienced. Roche et al. and Leo et al. also used online training logs, Strava and Trainingpeaks respectively, to compare training characteristics (Leo et al., 2021; Roche et al., 2021).

This study was also part of a larger survey study, examining the sleep, recovery, nutrition, and supplement habits of endurance athletes. This over all survey included in-depth

analysis of those three factors associated with training, taking about 1 hour to complete. While participants were included in a raffle to be rewarded with 1 of 15 $100 gift cards, the length of the survey may have deterred responses from this subsection related to training changes due to COVID-19. Finally, free text responses were only obtained from those who reported that "yes" their training did change due to the COVID-19 pandemic to better understand how and why training changed. No follow up questions were asked of the group that said "no" training did not change which may have provided insight to factors that allowed this group to maintain their training as a comparison.

5.3 Summary

This study sought to examine training and demographic characteristics of endurance athletes associated with training changes due to the COVID-19 pandemic. Based on analysis of 331 endurance athletes, age, sex, primary endurance sport, prior coaching and prior use of a training program were significantly associated with changes in training outside of proportions noted for the whole group. These factors can be taken into consideration by athletes, coaches, and other sports professionals as COVID-19 public health and safety restrictions are lifted to ensure a safe transition to return-to-play.

References

Allen, S. V., & Hopkins, W. G. (2015a). Age of Peak Competitive Performance of Elite Athletes: A Systematic Review. *Sports Medicine (Auckland, N.Z.)*, *45*(10), 1431–1441. https://doi.org/10.1007/s40279-015-0354-3

Booth, F. W., Ruegsegger, G. N., Toedebusch, R. G., & Yan, Z. (2015). Endurance Exercise and the Regulation of Skeletal Muscle Metabolism. In *Progress in Molecular Biology and Translational Science* (Vol. 135, pp. 129–151). Elsevier. https://doi.org/10.1016/bs.pmbts.2015.07.016

Chilamakuri, R., & Agarwal, S. (2021). COVID-19: Characteristics and Therapeutics. *Cells*, *10*(2), 206. https://doi.org/10.3390/cells10020206

COVID-19 Strategy Update. (2020). World Health Organization. https://www.who.int/docs/default-source/coronaviruse/covid-strategy-update-14april2020.pdf?sfvrsn=29da3ba0_19

Cowling, B. J., & Aiello, A. E. (2020). Public Health Measures to Slow Community Spread of Coronavirus Disease 2019. *The Journal of Infectious Diseases*, *221*(11), 1749–1751. https://doi.org/10.1093/infdis/jiaa123

Facer-Childs, E. R., Hoffman, D., Tran, J. N., Drummond, S. P. A., & Rajaratnam, S. M. W. (2021). Sleep and mental health in athletes during COVID-19 lockdown. *Sleep*, *44*(5), zsaa261. https://doi.org/10.1093/sleep/zsaa261

Fikenzer, S., Fikenzer, K., Laufs, U., Falz, R., Pietrek, H., & Hepp, P. (2021). Impact of COVID-19 lockdown on endurance capacity of elite handball players. *The Journal of Sports Medicine and Physical Fitness*, *61*(7). https://doi.org/10.23736/S0022-4707.20.11501-9

Harangi-Rákos, M., Pfau, C., Bácsné Bába, É., Bács, B. A., & Kőmíves, P. M. (2022). Lockdowns and Physical Activities: Sports in the Time of COVID. *International Journal of Environmental Research and Public Health*, *19*(4), 2175. https://doi.org/10.3390/ijerph19042175

Leo, P., Mujika, I., & Lawley, J. (2021). Influence of COVID-19 Restrictions on Training and Physiological Characteristics in U23 Elite Cyclists. *Journal of Functional Morphology and Kinesiology*, *7*(1), 1. https://doi.org/10.3390/jfmk7010001

Losch, S., Traut-Mattausch, E., Mühlberger, M. D., & Jonas, E. (2016). Comparing the Effectiveness of Individual Coaching, Self-Coaching, and Group Training: How Leadership Makes the Difference. *Frontiers in Psychology*, *7*, 629. https://doi.org/10.3389/fpsyg.2016.00629

Markotegi, M., Irazusta, J., Sanz, B., & Rodriguez-Larrad, A. (2021). Effect of the COVID-19 pandemic on the physical and psychoaffective health of older adults in a physical exercise program. *Experimental Gerontology*, *155*, 111580. https://doi.org/10.1016/j.exger.2021.111580

McClaran, S. R. (2003). The effectiveness of personal training on changing attitudes towards physical activity. *Journal of Sports Science & Medicine*, *2*(1), 10–14.

Myer, G. D., Faigenbaum, A. D., Cherny, C. E., Heidt, R. S., & Hewett, T. E. (2011). Did the NFL Lockout expose the Achilles heel of competitive sports? *The Journal of Orthopaedic and Sports Physical Therapy*, *41*(10), 702–705. https://doi.org/10.2519/jospt.2011.0107

Pillay, L., Janse van Rensburg, D. C. C., Jansen van Rensburg, A., Ramagole, D. A., Holtzhausen, L., Dijkstra, H. P., & Cronje, T. (2020). Nowhere to hide: The significant impact of coronavirus disease 2019 (COVID-19) measures on elite and semi-elite South African athletes. *Journal of Science and Medicine in Sport*, *23*(7), 670–679. https://doi.org/10.1016/j.jsams.2020.05.016

Platt, B. N., Uhl, T. L., Sciascia, A. D., Zacharias, A. J., Lemaster, N. G., & Stone, A. V. (2021). Injury Rates in Major League Baseball During the 2020 COVID-19 Season. *Orthopaedic Journal of Sports Medicine*, *9*(3), 2325967121999646. https://doi.org/10.1177/2325967121999646

Ritchie, H., Mathieu, E., Rodés-Guirao, L., Appel, C., Giattino, C., Ortiz-Ospina, E., Hasell, J., Macdonald, B., Beltekian, D., & Roser, M. (2020, March 5). Coronavirus Pandemic (COVID-19). Our World in Data. https://ourworldindata.org/covid-cases#citation

Roche, M., Sainani, K., Noordsy, D., & Fredericson, M. (2021). Impacts of COVID-19 on Mental Health and Training in US Professional Endurance Athletes. *Clinical Journal of Sport Medicine: Official Journal of the Canadian Academy of Sport Medicine*. https://doi.org/10.1097/JSM.0000000000000983

Romdhani, M., Rae, D. E., Nédélec, M., Ammar, A., Chtourou, H., Al Horani, R., Ben Saad, H., Bragazzi, N., Dönmez, G., Driss, T., Fullagar, H. H. K., Farooq, A., Garbarino, S., Hammouda, O., Hassanmirzaei, B., Khalladi, K., Khemila, S., Mataruna-Dos-Santos, L. J., Moussa-Chamari, I., … Chamari, K. (2021). COVID-19 Lockdowns: A Worldwide Survey of Circadian Rhythms and Sleep Quality in 3911 Athletes from 49 Countries, with Data-Driven Recommendations. *Sports Medicine*. https://doi.org/10.1007/s40279-021-01601-y

Rüst, C. A., Knechtle, B., Knechtle, P., Rosemann, T., & Lepers, R. (2012). Age of peak performance in elite male and female Ironman triathletes competing in Ironman Switzerland, a qualifier for the Ironman world championship, Ironman Hawaii, from 1995 to 2011. *Open Access Journal of Sports Medicine*, *3*, 175–182. https://doi.org/10.2147/OAJSM.S37115

Seshadri, D. R., Thom, M. L., Harlow, E. R., Drummond, C. K., & Voos, J. E. (2021). Case Report: Return to Sport Following the COVID-19 Lockdown and Its Impact on Injury Rates in the German Soccer League. *Frontiers in Sports and Active Living*, *3*, 604226. https://doi.org/10.3389/fspor.2021.604226

Tanaka, H., & Seals, D. R. (2008). Endurance exercise performance in Masters athletes: Age-associated changes and underlying physiological mechanisms. *The Journal of Physiology*, *586*(1), 55–63. https://doi.org/10.1113/jphysiol.2007.141879

Washif, J. A., Farooq, A., Krug, I., Pyne, D. B., Verhagen, E., Taylor, L., Wong, D. P., Mujika, I., Cortis, C., Haddad, M., Ahmadian, O., Al Jufaili, M., Al-Horani, R. A., Al-Mohannadi, A. S., Aloui, A., Ammar, A., Arifi, F., Aziz, A. R., Batuev, M., … Chamari, K. (2022). Training During the COVID-19 Lockdown: Knowledge, Beliefs, and Practices

of 12,526 Athletes from 142 Countries and Six Continents. *Sports Medicine*, *52*(4), 933–948. https://doi.org/10.1007/s40279-021-01573-z

Washif, J. A., Mohd Kassim, S. F. A., Lew, P. C. F., Chong, C. S. M., & James, C. (2021). Athlete's Perceptions of a "Quarantine" Training Camp During the COVID-19 Lockdown. *Frontiers in Sports and Active Living*, *2*, 622858. https://doi.org/10.3389/fspor.2020.622858

Wiersinga, W. J., Rhodes, A., Cheng, A. C., Peacock, S. J., & Prescott, H. C. (2020). Pathophysiology, Transmission, Diagnosis, and Treatment of Coronavirus Disease 2019 (COVID-19): A Review. *JAMA*, *324*(8), 782. https://doi.org/10.1001/jama.2020.12839

World Health Organization. (n.d.-a). *Coronavirus disease (COVID-19)*. World Health Organization. https://www.who.int/health-topics/coronavirus#tab=tab_1

World Health Organization. (n.d.-b). *COVID-19 vaccine tracker and landscape*. World Health Organization. https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines

Appendix A

Below is a list of questions from the larger Endurance Athlete Survey that were analyzed for this current study

- How old are you?
- What is your sex?
    - Female
    - Male
    - Non-Binary
    - Other (please specify)
    - Prefer not to Answer
- What is your highest level of education? Select one.
    - Some High School
    - High School Diploma (9-12 years)
    - Vocational Training (after high school)
    - Some College (less than 4 years)
    - Bachelor's Degree
    - Graduate Degree
- What is your house hold income? Select one.
    - Less than $20,000
    - $20,000 to $34,999
    - $35,000 to $49,999
    - $50,000 to $74,999
    - $75,000 to $99,999
    - Over $100,000
    - Prefer not to answer
- Are you a professional athlete?
    - Yes
    - No
- Are you a **current** collegiate athlete?
    - Yes
    - No
- (If no is selected to the previous question) Are you a **former** collegiate athlete?
    - Yes
    - No
- What is your **primary** endurance sport? Select one.
    - Cycling
    - Nordic skiing
    - Para-cycling
    - Running
    - Race Walking
    - Rowing
    - Speed skating
    - Swimming
    - Triathlon
    - Wheelchair racing
    - Other (please specify)

- Have you placed in the top 3 **overall** in any races **in the past year**?
    - Yes
    - No
- Have you placed in the Top 3 in your **age group or division** in any races **in the past year**?
    - Yes
    - No
- Do you **currently** have a coach?
    - Yes
    - No
- (If no is selected to the previous question) Have you **ever** had a coach?
    - Yes
    - No
- Do you **currently** follow a training program?
    - Yes
    - No
- (If no is selected to the previous question) Have you **ever** followed a training program?
    - Yes
    - No
- Has your training changed due to the COVID-19 Pandemic?
    - Yes
    - No
- (If yes is selected to the previous question)
    - How has your training changed due to the COVID-19 pandemic? Select all that apply.
        - I train less than before
        - I train more than before
        - I train at lower intensities than before
        - I train at higher intensities than before
        - Individual sessions are shorter than before
        - Individual sessions are longer than before
        - Other (please specify)
    - Why has your training changed due to the COVID-19 pandemic? Select all that apply.
        - I cannot access facilities I normally use for training
        - Group training sessions are no longer an option
        - My work situation has changed and I have less time
        - My work situation has changed and I have more time
        - My work situation has changed and my hours are less flexible
        - My work situation has changed and my hours are more flexible
        - Other (please specify)