Association of Body Dysmorphic–Induced Anabolic-Androgenic Steroid Use With Mental Health Outcomes:

A Systematic Review

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Abstract

Objective: To explore the relationship between body dysmorphic disorder (BDD), anabolic-androgenic steroid use (AAS) use, and mental health outcomes and to identify potential interventions and treatments that may help mitigate these detrimental effects.

Data Sources: PubMed, Scopus, CINAHL, Embase, and PsycINFO were searched from 1992 to 2022 with no language limits. Search terms included "AAS" AND "mental health outcomes" AND "body dysmorphia" and were expanded in PubMed to include "anabolic steroids induced depression," "anabolic steroids induced depression in athletes," "steroids," "mental health," and "performance-enhancing drugs."

Study Selection: Forty-one articles were identified, and 37 remained after duplicates were removed. After full-text appraisal, 33 articles were included in the final review.

Data Extraction: Two reviewers independently screened studies for inclusion criteria, extracted pertinent data, and assessed the quality of evidence.

Results: Bodybuilders and fitness athletes may be more susceptible to developing muscle dysmorphia, having disordered eating habits, and using performance-enhancing drugs like AAS. The COVID-19 pandemic increased reliance on social media and online interactions, which was previously associated with disordered eating patterns and negative body image. Being a member of a sexual minority may increase one's risk of developing muscle dysmorphia and other types of BDD, as these individuals may experience additional stressors and difficulties due to stigma and discrimination, which may worsen one's sense of self and body image.

Conclusion: The development and evaluation of interventions such as cognitive-behavioral therapy, mindfulness-based interventions, and peer support programs, should be prioritized to deter AAS use in people at risk.

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Body dysmorphic disorder (BDD) is characterized by an excessive and distorted preoccupation with 1 or more perceived physical defects or flaws in appearance that are not observable or appear minor to others.[1] This preoccupation can cause significant distress in many facets of an individual's life including social, occupational, or other important areas of functioning.

Individuals with BDD may engage in repetitive behaviors, such as mirror checking, skin picking, or reassurance seeking from others to alleviate their distress.[1,2] BDD is a relatively common disorder that can occur in both males and females and tends to develop in adolescence or early adulthood. Because of this excessive distortion of one's appearance, BDD is often accompanied by other mental health conditions, such as anxiety and depression.[3,4]

Anabolic-androgenic steroids (AAS) are a class of synthetic hormones also referred to as steroids or anabolic steroids. They are derived from the hormone testosterone, which is produced naturally in the human body. Athletes and bodybuilders frequently use AAS to enhance their performance by increasing muscle strength and size, with each steroid class having a different purpose.[5] Unfortunately, the abuse potential of AAS is high, and individuals with BDD may use AAS in an attempt to alter their appearance and alleviate psychological distress stemming from their perceived physical defects or flaws.[6] AAS can have serious negative health effects, including

Clinical Points

- Steroid use is associated with many detrimental effects on mental health, including a higher risk of developing symptoms of psychosis, depression, anxiety, and aggression.
- The COVID-19 pandemic has increased reliance on social media and online interactions, which was previously associated with disordered eating patterns and negative body image.
- Being a member of a sexual minority may increase one's risk of developing muscle dysmorphia and other types of body dysmorphic disorder, as these individuals may experience additional stressors and difficulties due to stigma and discrimination, which may worsen one's sense of self and body image.

but not limited to, liver damage, kidney damage, and an increased risk of heart attack or stroke.[7] Along with the physical organ damage, AAS can also cause psychological effects such as mood swings, aggression, and psychosis.[8] Although obtaining, possessing, distributing, and using AAS is strictly regulated in many countries, it can still be obtained from nonregulated sources in many jurisdictions.

The relationship between BDD, AAS use, and mental health outcomes is complicated and involves multiple factors. While some individuals with BDD may turn to AAS as a means of improving their perceived physical flaws, research has shown that AAS use may worsen mental health issues in individuals with BDD rather than improve them. This may be due to the physical and hormonal changes that occur with AAS use, as well as the psychological effects of the drugs and the intensification of the preoccupation with appearance that is characteristic of BDD.[9] Examination of this relationship is crucial to understand the underlying issues and alleviate detrimental mental health outcomes in those with BDD who are considering using or currently taking AAS.

This systematic review aims to further explore the relationship between BDD, AAS use, and mental health outcomes and to inform potential interventions and future treatments that may help mitigate these negative effects.

METHODS

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[10] reporting guidelines and was registered with PROSPERO International Prospective Register of Systematic Reviews.

Inclusion Criteria

The inclusion criteria included articles published in any language within the last 50 years, but the earliest article utilized in the review was published in 1992. The inclusion criteria were as follows: (1) any article containing primary data on the use of AAS by individuals with BDD and its association with mental health outcomes; (2) examined specific mental health outcomes including depression, anxiety, and BDD symptom severity; (3) comparison measures included the use of other substances and no substance use; (4) publication types included case studies and series, single-arm and double-arm clinical trials, and retrospective analysis; and (5) study participants were diagnosed with BDD and a history of AAS use.

Exclusion Criteria

Exclusion criteria included studies that were not relevant to the topic, of poor quality, and outside the specified time frame. If the study design was unclear from title or abstract review, the full text was then reviewed for eligibility.

Search Strategy

A systematic search of the literature was conducted in accordance with PRISMA guidelines. A comprehensive search was performed using the electronic databases CINAHL, Embase, PsycINFO, PubMed, and Scopus, with a focus on studies published between January 1, 1973, and December 31, 2022. The search strategy employed a combination of Medical Subject Headings and Boolean operators. Search terms were based on key concepts such as "AAS" AND "mental health outcomes" AND "body dysmorphia" and appropriate variants.

Search terms were expanded in PubMed to include "anabolic steroids induced depression," "anabolic steroids induced depression in athletes," "steroids" AND "mental health" AND "body dysmorphia," as well as "body dysmorphia" AND "performance-enhancing drugs" AND "mental health." Additionally, references of included studies were also evaluated for inclusion.

Data Extraction

After completing the initial screening process, eligible studies were further evaluated for data collection. Two reviewers (A.G., H.Z.) independently performed a full-text appraisal and extracted the relevant information into a data sheet. The extracted data focused on the relationship between AAS use and symptoms of BDD. The reviewers also checked the relevance and accuracy of data reporting. The research data reliability and generalizability were also evaluated during this process to ensure the credibility of the extracted data. A standardized data extraction form was used to ensure consistency and completeness of the extracted data, and any discrepancies in the data extraction process were resolved through discussion and consensus between the 2 reviewers. Due to the heterogeneous nature of the studies, risk of bias and quality assessment were not conducted.

The database query identified 41 articles. After removing duplicates, 37 articles remained. After a full-

Figure 1.
Preferred Reporting Items for Systematic Reviews and Meta-Analyses Article Inclusion Flow Sheet

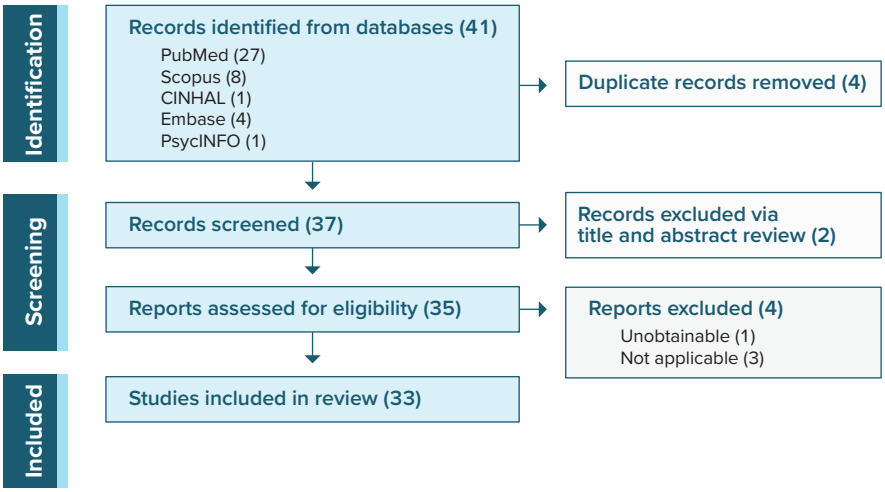
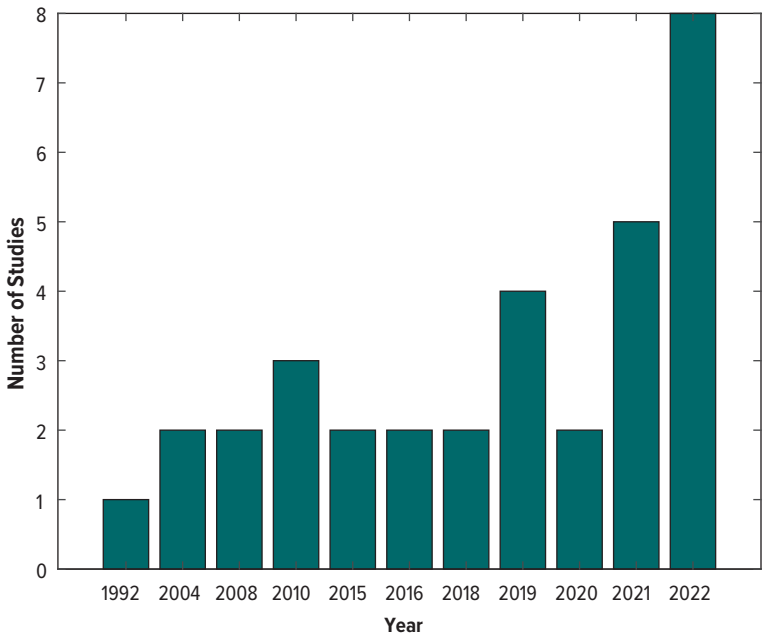


Figure 2.
Number of Included Studies by Year



text appraisal of those articles, 33 were included in the final review (Figure 1). The date of publication of the included studies ranged from 1992 to 2022 (Figure 2).

RESULTS

BDD is characterized by an obsession with alleged physical flaws and affects men and women equally according to prior research.[11] Jenkins and Castle[11] found that individuals with BDD may be more likely to abuse steroids in an effort to enhance their appearance. A study[12] of the effects of COVID-19–related lockdown among bodybuilders and fitness athletes revealed a marked decline in both physical activity and mental health. Financial worries also increased during lockdown, with about 32% depending on their athletic

endeavors for income. They also had high scores on measures of depression, insomnia, and anxiety, which may be due to the loss of the protective effect of physical activity on mental health or the psychological impact of being unable to train. Finally, the study[12] found that individuals at risk for muscle dysmorphia performed worse and scored higher on tests of anxiety, insomnia, and depression compared to those without the disorder.

To address men's health issues and decrease the utilization of AAS as a coping mechanism, understanding the effect that gender socialization has on men's health and behaviors is key. Therefore, lifestyle medicine is a crucial piece of men's health.[13] In addition to the everyday health risk factors, the recent COVID-19 pandemic added another layer of stress, anxiety, and isolation.[14] For a variety of reasons, people with BDD have been negatively impacted by pandemic-related stress.[15,16] To put this issue into perspective, approximately 2.2% of adolescents and 7.4% of adult and adolescent psychiatric inpatients have been found to have BDD.[16] With the increased stress and uncertainty related to COVID-19, people with BDD may use substances or engage in unhealthy behaviors to cope, increasing the risk of developing a substance use disorder and exacerbating BDD.

Furthermore, another factor that may contribute to an increased risk of substance use and BDD during the pandemic is the increased reliance on social media and online interactions. Zaami et al[14] found that the use of social media is linked to an increased risk of negative body image and disordered eating behaviors, and the pandemic has likely led to an even greater reliance on these platforms for social connection and communication.

According to Nagata et al,[17] people who identify as members of sexual minorities may have been especially susceptible to muscle dysmorphia and other types of BDD during the pandemic due to the additional stressors and challenges related to stigma and discrimination. Muscle dysmorphia, disordered eating attitudes, use of performance-enhancing drugs, and problems with body image have all been found to be more prevalent in people who have more sexual partners, are older, and have higher levels of eating concern and impulsivity.[18–21]

In the investigation of other factors, Nagata et al[18] also discovered that having more sexual partners is linked to higher levels of body dysmorphia and muscle dysmorphia in both men and women equally. This finding might be explained by the way in which society's standards for physical and sexual attractiveness affect people's perceptions of their bodies and their self-worth.[18] According to Strübel et al,[19] age is also linked to higher levels of muscle dysmorphia and body image disturbance. Again, this finding can be explained by the idea that maintaining a youthful appearance is valued, and aging can have a negative impact on physical appearance. Additionally, higher levels of impulsivity and eating issues have been linked to muscle dysmorphia and disordered eating attitudes.[20] These characteristics might play a direct role in the development of negative body image and weight management habits.

Hildebrandt et al[21] investigated the factors that may be related to the use of appearance- and performance-enhancing drugs (APEDS) in a group of young males and discovered that APEDS were widely used among this group, with a higher prevalence among those who had a strong desire for more muscle and those who identified as LGBTQ+ individuals. Dietary restriction, binge eating, and vomiting are examples of eating disorder symptoms that were also linked to the use of APEDS. However, when taking the drive for masculinity into account, the link between use of APEDS and eating disorder symptoms vanished, indicating that the drive for muscularity may be a more significant predictor of APEDS use in young males. In comparison to nonusers, participants using APEDS scored higher on measures of drive for muscularity and body appreciation but lower on the drive for leanness. These findings emphasize the significance of understanding the various elements that may lead to muscle dysmorphia, disordered eating behaviors, and other disturbances of body image.[22]

Use of AAS may also increase the risk of developing mood disorders in those with BDD. The independent use of AAS, without a history of BDD, has been associated with a higher risk of depression, mania, and other bipolar disorders. Depression is a possible side effect of using steroids, especially if taken in high doses or for an extended period, which can exacerbate BDD. The signs of steroid-induced depression include, but are not limited to, feeling down or hopeless, losing interest in once enjoyable activities, changing one's appetite or sleep schedule, having trouble concentrating, and feeling guilty or unworthy. The development of mood disorders could be due to the negative effects of AAS on brain chemistry and neurotransmitter activity.[23] This alteration in brain chemistry has the potential to cause substantial changes in mood and emotional state, which may further promote the emergence of mood disorders.

AAS use can also worsen mental health outcomes through the development of other psychotic symptoms. These psychotic symptoms include psychosis, which can present with hallucinations and disorganized thoughts. Again, this symptom development might be induced by the alterations in brain structure and function, especially in regions connected to mood and cognition.[23] In addition to raising the risk of depressive mood and psychotic disorders, AAS can also make users more vulnerable to anxiety and other types of stress. This vulnerability has been hypothesized to be due to effects of AAS on the body's stress response system, as well as potential psychological and social stressors linked to AAS use.[23]

Aside from problems with executive function skills such as working memory, initiation, mental flexibility, inhibition, self-monitoring, and emotional control,

research suggests that anabolic steroid use may be associated with a higher risk of aggression and self-harm.[24,25] For instance, a study by Hauger et al[26] that included 44 participants revealed that 22.7% (10/44) reported an increase in aggressiveness that they blamed on AAS use. The authors[26] found that those dependent on AAS had lower IQ scores and more signs of attention-deficit/hyperactivity disorder (ADHD). ADHD symptoms were significantly positively correlated with self-reported issues with executive function and psychological distress. Thus, per these results, AAS dependence is linked to lower executive function and psychological distress.[26] According to Hauger et al,[27] those who depend on AAS should be screened for mental health issues and given advice on how to reduce their potential risk.

When looking at how AAS mediates aggression, Murray et al[28] suggested that other factors can influence its development, such as antisocial personality disorders and substance abuse. Essentially, the relationship between AAS use and aggression may be mediated by antisocial personality traits and substance abuse,[28] although according to research there are many other prevailing issues with AAS use such as the development of eating disorders, muscle dysmorphia, executive function deficits, affective resilience, depression, suicidal thoughts, cardiovascular and liver problems, decreased serotonin neurotransmission, confusion and delirium, manic or hypomanic episodes, and difficulty recognizing emotion.[28–30] This plethora of detrimental effects is thought to be mediated by the hypothalamic-pituitary-adrenal axis, brain-derived neurotrophic factor levels, and androgen receptor activation.[28] These effects may also be mediated by impaired emotional processing, which may be a symptom of more serious issues such as abnormalities in brain structure and cognition.[31]

During the data extraction process, it became evident that future research on the treatment of anabolic steroid withdrawal depression and other potential side effects associated with the use of these medications is needed. While anabolic steroid withdrawal depression can be treated with antidepressant medications, specifically fluoxetine,[32] future studies should identify better therapies as well as the long-term effects of anabolic steroid use on mental health. To further identify potential preventative measures, it may also be helpful to examine the underlying mechanisms that lead to the emergence of anabolic steroid withdrawal depression and other mental health problems so that the risk factors associated with their use can be prevented. Researchers should concentrate on decreasing anabolic steroid use among young people in particular given the prevalence of peer pressure.

Overall, our research demonstrated that steroid use is associated with many detrimental effects on mental health, including a higher risk of developing symptoms of psychosis, depression, anxiety, and aggression. However, more research is needed to fully understand the mechanisms underlying these effects and to develop preventative and therapeutic approaches for steroid-related mental health issues.

DISCUSSION

According to the findings of this systematic review, bodybuilders and fitness athletes may be more susceptible to developing muscle dysmorphia, having disordered eating habits, and using performance-enhancing drugs like AAS. Also, the COVID-19 pandemic has increased reliance on social media and online interactions, which was previously associated with disordered eating patterns and negative body image. Additionally, being a member of a sexual minority may increase one's risk of developing muscle dysmorphia and other types of BDD, as these individuals may experience additional stressors and difficulties due to stigma and discrimination, which may worsen one's sense of self and body image.

Other factors associated with higher levels of muscle dysmorphia and related behaviors include having a greater number of sexual partners, getting older, and having higher levels of impulsivity and eating concerns. Therefore, it is crucial to continue researching these variables to determine how they might influence the emergence of muscle dysmorphia and the use of AAS and other performance-enhancing substances. It is commonly believed among the general population that AAS can treat muscle dysmorphia or alleviate some of the psychological symptoms; however, AAS can exacerbate the condition. Also, it may have physically harmful effects on the body, including psychiatric disorders, liver damage, and cardiovascular issues.[33,34] Therefore, it is essential for people with muscle dysmorphia to receive treatment such as cognitive-behavioral therapy, which can address the root cause of their condition and provide alternate coping mechanisms that do not involve substance use.

It is also important to acknowledge societal risk factors that can lead to worsening morbidity and mortality, and lifestyle medicine is an essential component in the health of individuals. Specifically, it is important to understand how gender socialization and society's view of masculinity can negatively affect men's health and how protective behaviors can be developed to effectively address men's health issues. Also, many people are now more stressed, anxious, and isolated, especially following the COVID-19 pandemic, which has had a significant effect on mental health. These factors can contribute to an increased risk of substance use and BDD, as people may turn to substances or unhealthy behaviors as a means of coping.

It is important for individuals with BDD to seek out appropriate treatment and support, and these treatments should be widely available. These treatments may entail enlisting the aid of mental health specialists like therapists or psychiatrists as well as engaging in self-help techniques and learning relaxation methods.

Along with individualized treatment plans, larger societal changes are required to address the causes of BDD and related conditions. Therefore, it might be necessary to address the stigma attached to mental health issues as well as societal pressures regarding appearance and body image. The significant impacts that BDD and related conditions can have on a person's relationships and social connections must also be acknowledged. Along with requesting support from friends and family, individuals with BDD should think about joining support groups or looking for other types of social support.

Future research should focus on the complex relationship between BDD and AAS, as well as the reasons for and preconceived notions of AAS use. Further study on the impact of the COVID-19 pandemic on BDD is needed, with a particular focus on identification of aggravating factors like increased stress levels and a greater reliance on social media.

The effectiveness of lifestyle medicine approaches in treating BDD and lowering the use of anabolic steroids among men should be researched in terms of intervention strategies. To gain a deeper understanding of the underlying mechanisms that contribute to the emergence of BDD, it is also critical to investigate the roles that gender socialization and masculinity play in health risk behaviors. Furthermore, the specific stressors and difficulties that members of sexual minorities encounter regarding muscle dysmorphia and BDD should be identified and addressed as a key area of research. The relationship between age and muscle dysmorphia, as well as how societal standards of physical appearance may affect this relationship over time, require longitudinal studies. Lastly, research should concentrate on understanding how physical activity protects mental health as well as how the psychological effects of not being able to exercise may affect mental health.

CONCLUSION

To summarize, several factors may be associated with an increased risk of muscle dysmorphia, disordered eating patterns, and use of performance-enhancing drugs. However, more research is needed to understand what role these factors play and if they could be offset by societal changes. Societal changes should address the negative stigma associated with having more sexual partners, getting older, and having higher levels of eating concerns and impulsivity. The development and evaluation of interventions for people who are at risk, like cognitive-behavioral therapy, mindfulness-based interventions, and peer support programs, should be prioritized to deter AAS use. The efficiency of these various interventions in lowering the risk of these behaviors and enhancing overall health outcomes should be studied over a long period of time, and the associated results should be provided to the public.

Our findings have important implications for practice, policy, and future research. It is important to specifically recommend that people with BDD seek out appropriate care to address the underlying causes of their condition and learn proper coping mechanisms before they turn to unhealthy substances such as AAS. More research is required to better understand the complex relationship between BDD, AAS use, and mental health outcomes. Once this complex relationship is understood, proper interventions can be implemented along with the aforementioned societal changes.

There are limitations that should be considered when interpreting our results, such as the small number of studies that met the inclusion criteria and the likelihood of bias in those that were included, which was most likely due to the strict search strings and the number of databases used. Future systematic reviews should utilize less stringent search strings in a greater variety of databases. In the face of these limitations, a more thorough understanding of the relationship between BDD, AAS use, and mental health outcomes is needed with additional research to replicate and build on the findings of this review.

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