Influence of Esports on stress: A systematic review

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Esports is a form of competition where human–computer interfaces mediate the inputs of players and teams.[¹] Esports is being broadcasted through live-streaming platforms with a hundred million players participating in it. Esports has become a multibillion-dollar business[²] with a global audience of 453 million in 2019.[³] These events have considerable prize money of 100–200 million[⁴] dollars that lure significant amateur players to pursue it professionally. The first esports event happened in 1972 at Stanford University where students competed in video games’ space war. Esports origin relies heavily on launching the worldwide web in 1989, and on the early 1990s software and hardware technologies with network and multiplayer functions. Esports began in the early 1990s, and it became increasingly popular during this decade, the number of players growing considerably.[⁵] It is growing every year.

Esports and video gaming: Excessive video games’ use is the common feature between esports players and game war. Esports origin relies heavily on launching the worldwide web in 1989, and on the early 1990s software and hardware technologies with network and multiplayer functions. Esports began in the early 1990s, and it became increasingly popular during this decade, the number of players growing considerably.[⁵] It is growing every year.

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addict teenagers. Professional gamers can play video games more than 22 h/week, and 30% of teenagers interested in esports are playing video games for more than five hours a day. Physical activities make people happier by increasing their serotonin levels, but playing computer games for a long time may trigger depression and social problems such as decreased academic achievement with conduct problems.

**Esports and psychopathology**

Gender and game types are essential factors in esports athletes’ mental health. Adolescent boys with Internet gaming disorder have higher rate of anxiety, depression, and alexithymia. In adolescent girls with Internet gaming disorder, depression manifest at higher rate than anxiety and alexithymia. Multiplayer online battle areas games have shown to regulate emotions, whereas massively multiplayer online role-playing games appear to be associated with mood and behavior disturbances. A survey conducted for 1928 Norwegian adolescents aged 13–17 years and measured video game usage, video game addiction, depression, heavy episodic drinking, academic achievement, and conduct problems. This survey indicated that video game addiction was related to depression, lower academic achievement, and conduct problems, but the time spent on a video game was not related to any of the studied adverse outcomes. Similarly, academic performance is correlated negatively with playing video game time from an educational point of view. Various kinds of video games affect differently to an individual’s mental health. For example, violent video games become the outlet of anger and frustration for adolescent boys. Fantasy games with unrealistic characters make teenagers act similarly. Importantly, when teenagers play games for an excessive amount of time, the person may exhibit pathological symptoms, and addicted teenagers loneliness, anxiety, and depression.

**Esports and sports**

There are many similarities between sports and esports. They both provide entertainment to the audience viewing the game, as they are both competitive environments that provide displays of skill and prowess and are designed in a very similar way. Esports has many traditional sport components, including players, teams, managers, leagues, competitions, marquee events, endorsement deals, player transfer fees, college scholarships, and a dark side to match-fixing, doping, and gender-related disputes. Certain underlying psychological similarities are observed between esports and established sports as athletes from both domains need a high level of sustained attention and have to make important decisions under time constraints. Several global esports organizations like the International E-Sports Federation also exist to provide an institutional basis for regulation and stabilization of rules that may validate esports games as a recognized professional sport.

Esports and public health perspective: From a public health perspective, concern only arises when engagement in gaming is excessive, and the aim is to minimize harm for both the players and viewers. In the most recent iteration of the Diagnostic Statistical Manual of Mental Disorders – V (DSM – V) (2013), Internet gaming disorder was included in the appendix as a condition warranting further research. In June 2018, the WHO included the gaming disorder as a mental health condition in the ICD-11. Gaming disorder is generally characterized by not able to control over gaming, increased priority is given to gaming when compare to daily routine and the presence of negative consequences. It results in significant impairment in personal, family, social, educational, occupational, or other important functioning areas. The inclusion of gaming as a mental condition prompted health professionals to explore esports activities and their role in contributing toward problematic gaming. The rise of professional gaming has led to an increase in esports. The term stress has been used to express “environmental demands encountered by individuals.”

As esports athletes compete in highly pressurized and competitive environments comparable to more traditional sports, stress likely exists in an esports performance environment. Another study identified the mental skill and techniques used by the esports player to achieve optimal performance in a highly competitive gaming environment. For successful performance, esports player needs to know about video games, think strategically, make fast and smart decisions, be motivated to keep moving forward, avoid being distracted, cope adaptively with harassment, and maintain a positive attitude. If the esports player needs to achieve optimal performance, the player should adapt to their opponents, communicate properly with the teammates, and trust their skills. This study also identified the possible barriers of performance, such as confidence issues, inadequate coping strategies with anxiety, past achievements and mistakes, harassment, lack of self and team development, and difficulty in separating life and gaming. Some psychological skill involved in esports includes a high level of sustained attention, planning, working memory, and inhibition to control the impulses. All these factors do contribute to or affect the psychological state of players. Another exploration about the mindset of winning players and teams in Esports suggest that up to 50% of performance improvement link to mental preparedness and a player’s state of mind. Research has identified that elite athletes are under intense pressure to succeed and face various demands in performing in an elite environment. Researchers have investigated these demands principally using qualitative methods to interview elite participants about the specific stressors.
they face when performing. For example, in an interview of 20 Australian University athletes to understand their stressors, they combined elite sport participation in higher education. The findings revealed a range of stress that included schedule clashes, financial pressure, and coaches’ inflexibility.[24] Another study interviewed five high-level League of Legends players about psychosocial factors in competitive esports and found many obstacles prevented optimal performance.[19] These obstacles included pressure of competing, being harassed by others, and negative communication during performance. Esports players are competing in increasingly pressurized environments. Stress is likely to impact performance in such an environment negatively. The present review aimed to develop and enhance an understanding of psychological issues among esports players. Even Esports popularity, only a few studies investigated the gamers’ health profile (physical and psychological).

**METHODS**

**Aim**

This study aimed to review all the recent research studies concerning Esports from a health perspective.

PICO guidelines followed for the systematic review.

P – Population/patient = Human participants

I – Intervention = NIL

C – Comparator/control = NIL

O – Outcome = Esports and health issues (physical and psychological)

The systematic review was conducted based on the preferred reporting item for systematic review and meta-analysis (PRISMA) and PICO guidelines.[25]

**Database searched**

Studies were identified by searching the three research engines such as PubMed, Google Scholar, and Research Gate. Since esports is a relatively understudied area, the keywords such as Esports, stress, and addiction used to search articles in the research engines.

**Inclusion criteria**

The data collection included all the studies published between 2017 and 2020. The assessments of psychological issues in esports, empirical studies, inclusive of game players between 14 and 25 years, studies published in the peer-reviewed journal, and studies published in English were included in the systematic review.

**Exclusion criteria**

Dissertations, pilot/protocol/prototype studies, and studies published in a language other than English were excluded.

**Technology-assisted search and screening**

Rayyan software used to screen database.[26] Those articles that did not meet the inclusion criteria were excluded. Cross-referencing of the excluded and selected studies were done by consensus of the co-authors.

**Study selection and data extraction**

A total of 20 papers reviewed as a result of the article’s search. Identified studies reviewed independently for eligibility in a two-step process: first screening was performed based on the title and abstract, and then, full texts accessed for a second screening. At both the stages, data was extracted based on the inclusion criteria [Figure 1].

All papers used for this review based their findings on online/video games dating from 2017 till date. Twenty-two papers screened through the search terms used in the databases. Papers selected for current review: Seven papers met the inclusion criteria for the current review to explore the Esports and stress. Two papers reported the physical stress and Esports and two papers reported the psychological stress and esports and three papers on Esports and addiction [Table 1].

Seven studies were selected, and these studies comprised three main topics such as (i) Esports and physical issues, (ii) Esports and psychological distress, and (iii) Esports and addiction. These studies used online survey method with followings guidelines.

1. Was the research question or objective in the paper clearly stated?
2. Was the study population clearly specified and defined?
3. Was 50% the participation rate of eligible persons ensured?
4. Were the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?
5. Whether sample size justification, power description, or variance and effect estimates provided
6. For the analyses in this paper, were the exposure (s) of interest measured before the outcome (s) being measured?
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it exist?
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
10. Was the exposure (s) assessed more than once over time?
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
12. Were the outcome assessors blinded to the exposure status of participants?
13. Was loss to follow-up after baseline 20% or less?
14. Were critical potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure (s) and outcome (s)?

Table 2: Given the studies’s nature, most of the studies were in the category of reasonable or fair, though few components were not reported in the studies.

**Esports and physical issues**

The early studies revealed that Esports might lead to several types of physical issues. The most commonly reported complaints of esports athletes are eye fatigue. Greater than twenty-five percent of collegiate sports athletes report practicing for more than five hours day. During practice, athletes fix their eyes on a computer screen for a long period of time.[27] Thus, many Esports athletes have computer vision syndrome, characterized by blurry vision, low back pain, and tension headache. This condition found in 90% of individuals using a computer for more than 3 h/day.[33]

A survey of 65 collegiate Esports players from nine universities across the USA and Canada inquired about gaming and lifestyle habits and musculoskeletal complaints due to esports competition. The result of the study revealed those players practicing between 3 and 10 h/day and the most reported complaints were eye fatigue (56%), followed by neck and back pain (42%) and also Esports athletes prone to have wrist pain (36%) and hand pain (32%).[28] Similarly, 35% of collegiate Esports athletes reported neck pain or back pain while gaming.[31]

Playing video games longer than 3 hours is associated with shoulder pain and is likely a result of poor posture while gaming[34] because, it requires quick, repetitive movements involving the fingers, hands, and wrists. These repetitive movements lead to hypertrophy of the flexor tendons in the carpal tunnel and an increased cross-sectional area and swelling ratio in the median nerve.[35]

Esports athletes were practicing between 3 and 10 h/day to master his or her sport. When individuals remained seated in a position for >3 h, it negatively affected their peripheral and central vascular health.[34]
Table 1: The Esports focused psychological studies

| Title                                                                 | Country | Sample  | Study design           | Tools used                                                                 | Findings                                                                 |
|-----------------------------------------------------------------------|---------|---------|------------------------|-----------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Managing the health of the esports athlete: An integrated health management model[30] | USA     | n=65    | Online survey method   | Self-reported questionnaire developed by the esports players collaborative effort in the New York Institute of Technology campus based on common injuries they have encountered in the past | More than % of esports gamers have Exercise deficit disorder (i.e., <60 min of physical activity a day) The esports players reported eye fatigue, back, and neck pain, followed by wrist and hand pain |
| Demographics and health behavior of video game and esports players in Germany: The esports study[31] | Germany | n=1066  | Cross-sectional online survey | A self-reported questionnaire developed for the study                        | The high amount of video game play time had poor negative association with participants' the health status |
| Investigating the psychological well-being of teenagers interested in esports career[32] | Turkey  | n=320   | Online survey method   | The self-reported questionnaire, psychological well-being scale             | Psychological wellbeing levels are affected by daily play of video games, and teenagers’ desire of have esports career |
| What is esports and why do people watch it?[33]                       | Finland | n=888   | Online survey method   | MSSC                                                                       | Esports athlete aggressiveness were found to positively predict esports spectating frequency |
| The mediating effect of motivations between psychiatric distress and gaming disorder among esports gamers and recreational gamers[34] | Hungary | n=4284 gamers | Online survey method | MOGQ, BSI, IGDT-10                                                          | Escapism is one of the main motivations among esports gamers. Escapism may also threaten esports gamers’ video game use and may lead to more gaming disorder-related behavior |
| Investigating the relationship between video gaming, spectating esports, and gambling[35] | Finland | n=513   | Online survey method   | GAS, the PGSI                                                              | Consumption of esports had a small to moderate association with video game-related gambling, online gambling, and problem gambling |
| Esports, skins, and loot boxes: Participants, practices, and problematic behavior associated with emergent forms of gambling[36] | Finland | n=582   | Online survey method   | Consumption habits, The PGSI                                                 | Participation in gambling and gambling like activities was found to be 67% with rates of problematic and potentially problematic gambling in the sample being 50.34%. So, increased gambling is associated with increased spectating of esports |

MSSC-Motivation Scale for Sports Consumption; BSI-Brief symptom inventory; IGDT-10: Internet gaming disorder test; GAS-Game Addiction Scale; PGSI-Problem Gambling Severity Index; SD-Standard deviation; MOGQ-Motives for Online Gaming Questionnaire

A comparative study that included 52 professionals and nonprofessional esports athletes with the Internet gaming disorder revealed differences in brain structure and function. In addition, they increased gray matter volume in the anterior cingulate gyrus, which is responsible for regulating addictive behaviors, in professional esports athletes compared with people with the Internet gaming disorder. Moreover, people with the Internet gaming disorder had increased gray matter volume in the thalamus, responsible for conditioned responses and associated with the stimulus-reward pathway.[37]

Table 3 reported that Esports might lead to various physical issues such as blurry vision, low back pain, neck pain, and tension headache.

Esports and psychological distress
Esports not only leads to physical issues, but it may also lead to adverse psychological effects. Playing video games
Table 2: Risk bias for the studies

| References | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Total |
|------------|---|---|---|---|---|---|---|---|---|-----|-----|-----|-----|-----|-------|
| DiFrancisco-Donoghue and Balentine[44] | Yes | Yes | Yes | Yes | No | No | NA | No | Yes | No | Yes | No | NA | NR | 5    |
| Rudolf et al.[48] | Yes | Yes | Yes | Yes | No | No | NA | No | Yes | No | Yes | No | NA | NA | 5    |
| Kocadağ[50] | Yes | Yes | Yes | Yes | No | No | NA | Yes | Yes | No | Yes | No | NA | Yes | 8    |
| Bányai (2019)[52] | Yes | Yes | Yes | Yes | No | No | NA | Yes | Yes | No | Yes | No | NA | Yes | 8    |
| Macey and Hamari[54] | Yes | Yes | Yes | Yes | No | No | NA | Yes | Yes | No | Yes | No | NA | Yes | 8    |
| Macey and Hamari[54] | Yes | Yes | Yes | Yes | No | No | NA | Yes | Yes | No | Yes | No | NA | No | 6    |
| Hamari and Sjöblom[56] | Yes | Yes | Yes | Yes | No | No | NA | Yes | Yes | No | Yes | No | NA | Yes | 7    |

NA-Not applicable; NR-Not reported

Table 3: The physical and psychological issues related to the excessive play of Esports

| Physical issues | Psychological issues |
|----------------|----------------------|
| Studies found playing esports longer than 3 h leads to the following physical issues | Studies found the excessive play of esports causes psychological issues such as |
| Eye fatigue | Depression |
| Computer vision syndrome | Addiction |
| Blurry vision | Aggressive behavior |
| Low back pain | Aggressive affect and hostility |
| Tension headache | Phobic anxiety |
| Wrist pain | Paranoid ideation |
| Hand pain | Social phobia |
| Neck and back pain | Obsession-Compulsive behaviors |
| Poor peripheral and central vascular health | Interpersonal sensitivity |
| Hypertrophy of the flexor tendons | Psychological distress |
| Increased gray matter volume in the tissue, etc. | Uncooperative attitude |
| Insufficient sleep hours (sleep disturbances) | Insufficient sleep hours (sleep disturbances) |
| Distress in social life | Distress in social life |
| Emotional problems | Emotional problems |
| Apathetic (lack of interest) | Apathetic (lack of interest) |

for a long time in daily life causes social, emotional, and mental problems such as depression and aggression. So uncontrolled and excessive play of video games can cause social and emotional problems.[38]

A study at the University of Chichester examined esports professionals’ psychological challenges when competing in a primary contests. A study at the University of Chichester examined esports professionals’ psychological challenges when competing in major contests. Esports players faced different types of stress factors, including communication problems and concerns with competing in front of a live audience, mirroring the mental conditions experienced by pro athletes, including footballers and rugby stars in high-profile tournaments. Similarly, excessive video game playing was related to social life distress, disturbance occupational activities, and academic performance among high school students, college students, and adults.[39]

In a survey of 276 students enrolled in ninth through twelfth grades in the International Schools in Buraidah, Al-Qassim, it is determined that addiction to video games was strongly associated with psychological distress, and also female gender, higher screen time, and shorter sleep hours were found as other significant correlates.[40]

Esports has become an ever-increasing part of many adolescents’ day to day lives. The relationship between computer games and aggression in adolescents with mental health was explored and found that computer games increase adolescent aggression and decrease mental health.[41] Similar results found that the addictive behavior of excessive gaming is interrelated with aggressive behavior.[42] Similarly, a study based on the Affective Aggression Model revealed that exposure to violent video games would increase aggressive behavior in both the short-term and long-term duration.[43]

The experimental research showed that playing violent video games produces a higher level of aggressive cognitions, aggressive affect, physiological arousal, and aggressive behavior (short term) than nonviolent video games.[44] Similarly, other researchers assessed whether violent video games increase physical aggression over time in both high (United States) and low (Japan) violent cultures. The study revealed that habitual violent video games play in the school age-predicted later aggression, even after controlling for gender and previous aggressiveness in each sample. This shows that playing violent video games is a significant risk factor for later physically aggressive behavior. This violent video game effect on youth generalizes across very different cultures.[45]
Esports and addiction

Game addiction is a major problem for society to deal with, and there will be harmful psychosocial consequences. Scientists have started viewing video gaming as a pathological issue.[46] Teenagers with addictive behaviors may be evolving into aggressive, uncooperative, apathetic, and tense personalities.[47]

The participation rates and demographic characteristics of esports spectators whose gambling were assessed through an international online survey \( n = 582 \), and the sample highlighted the prevalence of young, often underage, males in esports-related gambling activities. Participation in gambling and gambling-like activities was 67%, with rates of problematic and potentially problematic gambling in the sample being 50.34%. The result revealed that increased gambling is associated with increased spectating of esports. Similarly, a study using an international online survey \( n = 613 \) revealed that esports' consumption had a moderate relationship with video game-related gambling, online gambling, and problem gambling.[32]

DISCUSSION

The present review studies showed the impact of increased Esports on psychological well-being, physical stress, and addiction. In a cross-sectional online survey of 165 multiplayer online battle arena, gamers revealed that a higher level of playtime was associated with poor psychological well-being.[48] The studies have corroborated the association of long hours of online gaming and the presence of depression, social phobia, obsession–compulsion, interpersonal sensitivity, hostility, phobic anxiety, paranoid ideation, and psychoticism ADHD and Internet addiction. The gender difference observed for expression of social anxiety.[49-51] Similar findings have been reported using video game use questionnaire and symptom checklist scale-90 that reported a nonspecific relationship between various domains of psychopathology and video game use in general and problem video game use in particular.[52]

Competition is related to psychophysiological stress response and it is a key aspect of esports. The esports in competitive settings is related to physiological or psychological stress based on the systematic literature review. A total of 17 studies were reviewed and the result shows that five studies on stress in competitive setting demonstrated no hormonal reaction, one study reported an increase in anxiety levels in the winners as well as increase cortisol levels from baseline to postgame, and two studies found an activation of the sympathetic nervous system. These stresses in some of the cases do manifest as aggression.[53] Although the research is available in gaming and psychological distress, empirical work must assess the psychological issues and their impact on esports players.[Table 3].[54]

Strengths and limitations

A comprehensive and systematic approach to have a detailed review of each full-text article. The attempt was made to reduce the risk of bias. Rayyan software, the PICO, and PRISMA guidelines used to minimize error. The limitation of this review is the availability of a limited number of databases meeting the inclusion criteria.

CONCLUSION

Over the past few years, the popularity of Esports events has grown enormously. This kind of event typically involves professional video game players competing in multiplayer video game competitions. The present study collated all the recent empirical studies that intend to assess the health issues (physical and psychological) in Esports and revealed that excessive Esports play causes social, emotional, addiction, and psychological problems such as depression and aggression. From the studies reviewed, assessing it is seen that the survey method was used for the negative consequences of gaming. Regarding future research directions, health issues, their relationship with nature of games, duration of play, and the interventions to deal with the Esports negative impact needed to be explored. There is a need to provide psychological as well as physical skills training like positive self-talk, breathing techniques, skills to avoid physical distress, and imagery to improve focus and encouraging their use during Esports competitions to regulate emotions.

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Conflicts of interest

There are no conflicts of interest.

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