



Are eSports players comparable to traditional athletes? A cross-sectional study

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Summary. *There is some debate as to whether professional eSports players should be regarded as athletes in the traditional sense. With an eye toward addressing this controversy, this study was undertaken with the aim of analyzing elite eSports players' characteristics and their training and competition routines, and of comparing them with data on their counterparts in traditional sports. Fifty-one elite eSports players answered an ad hoc online questionnaire that gathered data on their basic traits, general training and competition habits, level of regular physical activity, and injuries sustained during the 2018-2019 season. The results indicated that elite eSports players have a considerable training load (38.37 ± 20.33 h/week) and use strategies to improve their performance (i.e., warm-ups, 73.91%; resistance training, 74.19%; psychological training 31.25%). However, some of these activities are not generally designed or supervised by qualified professionals. Meanwhile, some of the players reported injuries (13.04%) that had led to losses in competition time ranging from one day to more than a month. In terms of the comparison with traditional athletes, our findings show that elite eSports players seem to experience a similar training load and apply comparable strategies to boost their sports results. As such, they can be properly considered professional athletes, but players, the eSports industry, and the teams' staffs should be more aware of the most appropriate strategies to preserve long-term health and avoid burn-out.*

Keywords: elite gamers; video games; training; performance; injuries

¿Son los jugadores de eSports comparables a atletas tradicionales? Un estudio transversal

Resumen. *Se debate si los jugadores profesionales de deportes electrónicos deben considerarse atletas tradicionales. Para evaluar esta controversia, este estudio tuvo como objetivo analizar las características de los jugadores de eSports de élite y sus rutinas de entrenamiento y competencia, y contrastarlas con los datos de sus contrapartes de deportes tradicionales. Cincuenta y un jugadores de eSports de élite respondieron un cuestionario en línea ad hoc sobre sus características básicas, hábitos generales de entrenamiento y competencia, nivel de actividad física regular y lesiones sufridas durante la temporada 2018-2019. Los resultados indicaron que los jugadores de eSports de élite tienen una carga de entrenamiento considerable ($38,37 \pm 20,33$ h/semana) y utilizan estrategias para mejorar su rendimiento (es decir, calentamientos, 73,91%; entrenamiento de resistencia, 74,19%; entrenamiento psicológico, 31,25%). Sin embargo, algunas de estas actividades generalmente no están diseñadas o supervisadas por profesionales calificados. Además, una minoría de los jugadores reportó lesiones (13,04%), lo que implica una pérdida de tiempo de un día a más de un mes. Según nuestros hallazgos y en relación con los atletas tradicionales, los jugadores de eSports de élite parecen experimentar una carga de entrenamiento similar y aplican estrategias comparables para mejorar sus resultados deportivos. Como tales, pueden considerarse atletas profesionales, pero los jugadores, la industria de los deportes electrónicos y el personal de los equipos deben conocer las estrategias más adecuadas para preservar la salud a largo plazo y evitar el agotamiento.*

Palabras clave: jugadores de élite; videojuegos; entrenamiento; rendimiento; lesiones

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Introduction

Electronic sports, or eSports, are organized video game competitions, usually involving a cash prize (Brock, 2017; Jenny et al., 2018). Although the birth of official eSports competitions is generally identified with the Space Invaders Tournament held by Atari in the eighties, these contests really began to gain mainstream popularity in the last two decades (Giakoni-Ramírez et al., 2022; Kane & Spradley, 2017). During this period, the popularization of multiplayer video games has led to the birth of new social structures resulting from the development of virtual communities of players through forums, chats, social networks, and virtual and face-to-face events (Carrillo Vera, 2015).

eSports have expanded to the extent that national and international competitions are now held in purpose-built venues in places such as China, the United States, South Korea, and Western Europe, attracting players from all around the world (Kane & Spradley, 2017; Thakur et al., 2021). These arenas feature a central stage where eSport players take their seats in front of desktop computer stations. Tournaments are broadcasted via television stations and internet streaming platforms such as Twitch (Carrillo Vera, 2015; Jenny et al., 2018). An estimated 477 million people viewed these events in 2021, a figure that could reach 577 million by 2024, including both enthusiasts and occasional spectators (Gough, 2021). It is worth noting that many members of eSports audiences, like those of many traditional disciplines, follow the competition but do not necessarily play the video games they watch others compete in. Many users may not have the skills necessary to compete at a high level, but they enjoy watching talented players face off against each other. This phenomenon highlights how the population of eSports viewers has moved beyond just video game players and shares some similarities with other sporting events such as the Super Bowl or the World Cup, competitions that many viewers watch even though they do not regularly play American football or soccer (Giakoni-Ramírez et al., 2022; Jenny et al., 2018). The winners of eSports tournaments win million-dollar prizes and can achieve earnings that are very close to those of traditional professional athletes. For example, N0tail, winner of the Dota2 World Championship, a multiplayer online battle arena, has earned over \$7 million in his gaming career. These earnings are similar to those of professional athletes; the average National Basketball Association player earns over \$8 million per season (Gough, 2021b; Heath, 2021; *Top 100 Highest Overall Earnings*, 2021). The eSports phenomenon is not going to stop. Despite a year-on-year decline of 1.1%, the global game market is expected to grow 8.7% to reach \$218.7 billion by 2024, surpassing the previously estimated threshold of \$200 billion in 2023 (Wijman, 2021).

With the increasing relevance they have gained recently, eSports seem to be just starting to be recognized as sports (Kelly & Leung, 2021; Thakur et al.,

2021). An example of this is their inclusion in the 2022 Asian Games thanks to the approval of an International Olympic sub-committee (Kelly & Leung, 2021; Venkat, 2021). However, according to scientific literature, there is still no consensus that eSports can be considered sports. This uncertainty is partially attributable to the lack of a universally accepted definition of sport (García-Lanzo et al., 2020; Kang et al., 2020; Parry, 2021; Thakur et al., 2021). On one side of the issue are observers such as Kane and Spradley (2017), who argue that eSports could be considered sports for three main reasons. First, eSports players show signs of physical exertion during competitions and training, such as a rise in basal blood pressure or an increase in perceived exertion. Some reports state that eSports players exercise regularly and believe that physical activity positively impacts their performance (Kari & Karhulahti, 2016; Thakur et al., 2021). Secondly, in order to become professionals, players need to develop skills and techniques specific to the games in which they compete. For example, much like athletes, eSport players must combine their perceptive-cognitive and domain-specific skills (such as anticipation, problem-solving skills, and strategic thinking) to achieve good performance (Gong et al., 2019; Kang et al., 2020; Pluss et al., 2019). Finally, video games professional players compete in teams within different leagues around the world, which could be compared to sports leagues, as each of them has its own rules, professional rankings, tournaments and competitions (García-Lanzo et al., 2020; Giakoni-Ramírez et al., 2022; Kane & Spradley, 2017). Therefore, the best electronic athletes can be considered elite athletes because, quantitatively, they are the best worldwide at a highly professionalized activity (Williams et al., 2017) with significant growth prospects.

Traditional elite athletes (i.e., badminton, beach volleyball, handball, tennis, volleyball) train for an average of 9 to 17 hours/week (Augustsson et al., 2006; Fett et al., 2019). Additionally, elite athletes may be exposed to specific sporting and non-sporting stressors that could increase their vulnerability to mental health problems (Palanichamy et al., 2020; Rice et al., 2016). What is more, they may take advantage of specific complementary training strategies, either psychological (Birrer & Morgan, 2010; Kang et al., 2020) or physical (Beattie et al., 2014; Suarez-Arrones et al., 2018).

In the field of public health, many scientific reports have analyzed eSports, especially from a psychological and social point of view, focusing on issues such as problematic behaviors, personality characteristics, burn-out, and anxiety (Holden et al., 2018; Kang et al., 2020; Martin-Niedecken & Schättin, 2020; Palanichamy et al., 2020; Pluss et al., 2019; Rudolf et al., 2022). Recently, a growing body of literature has examined the physical and cognitive characteristics that contribute to defining not only the activity profiles of elite video gamers, but also the most frequent kinds of injuries they experience throughout their careers (Difran-

cisco-Donoghue et al., 2021; Emara et al., 2020; *Esports Injuries*, 2019; Nagorsky & Wiemeyer, 2020). As far as injuries are concerned, proper diagnosis and early treatment are essential for eSports players, just as with traditional athletes (Difranco-Donoghue et al., 2019; *Esports Needs to Face Its Injury Problem – The Esports Observer*, n.d.; Plunkett, 2015). What is more, both eSports participants and tennis or professional soccer players can suffer from different types of overuse injuries associated with the movement patterns involved in executing specific technical skills (DiFrancisco-Donoghue & Balentine, 2018; Emara et al., 2020; Fu et al., 2018; Hartwell et al., 2017; Pereira et al., 2019; Pfirrmann et al., 2016).

Psychosocial, cultural, and economic elements should also be considered in this debate (Brock, 2017) because they contribute to creating intense external pressure and an associated increase in stress levels (Brock, 2017; Holden et al., 2018; Palanichamy et al., 2020) with detrimental effects on players' health and well-being (Brock, 2017; Difranco-Donoghue et al., 2019; Holden et al., 2018). It is in addressing this issue that our study fits into the debate. In contrast with the prevailing literature, which considers the abstract and traditional definition of sport in an attempt to settle whether eSports can be included in this classification (Parry, 2019), our proposal aims to provide a preliminary description of these two groups' behavior while training for official competitions.

This study's primary aim is to describe the characteristics of high-level eSports players and their training and competition behaviours. Then, the study will investigate certain relationships between this data and the scientific literature on traditional professional athletes. This comparison will consider the weekly training schedule, types of complementary practices performed, and the warm-ups carried out to prepare for an official eSports elite competition. The second purpose of this study is to highlight the most common injuries that eSports players may experience during a competitive season.

Material and methods

Participants

This study recruited participants from ten organizations with at least one team participating in at least one eSports game in the "Liga de Videojuegos Profesional" (LVP) during the 2018-2019 season. A total of 51 players from five different organizations participated in the research by responding to an *ad hoc* questionnaire. Five of these answers were rejected because they did not fully provide the required information. The study's final sample consisted of 46 elite male eSports players aged between 16 and 33 years (Mean= 22.39; SD=4.13) with experience in competitive eSports ranging from 0.5 to 20 years (Mean=4.69; SD=4.61). Most of the participants mainly used a mouse and a keyboard to play games (n=37), but others (n=9) used a mobile phone.

Instruments

Data was collected using an *ad hoc* questionnaire designed and validated in different stages, following procedures of similar studies (Martínez-Gallego et al., 2021; Peña et al., 2021). A review of relevant literature was conducted to generate the main variables of the study and to create adequate items. Then, following an internal discussion, an initial document was drafted. Later, the questionnaire was reviewed by members of the LVP staff (n=2) and by staff members of the eSports teams that had agreed to receive the final version of the questionnaire, including experts from the field of psychology (n=2). Their suggestions were taken into account, and some aspects of the survey were modified accordingly. Finally, in order to identify potential errors or problems, a pilot survey was completed by two amateur eSports players who volunteered to participate and were not included in the final study.

The survey was drafted in English and Spanish and was available online from July to October 2019, alongside an online video recorded by the study's authors explaining the main aims of the research and encouraging participation. The questionnaire consisted of 40 items grouped into 5 different sections. The first section collected general data (age, gender, hand dominance, platform, and peripherals position) (5 questions, 1 open-ended and 4 multiple choice). The second section was about training habits, including weekly practice schedule, frequency and duration of breaks, contents of training sessions, types of complementary training performed, and supervision (10 questions, 2 open-ended and 8 multiple choice). The third section was about competitions and games played, hours per week spent on official competitions, competitive experience in official events, and warm-up routines before a competition (5 questions, 3 open-ended and 2 multiple choice). The fourth consisted of questions on other sports or physical activities performed regularly (2 questions, 1 open-ended and 1 multiple choice). The last section dealt with injuries requiring medical attention suffered during the 2018-2019 season (diagnosis, body part affected, training or competition time-loss due to the injury, specific moment of the injury, and description of occurrence) (18 questions, 2 open and 16 closed).

The open-ended questions were coded based on the common answers that were given by the eSports players, and then they were categorized in order to make the planned analyses for this article possible. To help ensure the transparency and reproducibility of this research, the questionnaire can be accessed via the following link: <https://forms.gle/LPyarXDvZHCe-heE59>.

Procedure

This is an observational, cross-sectional, descriptive study using non-probabilistic sampling. The teams involved in the study were contacted via e-mail and

asked to participate in this project, and each of the participants (elite eSports players) anonymously responded to the survey only once. Team contacts were obtained via the LVP.

A local Research Ethics Committee (internal code 89/2019) approved the study, which respected the Declaration of Helsinki and its later amendments (World Medical Association, 2013). Participants received all the information detailing the study's aims in advance and signed informed consent. Participants' rights were preserved, and they were informed that participation was voluntary and that they could withdraw at any moment.

Analysis

Absolute and relative frequencies for the categorical variables, measures of central tendency (means), and dispersion [standard deviations (SD)] for continuous variables were calculated. Qualitative terms were assigned to determine the observed frequencies' magnitude as follows: All = 100% of the respondents; Most = $\geq 75\%$; Majority = 55–75%; Approximately half = $\sim 50\%$; Approximately a third = $\sim 30\%$; Minority = $< 30\%$. Data were extracted from the online survey (Google forms[®]) to a spreadsheet (Microsoft[®] Excel for Mac, version 16.40). After codifying all responses, the analyses were performed using JASP software (version 0.10.2.0).

Results

The results are divided into four fields based on the data obtained through the questionnaire: training load, complementary training, other physical activities, and injuries.

Training load

The respondents' weekly practice time was between 6 and 72 hours (mean = 38.37; SD = 20.33). Most of them (93.48%) took breaks during training sessions, but there is no standard as to the frequency and duration of these breaks (see Table 1). Only about half of the players (51.16%) always planned breaks. When they did plan them, it seems that they rarely (20.93%) planned the activities.

Finally, the majority of the surveyed players (73.91%) reported performing a warm-up before competitions (see Table 2).

Complementary training and other physical activities

The majority of the respondents (69.57%) stated that they performed some sort of complementary training, including physical, visual, or psychological training, to improve their performance. Only a minority of the surveyed players reported combining complementary training with practice under qualified professional supervision (see Table 3).

Table 1. Frequency and duration of eSports players' breaks

| Breaks | Sample | |
|---------------------------------------|--------|---------|
| | n | (%) |
| How often do you take a break? | | |
| Every hour | 15 | (34.88) |
| After 2-3 hours | 17 | (39.53) |
| After 3-4 hours | 8 | (18.60) |
| After 4-5 hours | 2 | (4.65) |
| After 5 hours | 1 | (2.32) |
| How long are the breaks? | | |
| Less than 5 minutes | 4 | (9.30) |
| Between 5 and 10 minutes | 11 | (25.58) |
| Between 10 and 15 minutes | 4 | (9.30) |
| Between 15 and 30 minutes | 4 | (9.30) |
| Between 30 and 45 minutes | 5 | (11.62) |
| Between 45 and 60 minutes | 7 | (16.27) |
| Variable duration | 8 | (18.60) |

Table 2. Warm-up routine strategies performed before competitions by eSports players

| Warm-up training | Sample | |
|---|--------|---------|
| | n | (%) |
| Do you perform a warm-up routine before competing? | | |
| No | 12 | (26.08) |
| Yes | 34 | (73.91) |
| What type of warm-up? | | |
| Physical training | | |
| No | 20 | (58.82) |
| Yes | 14 | (41.17) |
| Playing videogames | | |
| No | 4 | (12.12) |
| Yes | 29 | (87.87) |
| Psychological training | | |
| No | 21 | (61.76) |
| Yes | 13 | (38.23) |
| Visual training | | |
| No | 26 | (76.47) |
| Yes | 8 | (23.52) |

Table 3. Complementary training approaches to improve players' performance

| Complementary training | Sample | |
|--|--------|---------|
| | n | (%) |
| What type of complementary training do you perform? | | |
| Physical training | | |
| No | 3 | (9.37) |
| Yes | 29 | (90.62) |
| Visual training | | |
| No | 23 | (71.87) |
| Yes | 9 | (28.12) |
| Psychological training | | |
| No | 22 | (68.75) |
| Yes | 10 | (31.25) |
| Do you perform these practices under qualified professional supervision? | | |
| No | 18 | (56.25) |
| Yes, all of them | 5 | (15.62) |
| Yes, the physical ones | 3 | (9.37) |
| Yes, the psychological ones | 4 | (12.50) |
| Yes, the physical ones and the psychological ones | 1 | (3.12) |
| Yes, the visual ones | 1 | (3.12) |
| Do you do any other sport or physical activity? (Minimum two sessions per week) | | |
| Yes | 32 | (69.57) |
| No | 14 | (30.43) |

In addition, the majority of the surveyed players (69.57%) performed other kinds of physical activity regularly (at least two sessions per week), including resistance training (74.19%), cardiovascular activities (29.03%), traditional sports (25.80%) and mobility exercises (3.22%).

Injuries

A minority of the players (13.04%) reported having sustained at least one injury that required medical attention during the 2018-2019 season. There was only one respondent (2.17%) who had suffered more than one injury in the season. One of the injured players (14.29%) had suffered a similar injury prior to the season, but for most of them it was their first injury (85.71%). Injuries had varying degrees of impact on the respondents in terms of time loss (see Table 4).

According to the respondents, the injuries that appeared for the first time uniformly affected their upper limbs (100%). Only one player had suffered another injury to his back. In the majority of the cases (57.13%), the injury was preceded by discomfort in the area, but on other occasions (42.87%) it happened suddenly. A few injuries occurred during training (28.58%) or official competitions (14.29%).

Discussion

There is a constant debate concerning whether professional eSports players should be regarded as traditional athletes. We believe that this study contributes to clarifying this debate, as it provides a description of the characteristics of a sample of elite eSports players that can be related to other data regarding similar aspects of traditional athletes in different settings. The data and a range of factors suggest that professional eSports players should be treated the same as their non-electronic counterparts, as shown in Table 5 and as explained below.

Overall, good management of training loads allows athletes to develop or maintain physical fitness and enhance the motor skills essential to prepare them for competition (McLaren et al., 2018). These adaptations of training routines take the form of a combination of changes in volume, intensity, and frequency of training (McLaren et al., 2018). Although generalizations cannot be made, traditional elite athletes tend to train approximately 9 to 17 hours/week (Augustsson et al., 2006; Fett et al., 2019). According to the literature, the daily schedule of elite eSports players can vary from 5 to 15 hours/day (DiFrancisco-Donoghue & Balentine, 2018; Geoghegan & Wormald, 2019; Kari & Karhulahti, 2016), which may be similar to the 38.37 training hours per week that, on average, the sample of this study displays.

This huge difference in the training time between eSports players and traditional athletes may be explained by the fact that the efforts required while playing video games are not as physiologically limited

Table 4. Time loss due to injuries in the 2018-2019 eSport season

| Injury | Sample | |
|--|--------|---------|
| Time lost (no training or competing) due to the injury | n | (%) |
| Minimal (1-3 days) | 1 | (14.29) |
| Mild (4-7 days) | 1 | (14.29) |
| Severe (more than a month) | 1 | (14.29) |
| Re-injury (recurrence) | 4 | (57.13) |

Table 5. Comparison between the characteristics of traditional sports professionals or elite athletes and elite eSports players

| | Traditional sports professionals or elite athletes | Elite eSport players |
|-------------------------------|---|--|
| Training load | 9-17 hours/week ^{a,b} | Mean of 38.37 hours/week |
| Warm-up routines | Should comprise low-intensity aerobic exercises, mobility protocols, and sport or task-specific activities. Athletes usually perform incomplete protocols ^c | May include video game practice, visual-spatial exercises, and psychological exercises. No specific protocols to train playing gestures are planned. ESport players usually perform incomplete protocols |
| Complementary training | Athletes perform complementary training to develop complementary abilities and improve their performance (physical, visual and psychological training) ^{d,e,f} | The majority of eSports players perform complementary training to improve their performance (physical, visual and psychological training) |

Note: ^a(Augustsson et al., 2006). ^b(Fett et al., 2019). ^c(Fradkin et al., 2010). ^d(Formenti et al., 2019). ^e(Woods et al., 2019). ^f(Kang et al., 2020).

as in traditional sports (i.e., energy expenditure, acute injuries due to fatigue...). However, both eSports players and traditional athletes are subjected to strains that can lead to common consequences (i.e., overuse injuries, burn-out...) (DiFrancisco-Donoghue & Balentine, 2018; Holden et al., 2018; Pereira et al., 2019; Pérez Rubio et al., 2017). Therefore, due to the greater exposure time to these conditions that elite eSports players can have, it could be said that the overall training load experienced by them may be similar to or even in some instances greater than that of professional sports athletes. It is worth noting that most of the eSports players that participated in this study take breaks, which could be interpreted as a way to manage the substantial training load.

Traditional athletes and elite eSports players are also comparable in their use of warm-ups before competitions. Warm-ups are generally accepted as a sound strategy to improve performance and prevent injuries during physical activities when appropriately performed (Fradkin et al., 2010; McCrary et al., 2015), and they are of utmost importance for professional athletes (Fradkin et al., 2010). A warm-up protocol specifically designed for the activity that will be performed subsequently seems essential to enhance performance and prevent injuries (Bizzini & Dvorak, 2015; Fradkin et al., 2010; McCrary et al., 2015). According to our survey, it could be stated that most elite eSports players use warm-ups much as a traditional athlete would (Fradkin et al., 2010). However, sport-specific activities during

the warm-up routines of eSport players appear incomplete, as they lack work on mobility and intense physical activity.

Training strategies designed according to the demands of specific sports can significantly improve the performance of well-trained, experienced athletes in traditional sports such as Mixed Martial Arts (Kostikiadis et al., 2018), as partly explained by the ecological dynamics theory. The more the opportunities one has to interact with situations like the performance environments, the better he or she will regulate performance behaviors in real competitions. This translates into skill adaptation, which is critical in elite sports contexts (Formenti et al., 2019; Woods et al., 2019). However, this study does not show this tendency among elite eSports players. Therefore, depending on the type of complementary training they usually perform, it might be desirable for them to develop a higher level of specificity and interaction with the actual competitive environment.

Complementary training involving physical activity can help not only to improve attentional and cognitive skills (Formenti et al., 2019), but also to prevent some of the physical risks that eSports bring with them, such as physical inactivity (Holden et al., 2018), overuse injuries (DiFrancisco-Donoghue & Balentine, 2018; Pereira et al., 2019) and suboptimal postures while gaming (Emara et al., 2020; Geoghegan & Wormald, 2019). Among the types of complementary practice, psychological training may also indirectly enhance eSports performance. Players could improve their mental health by addressing some of the elements that can lead to common psychological risks (i.e., uncertainty about the future, pressure and precarious sociological factors) (Brock, 2017; Lajka, 2018). Furthermore, eSports' psychosocial component could be related to mental disorders and detrimental behaviors (DiFrancisco-Donoghue et al., 2019; *Esports Injuries*, 2019; Holden et al., 2018; Jonasson & Thiborg, 2010; Pereira et al., 2019). In this regard, eSports players are exposed to pressure like traditional sports players are, and they display similar psychological reactions (Pérez Rubio et al., 2017) such as burn-out (Holden et al., 2018). Therefore, psychological training could contribute to the prevention of these situations and, consequently, help improve eSports performance.

Finally, it has been observed that visual training can improve cognitive performance in traditional sports, enhancing clinical reaction time, executive control and perceptual speed (Formenti et al., 2019). Training vision in sports seems to affect visual attention's role in perception-action and eye-hand coordination (Formenti et al., 2019). Improving eSports players' skills in these areas could increase the number of actions they are able to take per minute, a helpful ability for those wishing to play eSports professionally (Brock, 2017; LeJacq, 2013).

Considering all these data, professional eSports players, just as traditional athletes, invest their time in seeking a performance boost via additional training.

According to this study's results, however, these complementary practice sessions are generally not supervised by a qualified professional. An interdisciplinary team of professionals must be prepared to reflect competitive environments and experiment with specific characteristics (Woods et al., 2019). Therefore, it seems that eSport complementary training sessions are still not optimal, but that there is a potential margin to increase performance.

Some interesting data were also collected on the physical activity routines of the sample of elite eSports players. Although our results slightly differed from those of other studies (DiFrancisco-Donoghue et al., 2019), they are along the same lines as those of some previous researchers who have indicated that professional eSports players do even more physical activity than the amount recommended by the World Health Organization (Kari & Karhulahti, 2016; Pereira et al., 2019) for the adult population. However, as also happens with some other complementary practices in eSports players, these activities are rarely designed by an exercise professional (Kari & Karhulahti, 2016).

To complete this picture of eSport players, the injuries that they can suffer have been analyzed. Like traditional athletes, professional gamers sometimes sustain injuries that can threaten their careers (DiFrancisco-Donoghue et al., 2019; *Esports Needs to Face Its Injury Problem – The Esports Observer*, n.d.; Plunkett, 2015). They are especially vulnerable to injuries with an overuse etiology (DiFrancisco-Donoghue & Balentine, 2018; Pereira et al., 2019), which are also common in regular sports (Fu et al., 2018; Pfirrmann et al., 2016; Zemková et al., 2020). The onset of this type of injury is associated with the characteristics of the specific athletic skill, which in the case of eSports injuries lies in the repetitive movements performed by the upper extremities (Emara et al., 2020; Geoghegan & Wormald, 2019; Zemková et al., 2020), as seen in the injuries reported in the present study.

However, the frequency of these injuries can be attributed not only the high physical and mental demands of eSports (Lajka, 2018), but to other issues such as the implied recognition given in the video game community to those who spend the most hours playing (Lajka, 2018), the prioritization of modifications that help performance rather than improving ergonomics and preventing injuries (Wong, 2017), or the lack of knowledge within eSports regarding the best way to train, prepare and the manage injuries (DiFrancisco-Donoghue et al., 2019; Pereira et al., 2019).

Nonetheless, it is worth noting that the professional eSports players within the sample of this study reported a low number of injuries. The so-called "Training – Injury Prevention Paradox" could explain this situation. This term describes a phenomenon wherein athletes accustomed to a progressive increase in training loads suffer fewer injuries than athletes who train at lower loads or experience spikes in their training load (Gabbett, 2016; Zemková et al., 2020). Therefore, professional eSports players may have better load man-

agement than amateur gamers, thus reducing their risk of injury. On the other hand, eSports are a field in which there are some reasons to expect difficulties in detecting physical and mental problems, such as the fact that health issues are still not regarded as relevant in the eSports industry (*Esports Needs to Face Its Injury Problem – The Esports Observer*, n.d.). This problem is also reflected in the present study by the lack of medical information provided by some elite eSports players when asked about the specific diagnoses of their injuries. Additionally, players may be hesitant to report discomfort because they want to avoid missing out on playing time (Difranco-Donoghue et al., 2019; Geoghegan & Wormald, 2019; Wong, 2017).

Professional eSports players can be exposed to injuries through mechanisms like those in regular sports. However, since some injuries (i.e., wrist and hand pain, eye fatigue, back and neck pain) are also common in sedentary office personnel, many health professionals and coaches may not know what type of injury to look for (Difranco-Donoghue et al., 2019). This could compromise the diagnosis and the injury management protocol.

Figure 1 depicts a summary of what an elite eSports player endures to reach a top performance level, according to the responses to the previously described questionnaire.

Finally, to put this discussion in a broader context, it should be noted that, at a professional level, the male gender is predominant in eSports (Kari & Karhulahti, 2016), and that eSports players retire at a younger age than most traditional athletes (*Esports Injuries*, 2019; *The Average Age in Esports*, 2017; Lajka, 2018; Pereira et al., 2019; Suncho, 2021; Wong, 2017). The sample of elite eSports players participating in this study reflects these trends. Additionally, it is very likely that the members of this sample devote more time to performance-boosting strategies (i.e., warm-up or complementary training) than other eSports players who have taken part in different studies (Brock, 2017; Kari & Karhulahti, 2016; LeJacq, 2013).

Limitations and future studies

The analyses presented in this study are based on data collected through an online questionnaire. The responses' accuracy should be assessed with caution, because answers may have been rushed, and some questions may have been misinterpreted. The survey was structured to ensure the least possible time loss to avoid these limitations. In addition, to reduce the risk of incorrect assumptions, participating teams and eSport players received support from the LVP and the research team. Meanwhile, no data was collected in this study about how and how often training schedules change during the eSports season. Similarly, no information was gathered about the content of complementary practices, hampering the assessment of their potential benefit on performance.

Additional analyses should be conducted to increase the body of knowledge about professional eSports players. Our study provides a first description of the pattern of behavior seen in this type of athlete, but it might be interesting to further examine the effects of the adoption of well-structured training protocols and professional supervision on performance. In this regard, there is a lack of in-depth studies on how physical and complementary training can be scheduled within a typical "eTraining" day. There is also a need for more conclusive studies with strong scientific evidence regarding the effects of training schedules on eSports players' health. Poor management of training loads can lead to injuries that might threaten the careers of these eSports players, and, as such, further research should also consider the specific injuries affecting these athletes and healthcare professionals' ability to recognize and treat them properly. Improved management can help players to lengthen their careers and reduce the risk of burn-out.

Practical implications of this study

There seems to be a need for a higher level of professionalization in the supervision of eSports players to



Figure 1. What does it take to become an elite eSports player?

help ensure their physical preparation. Exercise professionals should be given the opportunity to access the eSports industry and help eSports players perform better and safer training routines, designed with the specific needs of eSports in mind. Additionally, eSports coaches could use the information presented in this study to schedule breaks more effectively and improve pre-competitive warm-ups.

In light of the difficulties associated with reporting injuries that eSports players may suffer and their potential high morbidity among professional gamers, medical personnel should improve their detection protocols to prevent players from competing while injured. Players and the whole eSports industry should also recognize the importance of reporting and treating injuries as soon as they start to develop. Ultimately, this study also shows eSports players how essential it is for qualified professionals to supervise their complementary training and physical activity.

Conclusions

According to the information obtained from this study, elite eSports players' activity is very comparable to that of athletes in traditional sports. eSports players may experience a similar training load to their non-electronic counterparts and use similar strategies (breaks, warm-ups before official events, and complementary training) to improve their performance.

Overall, elite eSports players also tend to do physical activity more regularly than might be expected, a finding which may contribute to debunking the myth that eSports players are inactive. Therefore, professional eSports players should be considered traditional professional athletes, and eSports should be given a chance to be officially recognized similarly to traditional sports.

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