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Depression Following Athletic Retirement in Elite Athletes: A Review of Risk Factors, Neurobiological Mechanisms, and Preventive Strategies

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Abstract

Background: Depression is one of the most common mental disorders worldwide and a significant public health concern. In elite athletes, particular attention has been given to the transition period following career termination, which involves numerous biological, psychological, and social changes that may increase the risk of mood disorders.

Aim: This review aims to present current knowledge on the epidemiology, risk factors, and neurobiological mechanisms of depression following athletic retirement, and to discuss preventive strategies and future research directions.

Material and Methods: This is a narrative review based on an analysis of the available scientific literature on the mental health of elite athletes, with particular emphasis on the post-career period.

Results: Available data indicate that depressive symptoms occur in approximately 15-30% of former athletes, particularly within the first years after career termination. Major risk factors include strong athletic identity, involuntary retirement, lack of alternative career pathways, chronic pain, and repetitive head injuries. Neurobiological mechanisms also play a significant

role, including dysregulation of the HPA axis, neuroinflammatory processes, and alterations in neurotransmitter systems.

Conclusions: Depression following sports career termination is a complex biopsychosocial issue. Effective prevention requires early, systemic, and interdisciplinary approaches that encompass both the active career period and the transition to post-sport life. Further research, particularly prospective studies, is necessary to better understand the underlying mechanisms and to develop effective support strategies.

Keywords: elite athletes, depression, mental health, career transition, athletic retirement

1. Introduction

Depression is one of the most common mental disorders worldwide and represents a major public health concern. Its etiology is multifactorial, involving complex interactions between biological, psychological, and social factors. Clinically, depression is characterized by persistent low mood, anhedonia, and a range of cognitive and somatic symptoms that significantly impair functioning across multiple domains of life.

Regular physical activity is widely recognized as a protective factor for mental health. However, in elite sport, high training loads, performance pressure, and constant external evaluation may act as additional sources of psychological and physiological stress. Accordingly, increasing attention has been directed to the mental health of elite athletes, particularly during critical career transitions such as severe injury, chronic pain, interruptions in competition, and retirement from sport [1-3].

Elite athletes function within highly structured environments that often require long-term commitment and foster the development of an identity strongly centered on the athletic role. As a result, sport frequently becomes not only a professional activity but also a primary source of social status, financial stability, and daily structure [1,3].

Retirement from sport - whether planned or involuntary - may therefore constitute a significant life stressor with multidimensional consequences. The transition to post-career life, commonly referred to as athletic retirement, is now conceptualized as a complex biopsychosocial process rather than a single event. Evidence suggests that this period is associated with an increased

risk of depressive symptoms, emotional distress, anxiety, and reduced quality of life, particularly in the first years following retirement [2].

Despite growing interest in athletes' mental health, depression after sports career termination remains insufficiently understood, particularly in terms of its underlying mechanisms and long-term outcomes. Therefore, increasing emphasis is placed on identifying risk factors, elucidating neurobiological pathways, and developing effective preventive strategies to support athletes during the transition to life after sport [1,3,4].

2. Material and Methods

This study was designed as a narrative review of the literature focusing on mental health outcomes in elite athletes, with particular emphasis on the post-career period. A comprehensive search of available scientific publications was conducted using major electronic database - PubMed.

The search strategy included combinations of the following keywords: "elite athletes," "depression," "mental health," "career transition," and "athletic retirement." Articles published in English were considered. Both original research studies and review articles were included to ensure a broad overview of the topic.

The inclusion criteria comprised studies addressing depressive symptoms, diagnosed depressive disorders, or mental health outcomes in current or former elite athletes, particularly in relation to career termination. Special attention was given to studies exploring risk factors, neurobiological mechanisms, and preventive or intervention strategies.

Studies focusing exclusively on non-elite athletes or unrelated psychiatric conditions were excluded. The selected literature was analyzed qualitatively, with emphasis on identifying recurring themes, methodological approaches, and gaps in current knowledge.

3. Epidemiology

Understanding the epidemiology of depression following the end of a sports career is crucial for identifying high-risk groups and developing effective preventive and intervention strategies. Elite athletes are often perceived as mentally resilient individuals; however, a growing body of evidence suggests that after retirement they may experience depressive symptoms at rates comparable to, and in some subgroups even higher than, those observed in the general population.

According to data from the World Health Organization (WHO), depression is among the most common mental disorders worldwide. It is estimated that approximately 280 million people, or

about 5% of the adult population, experience depression at any given time. Mental health disorders, including depression and anxiety, are among the leading causes of long-term disability and represent a significant global economic and social burden. These data provide an important reference point for assessing the prevalence of depression among elite athletes.

Epidemiological studies involving former professional and Olympic athletes indicate that clinically significant depressive symptoms occur in approximately 15-30% of retired athletes, particularly in the first years following career termination. Meta-analyses of mental health in athletes have shown that the prevalence of mental disorders among active elite athletes ranges from approximately 19% for alcohol misuse to as high as 34% for symptoms of anxiety and depression. In former elite athletes, the prevalence of depressive and anxiety symptoms is estimated at approximately 16–26% [2,5,6].

Some analyses further suggest that former athletes may have up to a twofold increased risk of anxiety and depressive disorders compared to the general population. At the same time, significant variability exists across different sports disciplines. The highest rates of depressive symptoms have been reported among former American football players and jockeys, whereas among former rugby players or cricketers, the prevalence of depression appears to be comparable to that observed in the general population [7,8].

An important factor influencing the risk of depression is the manner in which an athletic career ends. Epidemiological data indicate that forced retirement - particularly due to severe injury, chronic pain, or performance decline - is associated with a significantly higher risk of depressive symptoms compared to planned and gradual transitions into retirement [9,10].

The type of sport also plays a significant role. Athletes participating in contact sports with a high risk of repeated head injuries exhibit a higher prevalence of long-term mood disorders. Recurrent concussions and central nervous system injuries observed, for example, in American football players or boxers, are associated with an increased risk of depression later in life, potentially due to neuroinflammatory and neurodegenerative processes [11-13]**.**

Epidemiological studies also highlight sex differences. Women in the general population have approximately twice the risk of developing depression compared to men, which is attributed to hormonal, social, and genetic factors. Similar trends are observed in the athletic population, although women remain underrepresented in research on athletes' mental health. Available data suggest that former female athletes may experience comparable or slightly higher levels of depressive symptoms, possibly due to greater exposure to psychosocial stressors, including sociocultural pressures, financial instability, and the need to balance multiple social roles [14,15].

Despite the growing number of studies, there remains a lack of high-quality data on the long-term impact of athletic careers on mental health, particularly with regard to women and less popular sports disciplines. Methodological heterogeneity, differences in diagnostic tools, and variability in follow-up periods after retirement make it difficult to draw definitive conclusions about the true scale of the problem. Nevertheless, available epidemiological evidence indicates that depression after retirement represents a significant health challenge among former elite athletes and requires further research, as well as the development of effective preventive strategies and support systems [16,17].

4. Risk factors

Depression following sports career termination is best understood within a biopsychosocial framework, in which psychological vulnerability interacts with biological mechanisms and environmental stressors. Available evidence suggests that depressive disorders in this population result from cumulative exposure to multiple risk factors occurring both during the athletic career and throughout the transition to post-sport life [18].

Psychological factors

One of the most frequently identified predictors of post-career adjustment difficulties is a strong and narrowly defined athletic identity. Elite athletes often construct their self-image largely around their role as athletes, leading to the deep internalization of this role as a central component of personal identity. The sudden loss of this role may result in a sense of loss of meaning in life, decreased self-esteem, difficulties in redefining life goals, and an increase in depressive symptoms. Studies indicate that athletes with a more multidimensional identity - encompassing, for example, educational or professional development outside of sport - demonstrate better adaptation after retirement [19,20].

Perfectionism may further increase vulnerability, particularly when self-worth is closely tied to performance. Lack of an alternative career pathway and forced retirement (e.g., due to injury or chronic pain) are additional risk factors associated with poorer psychological outcomes [18,21].

Biological factors

Biological mechanisms also contribute to the development of depression after career termination. A sudden reduction in physical activity may lead to alterations in mood-regulating systems, including decreased serotonergic and dopaminergic activity, reduced endorphin levels, and lower brain-derived neurotrophic factor (BDNF) concentrations. Dysregulation of the hypothalamic–pituitary–adrenal (HPA) axis may further impair stress responses. Repetitive

head injuries and concussions, common in contact sports, are associated with an increased risk of depressive symptoms, potentially due to neuroinflammation, white matter damage, and neurodegenerative processes. Chronic musculoskeletal pain may additionally contribute through inflammatory pathways, sleep disturbances, and reduced quality of life [22-24].

Social factors

The mental health of former athletes is also influenced by numerous social factors associated with the transition to post-sport life. Elite sport typically provides a highly structured lifestyle, including regular training, medical care, team support, and clearly defined goals. After retirement, athletes often experience a sudden loss of daily structure, which may lead to a sense of disorientation and difficulties in adaptation. [25]

Another factor is the loss of the social environment associated with the team and coaching staff. Reduced contact with teammates and sports personnel may weaken social support networks, which play a crucial role in maintaining psychological well-being. Additionally, some athletes experience a decline in social status and loss of recognition, which may lead to feelings of social marginalization. In many cases, financial uncertainty also emerges, particularly when a sports career has not ensured long-term economic stability [26,27]

The transition to retirement may also be associated with changes in body image and physical performance. Weight gain, decreased physical fitness, or lack of prior experience in recreational physical activity may further negatively impact mental well-being.

Sex differences

The literature also highlights the importance of sex differences in depression risk. Women in the general population have approximately twice the risk of developing depression compared to men, which is attributed to hormonal, social, and genetic factors. Similar trends are observed in the athletic population, although they remain underrepresented in research. Former female athletes may experience additional stressors related to social pressure, the need to balance multiple life roles, and hormonal factors. In some cases, eating disorders, menstrual cycle-related issues, and depression during pregnancy or the postpartum period may also play a significant role [14,15].

5. Neurobiological mechanisms

Numerous studies confirm that both physical and psychological stress increase the likelihood of developing mental disorders through the action of various hormonal and biochemical mechanisms.

Dysregulation of the hypothalamic–pituitary–adrenal (HPA) axis is one of the key biological mechanisms underlying depression. Alterations in HPA axis function are observed in up to 75% of patients diagnosed with major depressive disorder. Prolonged exposure to stress may lead to impaired cortisol regulation. In affected individuals, elevated levels of glucocorticoids are observed in plasma, urine, and cerebrospinal fluid, along with increased volume of the pituitary gland and adrenal glands. Corticosteroids exert detrimental effects on the hippocampus, amygdala, and the functioning of the prefrontal cortex. Following retirement from sport, dysregulation of the stress response may occur, contributing to the development of depressive symptoms [22].

Inflammatory enzymes also play a role in the etiology of depressive disorders, including manganese superoxide dismutase (MnSOD), myeloperoxidase (MPO), and inducible nitric oxide synthase (iNOS). These compounds are involved in inflammatory responses, the production of free radicals, and damage to proteins, lipids, and cellular DNA, ultimately leading to brain injury. Depressive disorders are also associated with pro-inflammatory cytokines, particularly tumor necrosis factor alpha (TNF-α) and interleukins IL-1 and IL-6. Proposed mechanisms by which cytokines contribute to depression include alterations in the metabolism of dopamine, noradrenaline, and serotonin within midbrain nuclei. Additionally, cytokines may lead to excessive cortisol secretion, both directly through stimulation of the HPA axis and indirectly by modifying glucocorticoid receptor sensitivity. Repetitive head injuries and chronic pain may induce a persistent inflammatory state, affecting neurotransmitter metabolism and neuroplasticity [22,23,28].

Among the various neurotransmitter systems influencing psychological functioning, dopamine stands out as a key regulator of motivation, reward processing, and cognitive functions essential for athletic performance. Dopamine regulates numerous physiological and psychological processes, including motivation, reward-seeking behavior, learning, motor control, and executive functions. It is critical for decision-making, stress resilience, and maintaining performance in high-pressure sports environments. After retirement, a reduction in reward-related stimuli may lead to anhedonia and decreased motivation [22].

6. Preventive strategies

Given the multifactorial nature of depression following sports career termination, preventive strategies should be systemic, multilevel, and interdisciplinary, encompassing both the active athletic career period and the transition to post-sport life [29,30].

Evidence suggests that effective prevention should begin during the athletic career. Key components include career transition planning, development of dual career pathways, and ongoing psychological support. Gradual preparation for retirement reduces the risk of identity disruption and facilitates adaptation to new roles. Supporting education or vocational development alongside sport promotes a multidimensional identity, which is associated with better post-retirement outcomes [18,31].

Systematic mental health assessment should be integrated into standard care for athletes approaching retirement and especially during the first 1-3 years after career termination. Regular monitoring of mood, anxiety, sleep, chronic pain, and social functioning is recommended, using standardized screening tools. In athletes with a history of repetitive head injuries, additional cognitive and neurological assessment should be considered. Early identification of subclinical symptoms enables timely intervention [5,32,33].

Sports medicine physicians play a key role in identifying and coordinating care during the transition period. As they are often the first point of contact for former athletes, a high level of clinical vigilance regarding mental health is essential. Management should be interdisciplinary and include collaboration with mental health professionals. Sports organizations should also implement structured transition programs, routine screening, and ensure access to psychological support [29,34].

Reducing stigma associated with mental health disorders in the sports environment is essential to promote help-seeking behavior. With appropriate support and awareness, many athletes can successfully adapt and maintain good mental health after retirement [14].

7. Future directions

Despite the growing number of publications on athletes' mental health, depression following sports career termination remains insufficiently explored. Most available studies are cross-sectional in nature, which limits the ability to establish causal relationships between career termination and the development of depression. An important limitation is the scarcity of data concerning former female athletes. Potential sex differences in biological and psychosocial mechanisms also remain inadequately understood. Furthermore, there is a lack of standardized tools for assessing adaptation after career termination [18,19].

Future research should focus on long-term prospective studies that include both psychological and biological assessments conducted before and after the end of professional athletic careers. Such an approach would enable the identification of early predictors of depression, characterization of trajectories of psychological adaptation, evaluation of the effectiveness of

preventive programs, and identification of high-risk groups. Establishing a uniform definition of career termination and incorporating sex-specific analyses will also be essential for improving the consistency and clinical applicability of future research [18,19,35].

8. Discussion

Depression following sports career termination represents a significant and increasingly recognized challenge in athlete health. The transition from elite sport to post-career life constitutes a critical period associated with heightened vulnerability to mental health disorders, with prevalence rates of depressive symptoms comparable to - or exceeding - those observed in the general population.

The findings of this review support a biopsychosocial model of post-career depression. Psychological factors, particularly a narrowly defined athletic identity and perfectionism, play a key role in post-retirement adjustment. Biological mechanisms, including HPA axis dysregulation, neuroinflammatory processes, and alterations in neurotransmitter systems, provide a plausible link between chronic stress, physical trauma, and mood disturbances. Social determinants, such as the loss of structured routines, social networks, and professional identity, further contribute to psychological distress during this transition [2,5].

Despite growing interest in this topic, the available evidence remains limited. The predominance of cross-sectional studies, methodological heterogeneity, and the underrepresentation of female athletes restrict the generalizability of findings and hinder causal inference. These limitations underscore the need for standardized methodologies and longitudinal research designs.

From a clinical perspective, these findings highlight the importance of early and interdisciplinary preventive strategies. Integrating mental health care into sports medicine, promoting dual career pathways, and ensuring access to psychological support services may improve long-term outcomes. Additionally, reducing stigma within the sports environment remains essential to facilitate help-seeking behavior [1,29].

9. Conclusions

Depression following athletic retirement is a multifactorial condition arising from the interaction of psychological, biological, and social factors. Athletes who retire involuntarily or possess a strongly defined athletic identity appear particularly vulnerable to adverse mental health outcomes.

Effective prevention requires early, interdisciplinary strategies that extend beyond the active career period and support the transition to post-sport life. The implementation of structured support programs and routine mental health monitoring may improve long-term outcomes in this population.

Author Contribution

Conceptualization was carried out by Martyna Iwanowska and Beata Flis. Methodology was developed by Martyna Iwanowska. Software development was performed by Jakub Zalewski. Validation involved Adrian Goss, Bartosz Fronczak, and Maciej Wojewódzki. Formal analysis was conducted by Małgorzata Styczyńska and Alicja Cyrzan. Investigation was performed by Maciej Wojewódzki and Mateusz Ząbek. Resources were provided by Adam Zysk, Bartosz Fronczak, and Adrian Goss. Data curation was handled by Adam Zysk and Mateusz Ząbek. The original draft was written by Beata Flis, while review and editing were undertaken by Martyna Iwanowska. Visualization was prepared by Maciej Wojewódzki and Adam Zysk. Supervision was provided by Beata Flis and Martyna Iwanowska. Project administration was managed by Jakub Zalewski and Alicja Cyrzan.

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