Review

Mental illness in elite weightlifters

A systematic review

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Abstract: *Introduction:* The mental health of elite athletes is a growing area of research however there remains a paucity of data to support evidence-based screening and prevention programmes as well as holistic yet targeted care. Olympic Weightlifting has long been associated in the media with the use of banned substances at an elite level however little is known about the mental health impact that this might represent and what the wider mental health needs of this group might be. *Methods:* A systematic search of PsychINFO, MEDLINE, EMCARE, EMBASE and CINAHL databases was conducted from inception up until January 2022. Peer reviewed studies of any methodology looking at mental illness or symptoms amongst current elite level Olympic weightlifters were eligible for inclusion. *Results:* Four articles met all inclusion criteria. Two cross-sectional studies looked at depression and anxiety and two case studies reported psychosis following long-term use of Mephentermine. Results seemed to broadly align with research looking at elite athletes in other sports however it was not possible to compare results between the two cross-sectional studies due to methodological differences. *Conclusion:* There is very little published research in this area and it is of varying methodological quality. A narrow subset of mental health symptoms were investigated and most of the data were based on self-reported symptoms rather than diagnostic data. Further research is needed to explore the mental health burden in this group and to inform appropriate support programmes.

Keywords: doping, depression, mental disorders, elite athletes, mental health

Background

The mental health of elite athletes is a growing area of interest for researchers and it has been widely suggested that this population are often at higher risk of some mental health disorders with unique challenges for treatment options [1]. A recent meta-analysis of 22 studies, including 2895 to 5555 current elite athletes, found that the prevalence of mental health disorders ranged from 19% for alcohol misuse to 34% for anxiety and depression [2]. Whilst common risk factors for mental ill health in the general population, such as poor social support and major life events, may be applicable to elite athletes, it is also recognised that there are athlete-specific factors that may contribute to the emergence of mental illness and that these may be more pertinent at different stages within an athlete's career [3]. These include sport-related injury, overtraining and performance failure [4, 5, 6, 7]. The recent International Olympic Committee (IOC) consensus statement highlighted the importance of further research on elite athletes' mental health, outlining significant gaps within the field [8]. These include: a paucity of data on specific illnesses (namely psychosis and bipolar disorders as well as mental health emergencies); lack of attention to cross-cultural manifestations of different mental illnesses; and a lack of research informing appropriate psycho-social and pharmacological treatments. There is also little evidence to guide prevention strategies and the provision of validated screening programmes for elite athletes [8]. Olympic Weightlifting or "weightlifting" is a sport comprised of two main movements, the snatch and the clean and jerk, both of which involve moving a barbell loaded with weight plates, from the ground to overhead. The sport has long been stigmatised through the association with performance enhancing substances [9], with several countries including Egypt and Romania being banned from Tokyo 2021 due to alleged violations of anti-doping rules. The use of performance-enhancing substances, and specifically anabolic androgenic steroids (AAS), is known to have a significant impact on mental health, particularly given the links with chronic patterns of use and research suggesting that around 30% of these individuals become dependent [10, 11]. AAS have been linked to depression [12], cognitive impairment [13], aggression [12, 14] and psychosis [12]. Studies have also linked their use to muscle dysmorphia [15, 16, 17]; a type of body dysmorphic disorder whereby a lean or often very muscular body is not perceived as being muscular enough. Affected individuals often spend significant periods employing methods to increase muscle mass, including excessive weight training and using AAS [18], and are at risk

of developing eating disorders [15, 19]. Whilst the use of these substances is not confined to the elite levels of sport [11], interventions to identify and offer support to these athletes have not been widely investigated [8].

Furthermore, reflections on medical care at the Tokyo 2021 Olympic Games [20] reinforced the importance of considering the mental health of elite weightlifters, particularly given that poor mental health is a risk factor for injury [20, 21]. In order to improve support there needs to be a greater understanding of the mental health need that elite weightlifters represent.

This review aimed to synthesise the current evidence exploring the symptoms and diagnoses related to mental illness amongst current elite weightlifters, to inform future research and ultimately, to improve the support that can be provided to them.

Methods

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [22].

A computer-based search of PsychINFO, MEDLINE, EMCARE, EMBASE and CINAHL databases was conducted by a librarian working in AP's mental health trust. Databases were searched from inception until 7th January 2022. A Google search was also undertaken to find additional articles of interest. The search strategy included the following search terms "weightlifter," "powerlifter," "mental health," "major depression," "anxiety disorders," "psychosis," "eating disorders," "drug abuse," "addiction," "dementia" with explosion of Medical Subject Heading terms (see Electronic Supplementary Material ESM 1). The term "powerlifter" was included to widen our search and to reduce the chance of neglecting relevant papers.

Titles and abstracts were independently screened by AP and TM to identify potential studies relevant to the focus of this review. Full texts were then retrieved and screened to determine if they met inclusion criteria. Any disagreements were resolved by a third reviewer (JL). The reference lists of relevant studies were also hand searched for additional papers of interest. Given the broad aim of this review and the heterogeneity of potential studies included, a narrative synthesis approach was used [23].

Risk of bias was assessed by AP using validated tools from the Joanna Briggs Institute (JBI) [24]. The JBI checklists were chosen as they offer the only validated option for assessing the quality of case reports and are amongst the most recent validated tools suitable for assessing the quality of descriptive cross-sectional studies [25]. For the purpose of this review, there was no distinct threshold for the number of criteria each study had to meet.

Studies included could be of any methodology but had to be: peer-reviewed primary research; published in the English language; focused on mental illness; and studied current (not retired) elite level Olympic weightlifters (with elite meaning competing at a national, international or professional level). Studies were excluded if: the population were non-elite weightlifters; the population comprised of multiple sports; the population included powerlifters or bodybuilders/ physique sport competitors; or studies of "weightlifters" where "weightlifters" referred to athletes who lift weights (rather than Olympic style weightlifting) or "weightlifter" was used interchangeably with "bodybuilder."

Results

A total of 758 studies were identified from initial searches of the databases listed above, after removal of duplicates. After initial screening of titles and abstracts, 64 potentially eligible studies were identified. After full text screening, four articles were found to meet all of our inclusion criteria [26, 27, 28, 29]. Figure 1 represents the study flow chart.

Study characteristics

Table 1 highlights key characteristics of the studies included. Studies were conducted between 1989 and 2020; two were conducted in the USA (both cross-sectional in design) and two were case reports from India. Across all studies, there was a total of 1077 weightlifters, with the majority participating in Huebner et al.'s study (n=958) [26].

Response rates were similar between the cross-sectional studies [26, 27], with Huebner et al.'s online survey returning a 30.6% response rate [26] and for Mahoney's study using postal questionnaires, a 31.8% response rate [27]. The median age of Huebner et al.'s population was 45 (range 34–87) as they were focused specifically on Masters athletes (i.e. those who turn 35 or older during the current calendar year) [26]. Mahoney does not quote the median or range of ages; however suggests participants come from a range of age groups including junior athletes who are between the ages of 14 and 19 years inclusive, and senior athletes who are defined as being 20 years and over [27]. For the purpose of this review both Mahoney's "elite" and "non-elite" groups were included, as "non-elite" in this context still indicated they competed at a national level, thus meeting our inclusion criteria, but whose ranking by the US Weightlifting Federation (USWF) was lower than 11th place. Huebner et al. outlined demographic characteristics of their population, noting that their sample was heavily representative of a white, affluent, educated group

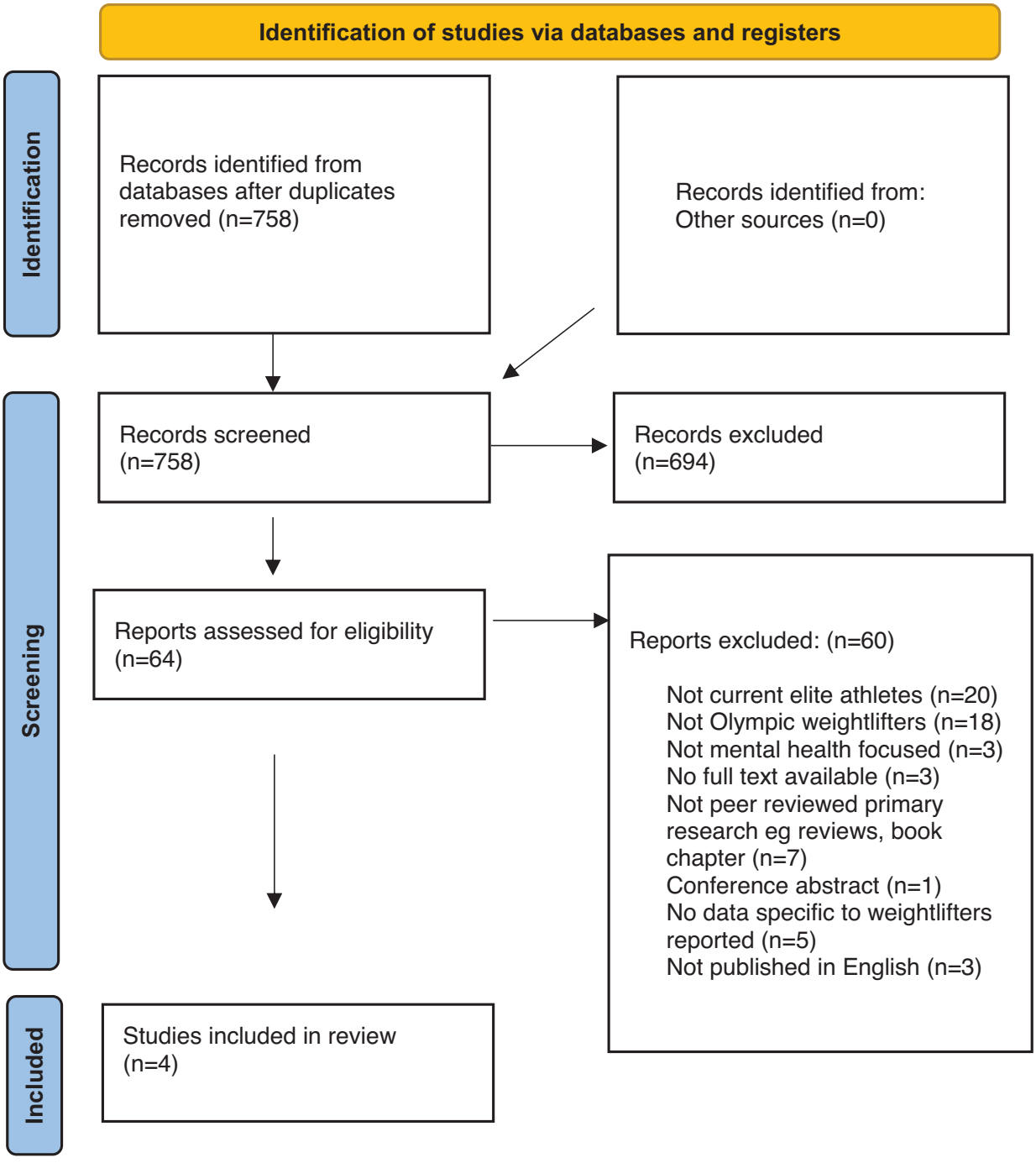

Figure 1. Flowchart of search strategy.

of athletes [26], whereas few demographics were reported by Mahoney, aside from sex and USWF ranking [27].

Both case reports concerned a male professional weightlifter, one aged 31 and one aged 23 years old [28, 29]. No further demographic information is provided by Sawant and Vispute [28], however Gehlawat et al. describe their case as being a graduate and unmarried [29]. Both papers documented examples of the athlete in question using Mephentermine, an alpha adrenergic receptor agonist used clinically as a vasopressor agent to maintain blood pressure in hypotension [30] and which is banned by the World Anti-Doping Agency (WADA) at present [31]. Both describe a history of Mephentermine dependence spanning a two to three year period, with emergence of an acute psychotic episode following increased use over a two to three month period [28, 29].

Mahoney's study was the only one included in the review to utilise validated questionnaires to gather data [27].

Table 1. Characteristics of studies included

Author, date, country	Study design	Population Characteristics	Instruments used	Mental Health Outcome (s) of interest	Summary of findings
Mahoney 1989, USA [25]	Cross-sectional	Senior Male (n=26); Junior male (n=22); Female (n=19); Elite (n=28); non-elite (n=22)	The Symptom Checklist 90R (SCL-90R) Profile of Mood States (POMS)	Symptoms of depression, anxiety, phobic anxiety	(Elite vs. non-elite mean scores) SCL-90R: Depression (57.5 vs. 65.1); anxiety (56.4 vs. 58.8); phobic anxiety (50.2 vs. 54.9) POMS: Depression (45.4 vs. 48.5)
Huebner et al. 2020, USA [24]	Cross-sectional	Masters female (n=521); Masters Male (n=437)	Online survey designed asking about psychological factors that impacted upon training	Prevalence of anxiety, depression, stress, sleep problems	Anxiety (f=8.2%; m=3.2%); depression (f=5.2%; m=4.4%); stress (f=17.9%; m=8.4%); sleep problems (f=17.7%; m=11%)
Sawant and Vispute 2012, India [26]	Case report	31 year old elite male weightlifter	Mental State Examination	Psychosis (agitation, persecutory delusions, delusions of reference)	Daily use of Mephentermine for 2 years with 3 month history of increased use led to psychotic presentation that resolved with abstinence and Risperidone 4 mg daily
Gehlawat et al. 2013, India [27]	Case report	23 year old elite male weightlifter	Mental State Examination	Psychosis (Agitation, persecutory delusions, delusions of reference)	Daily use of Mephentermine for 3 year period with 2 month history of increased use led to psychotic presentation that resolved with Olanzapine 5 mg and abstinence

Note. HR=hazard ratio.

Specifically, he used: the Symptom Checklist 90R (SCL-90R) [32], the Profile of Mood States (POMS) [33], the Rosenberg Self-Esteem Scale (RSES) [34] and the Psychological Skills Inventory for Sports (PSIS-R5) [35]. They compared results between elite and non-elite groups with the aim of understanding psychological variables associated with performance, many of which are outside the focus of this review.

Huebner et al. devised their own survey and gathered data on a range of topics including participants' levels of physical activity and training habits, as well as the impact of weightlifting on their lives [26]. Relevant to mental health, they asked participants if they had experienced problems with anxiety, depression, stress or sleep, such that this had affected their training "moderately or considerably" in the past two years. There was no definition or criteria provided however, for what constituted a "moderate or considerable impact." Prevalence of these self-reported difficulties were compared between sex and age groups.

Assessing risk of bias

None of the included studies met all the JBI checklist criteria. Huebner et al. met seven [26] and Mahoney's study met eight of the nine criteria [27]. Both cross-sectional studies included [26, 27] sampled their population of interest appropriately, describing the setting and participants adequately and utilised appropriate statistical analyses. However, Mahoney's small sample size meant that the statistical analyses of the data collected was not as comprehensive as the present study's authors would have liked, presenting challenges to its applicability in larger groups of elite weightlifters [27]. Huebner et al. had a much larger sample size, however the questionnaire used to collect data on the symptoms related to mental illness was not a validated research instrument. It was unclear as to the nature or degree of those symptoms considered and whether or not these difficulties represented a diagnosable clinical condition [26]. See ESM 2 for an outline of the criteria met for each study included.

The case reports did not clearly meet more than four of the eight criteria in the JBI checklist [24]. Both case reports did not include sufficient, if any, demographic and past medical history relevant to the weightlifter in question [28, 29], although both reports did give a clear account of the psychopathology at presentation and the investigations carried out to exclude additional physical harm and differential diagnoses. The intervention described by Sawant & Vispute could have been more detailed [28] and both case reports could have provided more explicit take-home messages of learning for clinicians in particular [28, 29]. Despite these concerns around methodological quality, given the literature suggests the mental health needs of elite weightlifters are not well understood, both case reports were included in this review.

Findings related to mental illness

Both depression and anxiety were measured in Mahoney and Huebner's studies [26, 27]. In the study by Mahoney, the elite group, when compared to their non-elite peers, reported lower levels of depression and anxiety symptoms, including phobic anxiety as defined on the SCL-90R, although only the result pertaining to depression was statistically significant ($p<.02$) [27]. The POMS indicated higher levels of depression in the elite group but this difference did not reach statistical significance [27].

Huebner et al. found that the prevalence of mental health symptoms that impacted training were all found to be significantly greater amongst women compared with men ($p=.024$; $p=.014$; $p<.001$ respectively) [26]. Overall, 8.2% women reported symptoms of anxiety that affected training versus 3.2% men, and 5.2% reported depressive symptoms, versus 4.4% in men. Younger women (aged 35–44) reported higher levels of anxiety, depression and stress levels compared with older females, with those aged 45–59 reporting greater difficulty with sleep, perhaps in part due to hormonal shifts as a result of the peri-menopause or menopause [26]. Mahoney found that results from the POMS suggested elite females had higher levels of depressive symptoms than elite males 20 years or older but lower levels than junior elite males [27]. Small sample sizes once again however, precluded any meaningful statistical analysis of the difference between groups.

Huebner et al. noted a similar pattern in symptom prevalence between their male and female cohorts with the younger male age groups (aged 35–44) self-reporting a higher prevalence of symptoms in all domains [26]. A similar proportion of the oldest males (aged 60+) and youngest males (aged 35–44) reported sleep problems (11.9% vs. 11.4%); albeit from a smaller absolute group size [26].

Both case reports included in this review document an acute psychotic episode following a two to three month period of increased Mephentermine use, on a background of dependent use for the preceding two to three years [28, 29]. Both are characterised by an acute onset of agitation and the presence of delusions of reference and persecution with the absence of any perceptual abnormality. Following administration of antipsychotic medication and abstinence from the Mephentermine both cases saw a resolution of the psychotic symptoms.

Discussion

In this review we systematically searched the current literature on symptoms and diagnoses related to mental health in elite level Olympic Weightlifters (i.e. those who are competing at a national, international or professional level). We found very little peer-reviewed research published in this area, despite it growing as an international sport both at recreational and elite levels [36] and there being increased emphasis on considering mental health in elite sport more broadly [8] and in weightlifting specifically [20].

Only four articles were identified as meeting our inclusion criteria, published between 1989 and 2020 [26, 27, 28, 29], with none representing methodologies higher than a cross-sectional design in the hierarchy of evidence. We noted varying methodological quality, with none meeting all criteria as outlined by the JBI [24]. The results generated by our search suggested that the literature concerning weightlifting and mental illness is highly skewed towards bodybuilders and those who lift weights or resistance train within the general population. There is often a lack of information to define what "weightlifters" are, with the term often being used synonymously with bodybuilders.

The studies included in our review provide data on just depression and anxiety [26, 27] although these were based on participants subjectively self-reporting symptoms, rather than using any clinically corroborated sources or diagnostic data. In addition, two case reports documented acute psychosis secondary to the illicit use of a substance banned by WADA but this was in the absence of studies elsewhere supporting their observation in larger groups of weightlifters [28, 29].

Huebner et al. found that in their cohort of Masters athletes, 8.2% of females reported anxiety symptoms that interfered with training to at least a moderate level in the past two years, and 3.2% of males overall [26]. This trend is supported in a cross-sectional study of Slovenian athletes of mixed sports who competed at the Beijing Olympic games [37] whilst Olivardia et al. [15] found a similar lifetime prevalence of anxiety in a control group of 30 non-elite male weightlifters, however noted that in the presence of symptoms in keeping with muscle dysmorphia, this rate was significantly increased in the comparison group (up to 29%). Studies of the general population often support the hypothesis that women report higher levels of anxiety than men [38, 39]. Within athletic cohorts, when compared with the public, this can be increased further [40] with factors such as performance expectations and injury being important factors [41]. Females competing in solo sports have also been found to be at higher risk compared with team sports [42], possibly due to the protective nature of a more constant and supportive environment particularly if recovering from injury [40]. It is therefore perhaps not surprising that female weightlifters are found to report higher levels of anxiety and depression in the studies included in this review.

Huebner et al. found that there was no significant difference between male and female athletes reporting depressive symptoms (4.4% and 5.2% respectively) [26].

This is aligned with a French study that used clinically verified diagnoses [43] and found lifetime prevalence rates of 3.6%. Literature elsewhere in heterogeneous samples of elite athletes, have suggested much higher rates of self-reported depressive symptoms [5, 44, 45]. A trend towards increased depressive symptoms in younger female athletes, as noted by Huebner et al. is also supported elsewhere in a group of female elite tennis players [46]. It may be that factors relevant to this group including body image issues, eating disorders, internalisation of emotions and dealing with the multifaceted issue of inequity in sport [47], could be important in explaining this trend.

As Mahoney used validated instruments for assessing different symptom domains, he reported mean scores for participants and compared against groups, rather than reporting prevalence data [27]. He concluded that the elite group had less depressive symptoms than their less successful peers. We are unable to summise whether the depressive symptoms or the poorer athletic performance came first, however research has suggested an association between injury, failure in competition and higher levels of depression amongst elite athletes [48, 49, 50]. The typical "iceberg profile," originally described by Morgan [51] to characterise athletes' tendency to have below the population averages for the five negative mood states, with one positive mood state (vigour) being one standard deviation above the population mean [52], was supported by Mahoney [27] although he recognised that there may be significant variation across individuals of different sports.

Whilst we found no cohort studies looking at drug or alcohol use in weightlifters currently competing, research in other athletes has indicated that alcohol use is higher compared to the general population [53, 54] although this may be skewed by higher consumption during off-season and holiday periods [55]. It has been suggested that it may be used as a coping mechanism to deal with the stress associated with competition in those who compete at the highest levels [53]. In other non-elite populations of those who engage in bodybuilding-style weightlifting, levels of alcohol consumption have not been found to be significantly different when comparing those who use AAS and those who don't, although the AAS using population were found to have higher rates of some form of substance use prior to using AAS [56]. In a group of male high school athletes, the weightlifting population were amongst those who reported consuming alcohol more frequently [57].

Strengths, limitations and future research directions

This review employed a systematic approach to searching the literature and collating for the first time, the evidence relating to Olympic weightlifters and mental illness, providing a springboard for future research in this area. We are therefore confident that our searches have captured all relevant research published in the English language to date.

The body of literature included however, is very small and is of varying quality in terms of methodology. Whilst the case reports included may be highlighting an important area for further research [28, 29], we did not find studies with larger sample sizes to support greater understanding of psychosis secondary to illicit substance use in weightlifters. In the remaining two studies, the populations targeted are relatively small, with Huebner et al. [26] specifically focusing on a Masters population. It is therefore not possible to extrapolate their results to the international community of Olympic Weightlifters. Further research in this area should therefore look to study and compare weightlifters of varying cultural backgrounds, in Asia and across continents, including women as well as men. The use of validated instruments for recognising and diagnosing mental illness could allow comparison across groups, with the caveat that there is some cultural difference between the ways in which mental illness presents across the world [8].

The data relating to depression and anxiety [26, 27] is based on athletes self-reporting as opposed to clinically verified diagnostic data. It is therefore difficult to evaluate the severity of the symptoms, whether they meet criteria for a diagnosable mental illness and whether any intervention (be that pharmacological or psychotherapeutic) was required.

The breadth of symptoms of interest in the included studies was very narrow. Whilst there is research to suggest that recreational weightlifters or bodybuilders are at increased risk of using AAS or other banned performance enhancing substances [16, 58, 59] it is notable that we only came across two case reports that documented the potential implication for a diagnosable mental illness in relation to the use of banned substances [28, 29]. Given the endemic doping in this sport that is reported elsewhere [60], this suggests there is the need for more peer-reviewed research to better understand the potential mental health factors related to the use of banned substances.

The notable absence of such research is perhaps not surprising given the myriad of barriers for disclosure, not least the taboo nature of the issue and the potential for serious penalties if admitting to use of banned substances. A shift in culture within the sport is needed alongside further research, in order to help educate, motivate and empower both elite athletes and coaches about the risks of doping and the potential for mental illness [8, 61, 62]. The integration of trained clinicians within the wider sports medicine community could help towards this goal, and more broadly in achieving a holistic approach to the mental health care of elite athletes [63].

This review has therefore highlighted areas that need to be addressed through future research. No qualitative studies were found that help to illustrate the lived experience of weightlifters and mental illness. We do not have data on how being an elite weightlifter may influence an individual's body image or training and eating behaviours. This is despite research conducted in the general population indicating that individuals who lift weights are at increased risk of symptoms aligned with body dysmorphia and eating disorders [16, 19, 58, 64, 65]. Furthermore, an exploration of the differences between men and women would be helpful given the variation in societal pressures and perpetrated ideal of the "desirable body" [66, 67].

The weightlifting populations studied in the research included are mainly from the West, suggesting there is little known about weightlifters' mental health across different cultures and demographic groups. This is pertinent because we do not have the data for many of the places in which Olympic Weightlifting is a relatively popular sport, including China and Eastern Europe. We note that studies published in languages other than English may exist but were not captured by the search strategy used.

Alongside cross-sectional data that can be corroborated by clinical records, longitudinal studies that include the transition into the sport and into retirement would be welcomed. A greater understanding of the trajectory of mental health symptoms before, during and after a career as an elite level athlete, is currently lacking. Retirement is an issue that has been studied in elite athletes more generally and which has begun to highlight the unique challenges in this group in terms of transition out of competitive sport and the implications for mental health [45, 68, 69]. These studies could help to inform screening programmes and preventative strategies allowing support staff to intervene before individuals report symptoms of mental illness.

Conclusions

Our systematic review of the literature found very little research on the mental health of elite Olympic Weightlifters with search results suggesting a greater focus on recreational athletes who lift weights or compete in bodybuilding. We cannot therefore confidently make assumptions about the mental health need that this group of elite athletes represent. The studies included suggest levels of self-reported anxiety and to a lesser extent depression, are possibly more common in female weightlifters and those that compete at lower levels [26, 27]. Despite the widespread reporting of the association between doping and weightlifting, there is not the data to facilitate a deeper understanding of what the contributing and consequential mental health factors are in relation to this practice.

Greater education of athletes, coaches and the wider team is needed to help promote a shift in culture, to help break down stigmas and to encourage discussions about mental health, in particular around the use of banned substances. It is hoped that this would be reflected in a greater body of evidence outlining the current mental health needs in this group of elite athletes.

Electronic supplementary materials (ESM)

The electronic supplementary material is available with the online version of the article at https://doi.org/10.1024/2674-0052/a000021.

ESM 1. Search strategies.

ESM 2. JBI checklists.

References

1. Rice SM, Purcell R, De Silva S, Mawren D, McGorry PD, Parker AG. The mental health of elite athletes: A narrative systematic review. Sports Med. 2016;46:1333–53. https://doi.org/10.1007/s40279-016-0492-2
2. Gouttebarge V, Castaldelli-Maia JM, Gorczynski P, Hainline B, Hitchcock ME, Kerkhoffs GM, et al. Occurrence of mental health symptoms and disorders in current and former athletes: a systematic review and meta-analysis. Br J Sports Med. 2019;53:700–6. https://doi.org/10.1136/bjsports-2019-100671
3. Purcell R, Gwyther K, Rice SM. Mental health in elite athletes: Increased awareness requires an early intervention framework to respond to athlete needs. Sports Med – Open. 2019;5. https://doi.org/10.1186/s40798-019-0220-1
4. Rice SM, Gwyther K, Santesteban-Echarri O, Baron D, Gorczynski P, Gouttebarge V, et al. Determinants of anxiety in elite athletes: a systematic review and meta-analysis. Br J Sports Med. 2019;53(11):722–30. https://doi.org/10.1136/bjsports-2019-100620
5. Hammond T, Gialloreto C, Kubas H, Hap Davis H. 4th. The prevalence of failure-based depression among elite athletes. Clin J Sports Med. 2013;23(4):273–7. https://doi.org/10.1097/JSM.0b013e318287b870
6. Frank R, Nixdorf I, Beckmann J. Depression among elite athletes: prevalence and psychological factors. Deut Z Sportmed. 2013;64:320–6. https://doi.org/10.5960/dzsm.2013.088
7. Putukian M. The psychological response to injury in student athletes: a narrative review with a focus on mental health. Br J Sports Med. 2016;50:145–8. https://doi.org/10.1136/bjsports-2015-095586
8. Reardon CL, Hainline B, Aron CM, Baron D, Baum AL, Bindra A, et al. Mental health in elite athletes: International Olympic Committee consensus statement (2019). Br J Sports Med. 2019;53:667–99. https://doi.org/10.1136/bjsports-2019-100715
9. Kolliari-Turner A, Oliver B, Lima G, Mills JP, Wang G, Pitsiladis Y, et al. Doping practices in international weightlifting: analysis of sanctioned athletes/support personnel from 2008 to 2019 and retesting of samples from the 2008 and 2012 Olympic Games. Sports Med – Open. 2021;7(4). https://doi.org/10.1186/s40798-020-00293-4

10. Gronbladh A, Nylander E, Hallberg M. The neurobiology and addiction potential of anabolic androgenic steroids and the effects of growth hormone. Brain Res Bull. 2016;126(1): 127–37. https://doi.org/10.1016/j.brainresbull.2016.05.003
11. Butzke I, Iff S, Zitzmann M, Quednow BB, Claussen MC. Interdisciplinary and psychiatric treatment of anabolic androgenic steroids users. Prax Bern 1994. 2022;111(6):e339–44. https://doi.org/10.1024/1661-8157/a003868
12. Reardon CL, Creado S. Drug abuse in athletes. Subst Abuse Rehabil. 2014;5:95–105. https://doi.org/10.2147/SAR.S53784
13. Kanayama G, Kean J, Hudson JI, Pope HG Jr. Cognitive deficits in long-term anabolic-androgenic steroid users. Drug Alcohol Depend. 2013;130:208–14. https://doi.org/10.1016/j.drugalcdep.2012.11.008
14. Hauger LE, Havnes IA, Jorstad ML, Bjornebekk A. Anabolic androgenic steroids, antisocial personality traits, aggression and violence. Drug Alcohol Depend. 2021;221. https://doi.org/10.1016/j.drugalcdep.2021.108604
15. Olivardia R, Pope HG Jr, Hudson JI. Muscle dysmorphia in male weightlifters: A case-control study. Am J Psychiatry. 2000; 157(8):1291–6. https://doi.org/10.1176/appi.ajp.157.8.1291
16. Hildebrandt T, Schlundt D, Langenbucher J, Chung T. Presence of muscle dysmorphia symptomology among male weightlifters. Compr Psychiatry. 2006;47(2):127–35. https://doi.org/10.1016/j.comppsych.2005.06.001
17. Leone JE, Sedory EJ, Gray KA. Recognition and treatment of muscle dysmorphia and related body image disorders. J Athl Train. 2005;40(4):352–9.
18. Cerea S, Bottesi G, Pacelli QF, Paoli A, Ghisi M. Muscle dysmorphia and its associated psychological features in three groups of recreational athletes. Sci Rep. 2018;8:8877. https://doi.org/10.1038/s41598-018-27176-9
19. Nieuwoudt JE, Zhou S, Coutts RA, Booker R. Symptoms of muscle dysmorphia, body dysmorphic disorder and eating disorders in a nonclinical population of adult male weightlifters in Australia. J Strength Cond Res. 2015;29(5):1406–14. https://doi.org/10.1519/JSC.0000000000000763
20. Ashikaga K, Yoneyama K, Hirayama K, Suzuki T, Muroi R, Inoue R, et al. Medical care provision at the venue of the weightlifting event of the Tokyo 2020 Olympic Games. Sport Sci Health. 2021;19:1–6. https://doi.org/10.1007/s11332-021-00865-1
21. Drew MK, Vlahovich N, Hughes D, Appaneal R, Peterson K, Burke L, et al. A multifactorial evaluation of illness risk factors in athletes preparing for the Summer Olympic Games. J Sci Med Sport. 2017;20(8):745–50. https://doi.org/10.1016/j.jsams.2017.02.010
22. PRISMA. PRISMA 2020 Checklist. Available from: http://www.prisma-statement.org/. [Accessed January 2022].
23. Popay J, Roberts H, Sowden A, Petticrew M, Arai L, Rodgers M, et al. Guidance on the conduct of narrative synthesis in systematic reviews: A product from the ESRC methods programme. Lancaster University; 2006.
24. Joanna Briggs Institute, The University of Adelaide. Critical Appraisal Tools. Available from: https://jbi.global/critical-appraisal-tools. [Accessed January 2022].
25. Ma L-L, Wang Y-Y, Yang Z-H, Huang D, Weng H, Zeng X-T. Methodological quality (risk of bias) assessment tools for primary and secondary medical studies: what are they and which is better? Mil Med Res 2020;7. https://doi.org/10.1186/s40779-020-00238-8
26. Huebner M, Meltzer D, Ma W, Arrow H. The Masters athlete in Olympic weightlifting: Training, lifestyle, health challenges, and gender differences. PLoS One. 2020;15(12):e0243652. https://doi.org/10.1371/journal.pone.0243652
27. Mahoney MJ. Psychological predictors of elite and non-elite performance in Olympic weightlifting. Int J Sport Psychol. 1989;20(1):1–12.
28. Sawant NS, Vispute CD. Mephentermine dependence with induced psychosis. Ger J Psychiatry. 2012;15(2):69–71.
29. Gehlawat P, Singh P, Gupta R, Arya S. Mephentermine dependence with psychosis. Gen Hosp Psychiatry. 2013;35(6):681.e9–10. https://doi.org/10.1016/j.genhosppsych.2013.04.019
30. Drugbank Online. Mephentermine. Available from: https://go.drugbank.com/drugs/DB01365. [Accessed January 2022].
31. Docherty JR. Pharmacology of stimulants prohibited by World Anti-Doping Agency (WADA). Br J Pharmacol. 2008;154(3): 606–22. https://doi.org/10.1038/bjp.2008.124
32. Buros Center. The ninth mental measurements yearbook. Lincoln, NB: Buros Institute of Mental Measurements, University of Nebraska; 1985.
33. McNair D, Lorr M, Dropleman L. Profile of mood states. San Diego, CA: Educational and Industrial Testing Service; 1971.
34. Rosenberg M. Conceiving the self. New York: Basic Books; 1979.
35. Mahoney MJ. The Psychological Skills Inventory for Sports (R-5). 5th ed. Goleta, CA: Health Science Systems; 1988.
36. The Wall Street Journal. Weightlifting on the Rise. 2017. Available from: https://www.wsj.com/articles/u-s-weightlifters-elevate-their-sport-1511368315. [Accessed September 2021].
37. Kotnik B, Tusak M, Topic M. Some psychological traits of Slovenian Olympians (Beijing 2008) – a gender comparison. Kinesiol Slov. 2012;18(2):5–18.
38. Altemus M. Sex differences in depression and anxiety disorders: potential biological determinants. Horm Behav. 2006;50(4): 534–8. https://doi.org/10.1016/j.yhbeh.2006.06.031
39. Bahrami F, Yousefi N. Females are more anxious than males a metacognitive perspective. Iran J Psychiatry Behav Sci. 2011;5(2):83–90.
40. Herrero CP, Jejurikar N, Carter CW. The psychology of the female athlete: How mental health and wellness mediate sports performance, injury and recovery. Ann Jt. 2021;6(38). https://doi.org/10.21037/aoj-20-53
41. Wolanin A, Gross M, Hong E. Depression in athletes: Prevalence and risk factors. Curr Sports Med Rep. 2015;14(1): 56–60. https://doi.org/10.1249/JSR.0000000000000123
42. Pluhar E, McCracken C, Griffith KL, Christino MA, Sugimoto D, Meehan 3rd WP. Team sport athletes may be less likely to suffer anxiety or depression than individual sport athletes. J Sports Sci Med. 2019;18(3):490–6.
43. Schaal K, Tafflet M, Nassif H, Thibault V, Pichard C, Alcotte M, et al. Psychological balance in high level athletes: Gender-based differences and sport-specific patterns. PLoS One. 2011;6(5):e19007. https://doi.org/10.1371/journal.pone.0019007
44. Gulliver A, Griffiths KM, Mackinnon A, Batterham PJ, Stanimirovic R. The mental health of Australian elite athletes. J Sci Med Sport. 2015;18(3):255–61. https://doi.org/10.1016/j.jsams.2014.04.006
45. Gouttebarge V, Frings-Dresen MHW, Sluiter JK. Mental and psychosocial health among current and former professional footballers. Occup Med. 2015;65(3):190–6. https://doi.org/10.1093/occmed/kqu202
46. Wughalter EH, Gondola JC. Mood states of professional female tennis players. Percept Mot Skills. 1991;73(1):187–90. https://doi.org/10.2466/pms.1991.73.1.187
47. McManama O'Brien KH, Rowan M, Willoughby K, Griffith K, Christino MA. Psychological resilience in young female athletes. Int J Environ Res Public Health. 2021;18. https://doi.org/10.3390/ijerph18168668

48. Davis HI, Liotti M, Ngan ET, Woodward TS, Van Snellenberg JX, van Anders SM, et al. fMRI BOLD signal changes in elite swimmers while viewing videos of personal failure. Brain Imaging Behav. 2008;2(2):84–93. https://doi.org/10.1007/s11682-007-9016-x
49. Baillie PHF, Davis HI, Ogilvie BC. Working with elite athletes. In Exploring sport and exercise psychology. 3rd ed. Washington, DC: American Psychological Association; 2014. p. 401–25.
50. Storch EA, Storch JB, Killiany EM, Roberti JW. Self-reported psychopathology in athletes: A comparison of intercollegiate student-athletes and non-athletes. J Sport Behav. 2005;28:86–98.
51. Morgan WP, Johnson RW. Personality characteristics of successful and unsuccessful oarsmen. Int J Sport Psychol. 1978;9(2):119–33.
52. Hanin YL. Iceberg profile. In: Eklund RC, Tenenbaum G, editors. Encyclopedia of sport and exercise psychology. SAGE Publications Inc; 2014. p. 362–6.
53. O'Brien KS, Ali A, Cotter JD, O'Shea RP, Stannard S. Hazardous drinking in New Zealand sportspeople: Level of sporting participation and drinking motives. Alcohol Alcohol. 2007;42(4):376–82. https://doi.org/10.1093/alcalc/agm035
54. O'Brien KS, Blackie J, Hunter JA. Hazardous drinking in elite New Zealand sportspeople. Alcohol Alcohol. 2005;40(3):239–41. https://doi.org/10.1093/alcalc/agh145
55. Dietze PM, Fitzgerald JL, Jenkinson RA. Drinking by professional Australian Football League (AFL) players: Prevalence and correlates of risk. Med J Aust. 2008;189(9):479–83. https://doi.org/10.5694/j.1326-5377.2008.tb02138.x
56. Kanayama G, Pope HG Jr, Cohane G, Hudson JI. Risk factors for anabolic-androgenic steroid use among weightlifters: a case-control study. Drug Alcohol Depend. 2003;71:77–86. https://doi.org/10.1016/S0376-8716(03)00069-3
57. Denham BE. Alcohol and marijuana use among american high school seniors: empirical associations with competitive sports participation. Sociol Sport J. 2011;28(3):362–79. https://doi.org/10.1123/ssj.28.3.362
58. Goldfield GS. Body image, disordered eating and anabolic steroid use in female bodybuilders. Eat Disord. 2009;17(3):200–10. https://doi.org/10.1080/10640260902848485
59. Brennan BP, Kanayama G, Hudson JI, Pope HG Jr. Human growth hormone abuse in male weightlifters. Am J Addict. 2011;20(1):9–13. https://doi.org/10.1111/j.1521-0391.2010.00093.x
60. ProCon.org. Doping cases at the Olympics. 2021. Available from: https://sportsanddrugs.procon.org/doping-cases-at-the-olympics/#sport. [Accessed February 2022].
61. Barnes LT, Patterson LB, Backhouse SH. A systematic review of research into coach perspectives and behaviours regarding doping and anti-doping. Psychol Sport Exerc. 2020;59. https://doi.org/10.1016/j.psychsport.2020.101780
62. Ntoumanis N, Quested E, Patterson LB, Kaffe S, Backhouse SH, Pavlidis G, et al. An intervention to optimise coach-created motivational climates and reduce athlete willingness to dope (CoachMADE): A three-country cluster randomised controlled trial. Br J Sports Med. 2021;55(4):213–9. https://doi.org/10.1136/bjsports-2019-101963
63. Currie A, Blauwet C, Bindra A, Budgett R, Campriani N, Hainline B, et al. Athlete mental health: Future directions. Br J Sports Med. 2021;55(22):1243–4. https://doi.org/10.1136/bjsports-2021-104443
64. Whitehead J, Slater G, Wright H, Martin L, O'Connor H, Lachlan M. Disordered eating behaviours in female physique athletes. Eur J Sport Sci. 2020;20(9):1206–14. https://doi.org/10.1080/17461391.2019.1698659
65. Hale BD, Diehl D, Weaver K, Briggs M. Exercise dependence and muscle dysmorphia in novice and experienced female bodybuilders. J Behav Addict. 2013;2(4):244–8. https://doi.org/10.1556/JBA.2.2013.4.8
66. Swami V. Cultural influences on body size ideals. Eur Psychol. 2015;20(1):44–51. https://doi.org/10.1027/1016-9040/a000150
67. Smolak L. Risk factors in the development of body image, eating problems, and obesity. In: Smolak L, Thompson JK, editors. Body image, eating disorders, and obesity in youth: Assessment, prevention, and treatment. American Psychological Association; 2009. p. 135–55.
68. Wylleman P, Rosier N, De Knop P. Transitional challenges and elite athletes' mental health. In: Baker J, Safai P, Fraser-Thomas J, editors. Health and elite sport. 1st ed. Routledge; 2014.
69. Haslam C, Lam BCP, Yang J, Steffens NK, Haslam SA, Cruwys T, et al. When the final whistle blows: Social identity pathways support mental health and life satisfaction after retirement from competitive sport. Psychol Sport Exerc. 2021;57. https://doi.org/10.1016/j.psychsport.2021.102049

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