

Musculoskeletal pain among E-sport athletes

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Background

Musculoskeletal (MSK) pain and injuries are common in endurance sports where athletes are required to perform at high intensity for an extended period of time (1). In the short term, MSK pain may significantly impair the athletes' performance, which can lead to unwanted time-off from practice and competitive tournaments (1). Ultimately, MSK pain may lead to complete withdrawal from sports and physical activity and long-term health issues (1–3). Previous studies found an association between training load, MSK pain and performance. These results indicate that an athlete may experience MSK pain or get injured from both too low and to high training loads (1,4).

Electronic sport (E-sport) also known as competitive gaming is defined by Hamari and Sjöblom as *“a form of sports where the primary aspects of the sport are facilitated by electronic systems; the input of players and teams as well as the output of the E-sport system are mediated by human-computer interference”* (5). The expected yearly growth-rate of E-sport is estimated to be 25% and approximately 190 million people around the world are actively involved in E-sport (6,7). E-sport also encompass structured tournaments which offer millions in prizemoney for the winning team (6,8). Furthermore, the tournaments are often streamed lived through the internet, so that the hundreds of millions of spectators from all over the world can follow their favourite teams in action (5,6). At present it is debated whether or not E-sport should be regarded as an actual sport instead of an recreational activity (8). The lack of physical activity and bodily movement is today the strongest argument against recognizing E-sport as sports (8). Nevertheless, the international demand for recognition is growing, and acceptance of E-sport as an actual sport may be inevitable (8). There is only few data on MSK pain in E-sport, however a small study with 65 participants found that 41% suffered from back or neck pain and more than 1 in 3 had pain related to the wrist (9). E-sport athletes have to perform for an extended period of time, similar to athletes from traditional endurance sport. As such, MSK pain in E-sport may be associated with training load like it is seen in other sports (4). Overall, MSK pain in E-sport could be an unrecognised issue. To provide healthcare professionals with and optimal starting point for managing these issues, there is a need for well-conducted studies on the prevalence of MSK pain among E-sport athletes. In addition, it is highly relevant to investigate if training loads related to E-sport and physical activity levels are different among athletes with MSK pain compared to athletes without MSK pain.

Aims

The aims of this questionnaire-based cross-sectional study are to; I) investigate the prevalence of MSK pain in E-sport athletes, II) assess if training loads among athletes with MSK pain are different from athletes without MSK pain, III) investigate if physical activity levels among athletes with MSK pain are different from athletes without MSK pain and IV) descriptively present data on participant characteristics, sleep patterns, physical activity levels and utilization of healthcare professionals and pain medication. It is hypothesised that E-sport athletes with MSK pain have a higher training load compared to athletes without MSK pain. Moreover, it is hypothesised that E-sport athletes with MSK pain have a lower level of physical activity compared to athletes without MSK pain.

Method

This project will be conducted at the Department of Physiotherapy at UCN, Aalborg, Denmark and the protocol will be developed from The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement (10). The project will in addition be pre-registered on www.Clinicaltrials.gov, prior to enrolment of the first participant. Participants will be provided with oral and written information regarding the study, before providing written informed consent.

Recruitment

We aim to recruit 200 E-sport athletes between 15 and 35 years of age. We estimate that 200 athletes will be an appropriate sample to investigate the prevalence of MSK pain within the E-sport community. The rationale for the age-range is based on numbers from DGI which is a national organization in Denmark which aim to strengthen the community-based sport clubs and associations (11). Approximately 60% of the E-sports athletes registered with DGI are between the ages of 15 and 35 (12). Athletes will be recruited from community-based and/or professional E-sport clubs and teams. Moreover, educational institutions who offer their students the opportunity to participate in E-sport will be contacted as well and invited to participate. Educational institutions and E-sport clubs and teams in Denmark will be identified through web-based searches and through the authors' network. Initial contact will be established through e-mail or via telephone. Members from the research group will subsequently visit clubs, teams and educational institutions who initially shows an interest for the project. At this occasion the members of the research group will give a short presentation of the project, answer questions regarding the project and distribute the questionnaire to those athletes who wants to participate.

Distribution of questionnaires

Prior to initiation of the study, the questionnaire will be pilot tested and evaluated regarding time to complete, relevance and comprehensibility. After the following optimization, the questionnaire will be distributed for all participating athletes as an online survey.

Eligibility criteria

E-sport athletes from Denmark between the age of 15 and 35, who are participating actively in E-Sport through a club and/or team based in the community, at an educational institution or in a private organization are eligible for enrolment. In addition, eligible athletes are required to participate in E-sport through a computer-based game. As such, athletes who primarily compete through other medias or consoles are not eligible for participation.

Participant information and outcome

Information regarding MSK pain, utilization of healthcare professionals and pain medicine, physical activity levels, E-sport related training load and sleep patterns will be obtained through this questionnaire-based study.

Participant characteristics

Enrolled athletes will be asked to provide; name, e-mail, phone number, age, gender, height, weight, educational level, smoking status, where they participate in E-Sport (e.g. community-based or educational institution), which league they are affiliated with (e.g. DGI-league or ESD-league) and which is their primary game (e.g. Counter Strike: Global Offensive, Fortnite or PlayerUnknown's Battleground).

Musculoskeletal pain

The primary outcome for the study will be if the athletes have had any MSK pain during the previous week. The answer to the primary outcome will be dichotomized (yes/no). Participants will also be asked about the location and number of pain sites. If the athlete has pain at more than one site, they will be asked to state at which site they experience their primary pain complaint. In relation to the site of the primary pain complaint, the athletes are asked to state the worst pain intensity they have experienced during the previous week. Pain intensity will be assessed with an 11-point numeric pain rating scale (0=no pain; 10=worst possible pain). The athletes will in addition be asked about pain frequency (daily, weekly, several times per week, monthly, rarely). To investigate the level of pain interference, athletes will be asked if their MSK pain affect their ability to engage in E-sport.

Eye fatigue

Within a group of E-sport athletes, one study found that 52% reported eye fatigue (9). As such, we are also interested in investigating if the included athletes experience eye fatigue in relation to E-sport participation.

Training load related to E-sport

Athletes will be asked how many hours per week they spend on structured E-sport with is defined as training with a coach being present. In addition, they are asked how many hours per week they train without a coach present (e.g. when they are at home). Time spend on training without a coach present will be defined as unstructured training. The total E-sport related training load will be assessed by combining the number of hours the athletes engage in structured and unstructured E-Sport.

Healthcare utilization

In order to investigate care-seeking behaviour regarding MSK pain within the study population, the athletes will be asked if they have had any treatment from a healthcare professional during the previous 3 months for MSK pain. In addition, participants will be asked if they currently use any pain medication, which type of medication they use and how frequent. The athletes are also asked to describe the reason for using pain medicine.

Level of physical activity

Physical activity levels will be assessed with the Danish version of the International Physical Activity Questionnaire (IPAQ) short form. This survey is comprised of 7 items which assess time spend on physical activity at vigorous and moderate intensity, walking and sitting during the previous 7 days.

Sleep patterns

To assess sleep patterns the athletes will be asked how many hours they sleep during the night. In order to investigate the quality of sleep the athletes will be asked if they experience trouble falling asleep, if their sleep is interrupted during the night and if they feel tired in the morning. This approach has been used previously to investigate sleep patterns (3).

Data analysis

The prevalence of MSK pain within the study population will be presented in absolute numbers and as percentage values. To investigate if E-sport related training loads differ among athletes with and without MSK pain we will use total E-sport related training load (N hours spend on structured E-sport + N hours spend on unstructured E-sport). An independent sample t-test will be applied for this comparison if data are normally distributed. To assess if physical activity levels are different among athletes with and without

MSK pain we will use the responses from the IPAQ short form. For this comparison we will use an independent sample t-test or the Wilcoxon rank-sum test. Participant characteristics, distribution and number of MSK pain sites, utilization of health professionals and pain medicine, physical activity levels, training loads and sleep patterns will be presented descriptively. The data will be presented with means, standard deviations and 95% confidence intervals. Non-parametric data will be presented with absolute numbers and as percentage values, medians and range.

Ethics

Prior to undertaking the study, approval was sought from the local ethics committee in the Northern part of Jutland in Denmark, however according to Danish law (*Bekendtgørelse af lov om videnskabsetisk behandling af sundhedsvidenskabelige forskningsprojekter §14 stk. 2*) no ethical approval is need.

Data proception

This study will adhere to the Helsinki declaration and person data will be collected and stored in accordance with the General Data Protection Regulation (GDPR).

Perspective

Arguably, staying pain – and injury free while participating in sports is the most optimal way to become a top-level athlete (8). The same logic could be applicable for E-sport athletes. As such, it is possible that highly engaged E-sport athletes will sustain injuries or experience MSK pain because of their choice of recreational activity. However, data on MSK pain among E-sport athletes is lacking. The national federation of E-sport in Denmark, *eSport Denmark*, was established in 2007 and is working towards branding, developing and expanding E-sport to the Danish population (13). Moreover, E-sport Denmark is collaboration with DGI to help establish community-based E-sport clubs and teams all over Denmark (14). As such, we are witnessing a paradigm shift where players organise themselves in teams and engaging in training sessions with coaches at a physical location. As the awareness and interest for participating in E-sport is on the rise, there is a need to collect data on the health status among E-sport athletes, in order to provide healthcare professional with the right tool and knowledge to help E-sport athletes to stay active within their sport.

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