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Review

Effects of Physical Exercise on Substance Use Disorder: A Comprehensive Review

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Abstract: Physical exercise has emerged as a promising complementary intervention for individuals with substance use disorders (SUD). This comprehensive review examines the neurobiological, psychological, and social benefits of exercise in improving quality of life (QOL), mental health, sleep quality, craving, physical fitness, and cognitive function among individuals with SUD. Aerobic exercises, particularly those of moderate intensity, demonstrate a consistent efficacy in reducing anxiety, depression, and cravings, while also enhancing cardiovascular health and psychosocial well-being. Strength training and concurrent programs provide additional benefits for muscular and cognitive function, although their effects on mental health are less consistent. Mind–body disciplines like yoga and Tai Chi offer accessible entry points for individuals with low baseline fitness but exhibit variable outcomes, especially in sleep and craving management. High-intensity interval training (HIIT) shows potential for craving reduction and cardiovascular improvements but may pose challenges for individuals with low initial fitness. This review underscores the importance of tailored, well-structured programs that align with participants' needs and capabilities. Future research should prioritize standardizing protocols, incorporating technological tools, and exploring hybrid intervention models to maximize adherence and therapeutic impact. Physical exercise remains a vital, multifaceted tool in comprehensive SUD rehabilitation strategies.

Keywords: substance addiction; physical exercise; FITT variables; quality of life; mental health; craving

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1. Introduction

Substance use disorder (SUD) represents a global public health issue with significant social and healthcare implications. According to the United Nations Office on Drugs and Crime and the World Health Organization (WHO), approximately 400 million individuals, that is 7% of the global population aged 15 years and older, are affected by alcohol use disorders, with another 209 million suffering from alcohol dependence [1]. Globally, more than 60 million people engage in the use of opioids, with opioid dependence contributing to a significant proportion of drug-related deaths. Stimulant drugs, including cocaine and amphetamines, are used by over 35 million people, presenting challenges related to dependence and associated health complications [2]. The consequences of substance use disorders extend beyond the individual level, placing an enormous burden on healthcare systems, reducing workplace productivity, and affecting the overall social fabric worldwide.

Research indicates a significant relationship between substance dependence, mental health, and quality of life (QOL). Studies have found high prevalence rates of depression, anxiety, and hopelessness among individuals with SUD, which have a negative impact on their QOL [3,4]. These findings highlight the importance of considering psychological factors when assessing and improving the QOL for individuals with chronic conditions, including SUD [5–7].

Traditional therapeutic interventions for SUD have primarily included pharmacological treatments and psychological therapies, both individual and group-based. However, there has been a growing interest in recent decades in incorporating complementary interventions that can enhance the outcomes of conventional treatment [8]. According to the WHO, physical exercise is defined as a subtype of physical activity that is structured, planned, and repetitive. Its application in such interventions has emerged as a promising tool, supported by preliminary scientific evidence suggesting benefits at both neurobiological and psychosocial levels [9–11].

The articles reviewed, published between 2007 and 2024, reveal a growing trend in scientific production concerning the impact of physical exercise in individuals with SUD. In the first years of the analyzed period, the number of publications was limited, but from 2013 onwards, there has been a sustained increase, reaching its peak at the end of this period. This pattern reflects the increasingly consolidated focus on this area, highlighting physical exercise as an innovative and essential strategy in the recovery process for individuals with SUD.

Physical exercise can be divided into several subtypes based on intensity: continuous (characterized by maintaining a constant effort over an extended period of time, typically at moderate intensity), fractionated (with work periods interspersed with short breaks), and interval-based exercise, which combines periods of high intensity with rest or lower-intensity phases, as observed in high-intensity interval training (HIIT) [12]. Exercise programs primarily feature two approaches: (a) "mind–body" disciplines, which integrate physical exercise, mindful breathing, and meditation techniques (such as Yoga, Tai Chi, or Qigong), typically performed at a low intensity; and (b) aerobic programs, ranging from moderate intensity to HIIT, mainly targeting improvements in cardiovascular fitness [12]. Recently, multidisciplinary programs focusing on muscle strength enhancement have gained prominence, employing resistance exercises involving large muscle groups (chest, back, core, and legs) [13–19]. However, these programs often lack methodological homogeneity and consensus, featuring insufficient descriptions and inconsistent management of key variables related to load, such as volume, intensity, frequency, and type of exercise. In the reviewed literature, their prescription is generally based on sets and repetitions [13,15,16] or effort duration [17].

The neurobiological mechanisms underlying the potential efficacy of physical exercise in SUD relate to its ability to modulate neurotransmission systems disrupted by chronic substance use. Regular physical exercise influences the release of neurotransmitters, such as dopamine, serotonin, and noradrenaline [20], which are intimately linked to reward circuits and addiction processes [21]. Moreover, positive effects on neuroplasticity and neurogenesis have been demonstrated, processes that are essential for the recovery of brain alterations induced by substance abuse [21].

From a psychosocial perspective, physical exercise can help reduce anxiety and depression symptoms, which are frequently comorbid in individuals with SUD [22]. Likewise, it can foster the development of adaptive coping strategies, enhance self-efficacy, and facilitate the establishment of healthy habits, aspects that are crucial for the recovery process [23].

Despite these promising findings, the current scientific literature presents certain limitations and heterogeneity regarding intervention protocols, studied populations, and outcome variables. Understanding the available evidence on the effects of physical exercise in individuals with SUD is essential to guide clinical practice and future research in this field.

This comprehensive review aims to synthesize and analyze the available scientific evidence of the effects of physical exercise in individuals with SUD, considering both the underlying neurobiological mechanisms and the observed psychosocial benefits. Unlike previous studies, this review incorporates a unique analysis of exercise program variables—such as type, intensity, frequency, and duration—and their specific impact on various psychological and physical outcomes in SUD. By exploring these dimensions, the study aims to provide a more detailed understanding of the role of structured exercise programs in the rehabilitation process. Additionally, the main gaps in current knowledge will be identified, and future lines of research will be proposed.

2. Methods

This narrative review aimed to systematically explore the existing literature on the impact of physical exercise as a complementary intervention for individuals with substance use disorders (SUDs). Specific inclusion and exclusion criteria were established, and a rigorous selection process was undertaken to ensure a comprehensive and methodologically sound approach.

2.1. Inclusion and Exclusion Criteria

To delineate the scientific literature and ensure the validity of the selected studies, specific inclusion and exclusion criteria were established to guide the selection process.

The inclusion criteria focused on studies that met the following conditions: (a) Participants were individuals over the age of 18 who participated in inpatient and outpatient treatment programs, community-based interventions, or public health initiatives related to substance use disorders (SUDs). (b) The studies addressed disorders involving alcohol, cannabis, methamphetamine, cocaine, heroin, morphine, opioids, and amphetamines. (c) The studies included a control group for comparative analysis. Studies were excluded if they met any of the following conditions: (a) The studies focused on tobacco use rather than substance use disorders. (b) The studies investigated gambling addiction rather than substance use disorders.

2.2. Search Strategy

The literature search was conducted using three major scientific databases: PubMed, Web of Science (WOS), and Embase. The search strategy included studies published up to June 2024 and used a combination of keywords related to substance use disorders (e.g., "addiction", "drug dependence", "alcohol use disorder"), physical exercise modalities (e.g., "aerobic training", "strength training", "yoga", "Tai Chi"), and key outcomes (e.g., "adherence", "craving", "relapse", "depression", "anxiety", "quality of life").

2.3. Selection and Review Process

The selection process adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [24]. Two reviewers independently evaluated the titles and abstracts of all the retrieved records to establish their eligibility. For studies that met the inclusion criteria or where eligibility was unclear, the full-text articles were obtained for further review. Then, the reviewers independently assessed these articles for consistency with the criteria. Any disagreements were resolved through discussion between the reviewers. If consensus could not be reached, a third reviewer was consulted to mediate and finalize the decision. Then, the two reviewers assessed the full-text articles, with doubts being resolved through consultation between each other, a third reviewer was consulted in case of any disagreement. The flow chart of this process can be found in Figure 1. The articles reviewed were published between 2007 and 2024, highlighting a growing trend in scientific production regarding the impact of physical exercise on individuals with substance use disorders. This time frame reflects the increasing recognition of exercise as a complementary intervention for SUD.

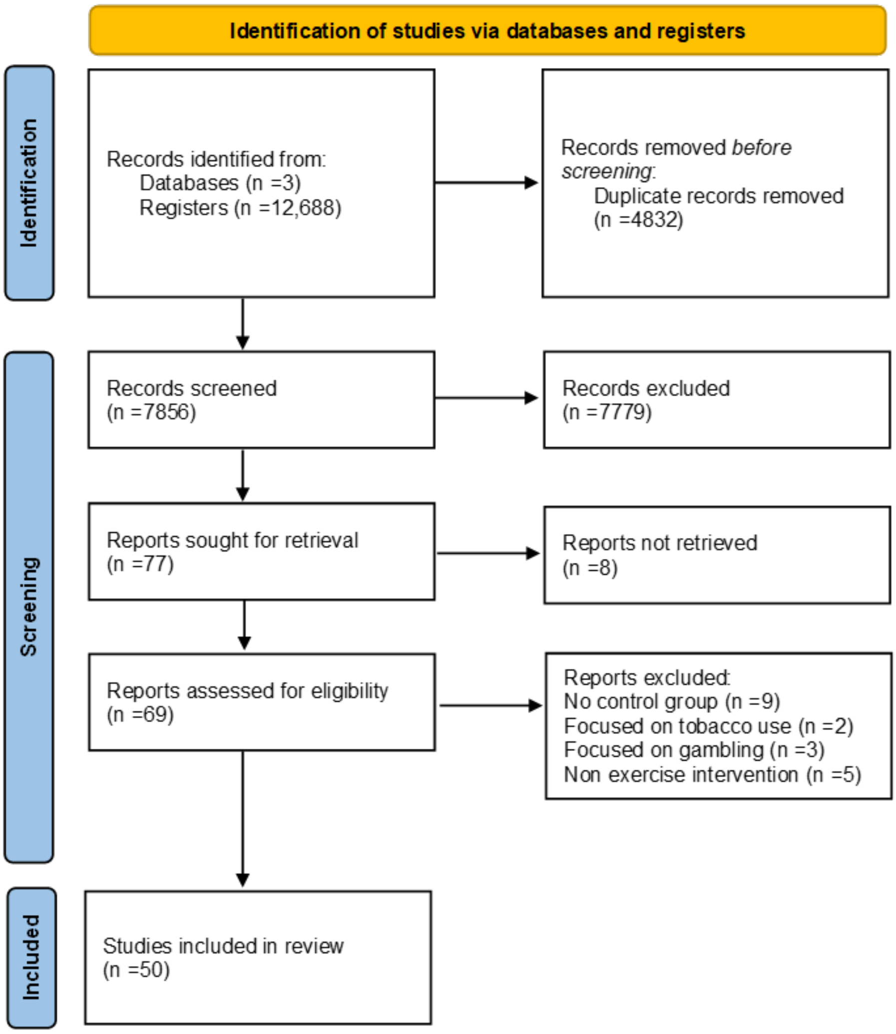

Figure 1. Flow diagram of the different phases of the review process.

2.4. Quality Assessment

The PEDro scale was applied to assess the methodological quality of the included studies [25]. This tool evaluates key methodological aspects, including randomization, allocation concealment, baseline comparability, blinding, and follow-up completion. While the PEDro scores provided insights into the rigor of the studies, no articles were excluded based on their scores. All PEDro scores can be observed in Supplementary Table S1 (see Supplementary Materials).

3. Results

3.1. Assessment and Impact of Physical Exercise on the Quality of Life of Individuals with SUD

Quality of Life (QOL) is a multidimensional construct based on the interaction of physical, emotional, functional, and social components, which generate a sense of well-being and life satisfaction [26]. One of the most commonly used tools to assess QOL in this population is the Short Form-36 Health Survey (SF-36), which evaluates these components across eight dimensions. Among these, mental health-related aspects, specifically depression, anxiety, and stress, are the most studied in this population. Depression is defined as a psychiatric disorder characterized by persistent sadness, loss of interest, and various emotional, cognitive, and physical symptoms [27,28]. Stress, on the other hand, is defined as the inability to cope with external demands, while anxiety refers to a state of agitation in anticipation of a threat [29]. Additionally, sleep quality has recently been included as a variable in studies, demonstrating its relationship with QOL and mental well-being in both healthy populations [30,31] and in individuals with SUD [32].

The SF-36 also has a shortened version [33] consisting of 12 questions (SF-12), which assesses two dimensions out of the eight included in the full version. However, this shorter version has been infrequently used with the target population in the reviewed literature, likely because it provides less information than the full questionnaire. Another tool used to assess QOL in individuals with SUD is the "Quality of Life Scale for Drug Addicts (QOL-DA)", which consists of 40 items measuring four dimensions: physiological, psychological, social, and symptomatic. The QOL-DA is a valid, reliable, and sensitive tool for measuring QOL in opioid-dependent individuals, although recent studies have also applied it to populations with methamphetamine and amphetamine addiction.

In addition to these tools for assessing health-related quality of life, the "Test for the Evaluation of the Quality of Life in Addicts to Psychoactive Substances" (TEQLAPS) is available in Spanish. It consists of 22 items—18 positive and 4 negative—with five response options for each item: nothing, little, sometimes, quite a lot, and a lot [34]. Among all the tools mentioned, the SF-36 is the most widely used tool to analyze QOL in various populations, including individuals with SUD [26,35–38].

Several studies have demonstrated that QOL in individuals affected by SUD is significantly lower than that of healthy individuals, as measured using the SF-36 [39–41]. Similarly, QOL has been negatively correlated with the likelihood of relapse into drug use ($r = -0.59$, $p < 0.01$) [32]. Therefore, improving QOL is a key variable in the rehabilitation process for patients affected by SUD.

In recent years there has been an exponential increase in the number of studies using physical exercise to improve QOL in this population [17,35,42–44]. This prior literature reveals a high heterogeneity in interventions, which include different types of exercise (mind–body, continuous cardiorespiratory, interval cardiorespiratory, strength training), intensities (low, moderate, and high, as presented in Table 1), frequencies (1 to 5 sessions per week), and durations (8 weeks to 12 months).

Table 1. ACSM classification of cardiorespiratory exercise intensity [12].

Intensities	% HR [1]
Low	<63
Moderate	64–76
High	>77

[1] % HR, Percentage of maximal heart rate.

The literature establishes the effectiveness of physical exercise in improving QOL in this population, showing beneficial effects on anxiety, depression, irritability, stress, and withdrawal symptoms. However, no specific type of exercise or intensity has been identified as having a significant effect on all these variables [11,45].

The following section will analyze the impact of physical exercise on each of these dimensions, considering the underlying mechanisms and the current scientific evidence available in the literature.

3.1.1. Assessment and Effects of Physical Exercise on Depression

Mental health issues, particularly depression, are among the most common comorbidities in individuals with SUD. The assessment of this construct is conducted using various scales, such as the Self-Rating Depression Scale (SDS) [46], the Beck Depression Inventory (BDI) [47], the Hamilton Rating Scale for Depression (HRSD) [48], and the depression factor within the Profile of Mood States subscale (POMS) [49]. The most frequently used tool in the reviewed literature is the SDS, particularly for substance-dependent individuals, including those addicted to methamphetamines (33.33% of studies using this questionnaire), amphetamines (33.33%), and alcohol (33.33%). The SDS consists of 20 items, with half scored inversely and the other half directly, so that higher scores indicate more severe depression.

The literature examining the effects of physical exercise on depression is extensive. Previous meta-analyses provide robust evidence supporting the efficacy of physical exercise in reducing symptoms of depression among individuals with SUD, as measured through standardized mean differences (SMD) (SMD = −0.47; z = 2.76; $p < 0.01$/SMD = −0.40; Z = 6.24; $p < 0.01$) [11,45].

Depression and Types of Physical Exercise in Intervention Programs

An analysis of studies that measure depression as a relevant variable in individuals with SUD shows that most studies implement three types of interventions: mind–body exercise (Tai Chi or Yoga) [26,50,51], aerobic exercise (typically at moderate intensity) [43,52,53], or moderate aerobic exercise combined with strength training [18,19,54,55].

Most of the studies that proposed intervention programs using mind–body disciplines did not report significant improvements in depression levels [50,56,57]. However, all the studies indicate that this type of exercise has a greater effect on reducing depression than traditional treatments (psychological therapy and/or pharmacological therapy). A recent systematic review and meta-analysis [45] reported that this type of physical exercise had a greater effect on reducing depression than standard therapy, reinforcing earlier findings. This type of exercise demonstrated a small but significant overall effect (SMD = −0.33; Z = 2.67; $p < 0.01$), as measured using Cohen's scale. A more recent meta-analysis showed greater reductions in depression levels in interventions that employed Tai Chi (SMD = −0.67; Z = −2.47; $p = 0.01$) [22]. This suggests that, when implementing interventions involving this type of physical exercise, Tai Chi may be the preferred discipline.

Regarding studies incorporating interventions aimed at improving cardiovascular and respiratory fitness through aerobic exercise (at 60% to 80% of maximum heart rate (HRmax)) in individuals with SUD affected by depression, significant improvements in depressive states were observed compared to those receiving traditional therapy [43,52,53,55]. Similarly, the most recent meta-analysis reported a large effect size for this type of intervention on depression improvement (SMD = −0.85; Z = −2.51; $p = 0.01$) [22]. Finally, aerobic exercise combined with strength training (15 min per session of resistance exercises targeting large muscle groups) also reported improvements similar to [18,19] or greater than [55] interventions that included continuous aerobic exercise (25 min per session).

Duration, Frequency, and Intensity of Physical Exercise for Reducing Depression in Individuals with SUD

There is significant heterogeneity in the frequency and duration of the interventions analyzed, demonstrating a lack of consensus in the literature regarding the optimal dose of physical exercise required to maximize improvements.

In the studies reviewed [26,35,43,45,54–56,58–60], no clear direct relationship has been found between the frequency and duration of training programs and their effect on depression. However, most programs with a frequency of at least three weekly sessions over durations ranging from 8 to 24 weeks (24 to 120 total sessions) reported significant improvements in reducing depression [26,43,54,58–60]. In the latest meta-analysis, which divided interventions into those lasting more or less than 12 weeks, both durations led to significant reductions in depression. However, the effect size was greater in interventions lasting at least 12 weeks (SMD = −0.83; Z = −2.55; p = 0.01), although the homogeneity criterion was not met (I^2 = 86.9%; $p < 0.01$). The same study found differences in the total number of sessions, with programs involving at least 40 sessions reporting significant reductions and a large effect size (SMD = −0.80; Z = −2.95; $p < 0.01$) [22].

Similarly, moderate-intensity aerobic exercise programs, with frequencies of three weekly sessions over 12 weeks, appear to yield the most significant improvements in depressive states. However, it is worth noting that some studies [53] have achieved improvements in depression (albeit not as substantial) with shorter durations or lower frequencies. This suggests the importance of individualizing physical exercise programs for individuals experiencing this issue, tailoring interventions to their needs, capabilities, and limitations.

Regarding intensity in the recent literature, studies implementing moderate-intensity interventions have spanned between 6 weeks [53] and 12 weeks [43,61], typically involving aerobic exercise. There is a dichotomy in the measurement methods between the SDS and BDI. Significant reductions compared to control groups were observed in five out of six articles examining the relationship between moderate intensity and depression. Similarly, in the latest published systematic review and meta-analysis, moderate-intensity exercise reported a moderate effect on improving depression compared to standard therapy (SMD = −0.64; Z = 5.72; $p < 0.01$) [45].

Other interesting results support physical exercise as a complementary treatment to traditional approaches for managing depression. For instance, Rawson et al. (2015) demonstrated that an 8-week intermittent, moderate-intensity exercise program, consisting of three weekly sessions, was effective in reducing multiple psychological symptoms, including depression, in methamphetamine-addicted patients [19].

Regarding high-intensity programs in the literature focused on depression improvement, only the study by Dürmüş et al. (2020) [62] was identified. This study examined the effects of a high-intensity interval training program on hormonal levels (cortisol, insulin-like growth factor 1, interleukin 17, and interferon gamma) and psychological parameters (HRSD) in opioid-addicted patients. Significant improvements were observed in HRSD scores ($p < 0.01$) compared to the control group after a program lasting just 21 days. In the most recent systematic review and meta-analysis, high-intensity exercise also showed better outcomes in depression improvement compared to standard therapy (SMD = −0.25; Z = 2.51; p = 0.01) [45].

In conclusion, physical exercise is an effective intervention for reducing depression in individuals with SUD. Regarding the optimal type and dose, moderate-intensity aerobic exercise has shown the most significant effects compared to other intensities ($p < 0.05$) [45]. Interventions comprising three weekly sessions over 12 weeks have produced the most consistent results for improving depression, reaffirming its utility as a complement to conventional therapy.

3.1.2. Assessment and Effects of Physical Exercise on Anxiety and Stress

A wide variety of scales and questionnaires (up to eight different ones) have been identified for measuring anxiety. In contrast, only one tool used to assess stress has been found in the literature. The most commonly used questionnaires for measuring anxiety in populations with SUD are the "Self-Rating Anxiety Scale" (SAS) [63], which consists of 20 items (items 2, 5, 6, 11, 12, 14, 16, 17, 18, and 20 are scored inversely, while the remaining items are scored directly), and the "Beck Anxiety Inventory" (BAI) [64], which includes 21 items scored from 0 to 4, with higher scores indicating greater levels of anxiety. The only questionnaire used in the reviewed studies for measuring stress is the "Perceived Stress Scale" (PSS). This tool consists of 14 items and measures how frequently, over the past 30 days, the individual perceived situations as stressful, using a Likert scale in which 0 indicates "never" and 4 indicates "very often". Positive items are scored inversely, and all items are summed up to create a total score [65].

The consequences of addiction often lead to a deterioration in mental health, including symptoms of stress and anxiety linked to prior substance use [66]. This highlights the need for psychological treatment to address these issues and related mental disorders.

Physical exercise has been shown to be effective as part of traditional therapy in improving anxiety and stress in patients with SUD [11,19,43,55,61,67]. Regarding anxiety, the two meta-analyses consulted reported similar effect sizes (SMD = −0.31; Z = −4.11; $p < 0.01$; SMD = −0.33; Z = 4.82; $p < 0.01$) [11,45]. For stress, the latest systematic review and meta-analyses also found a significant reduction (SMD = −0.56; Z = 3.08; $p < 0.01$) [45].

Anxiety has been widely measured due to its relationship with quality of life, as it can be more intense in individuals with SUD, negatively impacting well-being and hindering the recovery process. Anxiety is not only a common symptom, but it is also associated with cravings and a higher likelihood of relapse, among other critical factors in individuals with SUD [68].

Anxiety, Stress, and Types of Physical Exercise in Intervention Programs

In the current literature, the concepts of anxiety and stress are often closely linked across various studies. Furthermore, most studies analyzing the effects of physical exercise on these variables employ "mind–body" methodologies [26,38,51,69–71], particularly Yoga [26,38,51,69,71].

A recent systematic review and meta-analysis showed that Yoga has an almost moderate effect on reducing anxiety in individuals with SUD (SMD = −0.48; Z = 4.17; $p < 0.01$). However, its effects on stress were inconclusive, possibly due to the inclusion of only two studies in this analysis (SMD = −0.61; Z = 1.79; $p = 0.07$), making it difficult to draw definitive conclusions [45]. Nevertheless, other studies have reported significant reductions in both anxiety [69,71] and stress [26,38] in this population following Yoga practice. Conversely, one study focusing on individuals with methamphetamine addiction found significant improvements in stress ($p = 0.026$) but not in anxiety when comparing a Yoga program to standard treatment [72]. Thus, interventions employing mind–body therapies have demonstrated a favorable effect on reducing anxiety and stress. However, further research, particularly regarding their effects on stress, is necessary to determine their superiority over standard therapy.

One study compared the effects of various types of exercise (continuous aerobic and Yoga) with standard therapy on levels of depression and anxiety, as measured using the Hospital Anxiety and Depression Scale (HADS). Within the anxiety subscale, both standard therapy and Yoga showed significant pre- to post-intervention reductions. While Yoga achieved greater significance in its results ($p < 0.01$) and effect size (g = 0.88), this reduction in anxiety levels was not found to be significantly greater than that of standard therapy ($p = 0.09$) [71].

The observed benefits of mind–body disciplines for individuals with SUD may stem from their focus on meditation, connection, and the balance between body and mind. These practices emphasize breathing combined with movement techniques, potentially contributing to reduced heart rate and blood pressure (BP). This, in turn, activates the parasympathetic branch of the autonomic nervous system, inducing a reduction in anxiety or stress levels [73,74].

Regarding aerobic exercise, the most recent meta-analysis reported a moderate effect on anxiety reduction compared to standard therapy (SMD = −0.73; Z = −2.29; $p < 0.05$), although it showed a non-normal distribution [22]. Another study, which implemented a moderate-intensity aerobic exercise program (65–75% of maximum heart rate (HRmax)), found significant reductions in anxiety levels compared to the control group ($F(1,29) = 59.59$, $p < 0.01$, $\eta^2 = 0.67$), as well as pre-intervention values ($F(1,29) = 72.38$, $p < 0.01$, $\eta^2 = 0.71$), as measured using the Self-Rating Anxiety Scale (SAS) [43].

Similarly, in other studies, such as Ellingsen et al. (2023) [67], aerobic exercise demonstrated an acute effect in reducing anxiety levels significantly. These reductions were measured by one, two, and four hours post-exercise using a visual analog scale (VAS), where 0 indicates no anxiety and 10 indicates extreme panic. However, results were inconsistent in mid-term interventions (lasting 6 to 12 weeks) [43,53,71], with only one study reporting reductions in anxiety levels following a 12-week aerobic exercise program [43]. Another study implementing an aerobic exercise program [53], specifically on a treadmill, noted that the assumption of normality was not met. The intervention group did not achieve significant reductions in anxiety ($p = 0.81$; r = 0.06), although reductions in stress were significant (M = −5.60 [−8.47, −2.79]; $p < 0.01$; $\eta^2 = 0.48$).

Additionally, combining cardiovascular training with strength exercises has demonstrated significant effects in reducing anxiety [13,16,19], even with shorter durations (8 weeks) compared to aerobic exercise programs.

Duration, Frequency, and Intensity of Physical Exercise for Reducing Anxiety and Stress in Individuals with SUD.

Regarding the duration and frequency of programs, session durations typically range from 60 to 90 min, with a frequency of 3 to 5 sessions per week and lasting from 8 to 24 weeks in total.

In the reviewed interventions, those with a minimum frequency of three weekly sessions lasting one hour and a total duration of at least 12 weeks showed the most consistent results in reducing anxiety and stress compared to standard therapy [26,43,50,70–72]. These effects were similar to those observed in previously mentioned interventions [19,38,51,54,75]. Studies that only met one of these conditions [19,38,51,53,70,72,75] showed a greater variability in results. Only two studies fulfilling either a program duration of 24 weeks of moderate-intensity aerobic exercise or a minimum weekly frequency of three sessions combining aerobic and strength exercises reported significant reductions in anxiety levels [70,75].

In contrast, the most recent meta-analysis [22], which did not differentiate between activity types, found no significant reductions in anxiety levels as a result of interventions. However, longer-duration interventions showed a larger effect size (SMD = −1.30; Z = −1.94; $p = 0.05$). Interestingly, interventions with fewer than 40 total sessions (SMD = −0.49; Z = −2.93; $p < 0.01$) and sessions lasting less than one hour (SMD = −0.70; Z = −4.07; $p < 0.01$) were associated with significant benefits for anxiety reduction.

A current systematic review and meta-analysis [45] focusing on the effects of different exercise intensities in SUD populations reported that moderate-intensity cardiovascular programs produced a moderate effect on reducing anxiety levels (SMD = −0.58; Z = 4.24; $p < 0.01$), though no significant effect was observed for stress reduction (SMD = −0.33;

Z = 1.56; $p = 0.12$). In contrast, high-intensity aerobic programs did not reduce anxiety levels (SMD = −0.03; Z = 0.28; $p = 0.78$), but they did show a large effect size in reducing stress (SMD = −1.13; Z = 2.04; $p < 0.05$). It is worth noting that the high-intensity programs in this meta-analysis were calculated based on 60–85% of heart rate reserve, a range that in most cases falls below the optimal thresholds for inducing adaptations and being classified as high intensity.

This result should be interpreted cautiously due to the wide confidence interval, indicating substantial uncertainty about the effect of this type of exercise on stress reduction (95% CI = −2.22, −0.04) [45]. Conversely, the only study identified as genuinely high-intensity demonstrated significant anxiety reductions compared to the control group following a 21-day HIIT program (five total sessions), as measured by the Hamilton Anxiety Rating Scale (HAM-A) [62].

Finally, although anxiety and stress are related concepts in the literature, the effects of physical exercise on these dimensions in individuals with SUD are inconsistent. Regarding anxiety reduction, moderate-intensity cardiovascular exercise has shown the most significant results in the reviewed literature. However, more research is needed on concurrent strength and aerobic training, which may prove to be an optimal combination. Interventions lasting at least 12 weeks are necessary to explore these effects further. Similarly, the impact of physical exercise on stress in individuals with SUD requires more investigation, particularly the potential of high-intensity exercise, which could be the most promising approach.

The following table (Table 2) summarizes the most effective exercise modalities identified in the literature for each quality of life domain, highlighting their potential benefits in rehabilitation programs.

Table 2. Quality of life dimensions and optimal exercise modalities.

Dimension	Type of Exercise
Depression	Aerobic, Tai Chi, and combined programs
	Aerobic, Yoga, and Tai Chi
Anxiety	
Stress	HIIT [1] and Mind–body

[1] HIIT: High Intensity Interval Training.

In summary, physical exercise is an effective strategy for improving the quality of life in individuals with SUD, with positive effects on dimensions such as depression, anxiety, and stress. Although the optimal type, intensity, and duration of exercise have not been fully defined, studies suggest that moderate-intensity aerobic exercise programs lasting a minimum of 12 weeks tend to yield significant improvements. However, it may be possible to reduce the number of weeks provided the weekly session frequency increases to a maximum of 40 total sessions. Nevertheless, the heterogeneity of interventions complicates the establishment of clear consensus. Mind–body disciplines and concurrent exercise have also shown positive effects in specific areas, albeit with less consistency. Individualizing interventions to meet the needs and capabilities of this population is crucial for maximizing benefits. Despite advances, further research is required to explore standardized protocols and evaluate specific mechanisms underlying the improvements observed in QOL.

3.2. Assessment and Effects of Physical Exercise on Sleep Quality

Substance abuse causes sleep disturbances, affecting latency (the period of time between lying down and attempting to sleep and the moment when sleep actually begins), maintenance (the ability to continue sleeping without frequent awakenings during the night), and quality (a concept encompassing factors such as latency and maintenance). The Pittsburgh Sleep Quality Index (PSQI) is a widely used and validated questionnaire for measuring the subjective perception of sleep quality, with robust psychometric properties, including internal consistency and reliability [76,77]. The PSQI evaluates seven components: subjective sleep quality, quantity, latency, duration, efficiency, disturbances, use of medication, and daytime dysfunction [50]. The total score ranges from 0, indicating ease of sleeping, to 21, indicating severe difficulty across all areas [77].

Generally, the SUD population exhibits poor sleep quality scores (global PSQI score > 5) [42,43,50]. Improvements in the aspects that comprise sleep quality are associated with better physical and mental recovery [78–80]. Similarly to QOL, there is an inverse association between sleep quality and cravings for substances, including tobacco and alcohol [81]. Sleep deprivation increases the sensation of pain, negative thoughts, cognitive impairment, and lack of willpower [82–85].

3.2.1. Sleep Quality and Types of Physical Exercise in Individuals with SUD

Among the extensive range of studies employing physical exercise programs to improve the quality of life in individuals with SUD, sleep quality remains one of the least studied variables. No analyses or reviews have been found examining the impact of physical exercise on sleep quality specifically in this population. A systematic review and network meta-analysis focusing on older adults found better sleep quality in groups combining moderate-intensity exercise (walking) with muscle endurance exercises [86].

Interventions employing mind–body disciplines are those that most frequently consider this variable, reporting significant reductions in sympathetic activity and sympathoadrenal reactivity, which in turn facilitate parasympathetic system activation and reduce sleep disturbances [87]. In individuals with SUD, studies employing mind–body disciplines report heterogeneous results regarding sleep quality. Some studies concluded that these interventions did not lead to improvements compared to standard treatments [57,72]. Similarly, those studies that did find significant improvements in certain scores failed to show consistent effects across different components of the PSQI. Improvements were often limited to components such as daytime dysfunction and total PSQI scores [32,35,50]. This lack of consensus suggests that the effects of mind–body interventions on sleep quality may not be as pronounced and may not represent the optimal strategy for improving sleep. This variability could be attributed to the wide variety of programs encompassed under the term "mind–body". For example, programs involving Qigong and Tai Chi have shown significant reductions in PSQI scores, indicating improvements in sleep quality ($p < 0.01$; $p < 0.01$) [35,50]. However, these effects were not replicated in other interventions involving disciplines like Chan-Chuang [57] or Yoga [72].

The literature on the effects of aerobic exercise on sleep quality is limited. In the two studies identified, the analyses focused only on the effect of aerobic exercise programs on total PSQI scores. In both interventions, aerobic training programs led to significant improvements in sleep quality compared to standard therapy ($p < 0.01$) [42,43].

The number of studies comparing aerobic exercise interventions with mind–body programs is limited to one [35]. This study reported that, while aerobic exercise was effective in improving various sleep components, such as general sleep quality ($p < 0.01$), latency ($p < 0.05$), total sleep duration ($p < 0.01$), efficiency ($p < 0.01$), and total PSQI score ($p < 0.01$), Qigong produced superior improvements in scores related to latency ($p < 0.01$), sleep disturbances ($p < 0.01$), and daytime dysfunction ($p < 0.01$) compared to directed aerobic activities [35].

3.2.2. Frequency, Duration, and Intensity of Physical Exercise in Individuals with SUD for Improving Sleep Quality

Among the protocols designed to improve sleep quality, programs typically range from a minimum duration of three months to a maximum of eight months, with exercise frequencies of three to five sessions per week. Regarding the optimal exercise intensity for improving sleep quality, the available evidence remains limited.

For moderate-intensity exercise, only one study has examined its effect on sleep quality in individuals with SUD. In this study, the experimental group followed a 12-week exercise program consisting of five weekly sessions of one hour each, including activities such as cycling, jogging, and calisthenics at intensities of 70–75% HRmax. The training program resulted in significant reductions ($F = 12.88$; $p < 0.01$; $\eta^2 = 0.31$) in global PSQI scores compared to the group receiving standard therapy [43].

Similarly, the effects of high-intensity exercise programs on sleep quality in individuals with SUD are also limited. Only one study has investigated this aspect to date [42]. This study implemented an eight-month intervention with four weekly sessions of one hour each, performed at a high intensity (76–96% HRmax). The experimental group showed a reduction in global PSQI scores at both four and eight months of intervention compared to the control group ($p < 0.01$) [42].

These findings suggest that moderate-intensity aerobic exercise may be beneficial for improving overall sleep quality in patients with SUD. Low-intensity exercise may not provide sufficient stimulus to induce fatigue, while high-intensity exercise may impose excessive demands on individuals with SUD, particularly those with a sedentary baseline, unless they have prior experience with lower-intensity aerobic programs. However, the lack of comparative studies highlights the need for further research to establish definitive recommendations on the optimal duration, frequency, and intensity of exercise for improving sleep quality. Developing accessible, sustainable, and tailored interventions for this population is essential to maximize the impact on sleep quality.

3.3. Assessment and Impact of Physical Exercise on Cravings in Individuals with SUD

Craving is defined as an intense and irresistible desire to consume drugs, which can occur at any time [88]. It represents one of the main challenges in rehabilitating individuals with SUD and can be triggered by factors such as stress or exposure to environments or situations associated with prior substance use, complicating the ability to prevent relapse [89].

Currently, many types of treatments are employed to reduce cravings and prevent relapses in individuals with SUD. The most common are pharmacological or psychotherapeutic treatments [90]. However, scientific evidence accumulated over the past decade suggests that physical exercise can serve as a valuable therapeutic tool complementing these approaches, effectively reducing both craving and substance use relapses [37,42,61,72,91]. The heterogeneity in the substances studied in the literature is vast. Some articles focus on a single substance, which can vary widely, such as opioids [53], methamphetamine [42,92] (the most commonly studied substance), or alcohol [93]. On the other hand, some references involve heterogeneous samples as some individuals were addicted to multiple or different substances [85,94–97].

Over the past eight years, the literature has employed various methods to measure cravings. While both qualitative and quantitative methods have been used [54], quantitative methods predominate in almost all the reviewed studies. Among these, the visual analog scale (VAS) is particularly prominent [98]. The VAS is a straight line divided into 100 mm with a scale comprising 11 craving levels, in which 0 indicates no craving and 10 indicates maximum craving. Another less commonly used quantitative method is the use of questionnaires or scales, such as the Craving Questionnaires-Short Forms [53] or the Substance Craving Scale (SCS) [62].

Different scales are also used depending on the substance. For example, the Amphetamine Craving Scale [70] or the Craving Automated Scale for Alcohol [99]. However, the VAS is the most frequently utilized method in the recent literature.

The use of physical exercise programs to reduce withdrawal symptoms has seen significant growth in the scientific literature, becoming one of the most studied variables. Meta-analyses provide clear evidence of the effects of physical exercise on this issue [37,43,51], showing significant reductions in the withdrawal syndrome (SMD = −0.43; Z = 4.31; $p < 0.01$) and relapse rates (Odds Ratio = 1.69; Z = 6.33; $p < 0.01$) when exercise programs are used as treatment compared to standard therapy [11,45].

3.3.1. Craving and Types of Physical Exercise in Intervention Programs

Various studies have analyzed the impact of exercise type on the desire to consume substances, identifying three main comparisons between modalities [37,51,57]. One study evaluated the "Chan-Chuang" modality (combining mindfulness, isometric exercises, and strength training) [57]. Another one compared moderate-intensity aerobic exercise with strength training [51]. A third one investigated the difference between low-intensity aerobic exercise, such as walking, and moderate-intensity aerobic exercise, such as treadmill running [37].

In the literature, aerobic interventions are the most frequently employed for reducing cravings in individuals with SUD [45]. These include activities such as cycling, outdoor running, treadmill running, walking, and dancing. Aerobic exercises are the most common due to their simplicity and accessibility, requiring minimal equipment and being feasible in rehabilitation centers, gyms, or supervised sessions without advanced technical demands (e.g., strength-based programs). Moreover, group aerobic exercises provide physical and social benefits. Group settings promote social interaction, improve psychological factors, and enhance treatment adherence, all of which are crucial for recovery.

Evidence suggests that aerobic-based interventions are more effective than mind–body exercises (e.g., Yoga, Qigong, Tai Chi) in reducing craving levels [92,97,100]. This effect may be related to the release of neurotransmitters, such as dopamine and endorphins, which are not as strongly stimulated by mind–body exercises [101]. The effectiveness of mind–body therapies in individuals with SUD remains unclear in the current literature due to inconsistent results. Only two out of the four studies using mind–body therapies reported significant reductions in craving scores compared to control groups. In one study, the Tai Chi group demonstrated a significantly greater reduction than the control group ($p < 0.05$), with differences observed at three and six months post-intervention ($p = 0.01$; $p < 0.05$) [70]. Another study using Tai Chi reported significant improvements in cravings in both the standard therapy and the Tai Chi groups, with greater improvements in the latter ($p < 0.05$) [94]. However, the latest meta-analysis did not support mind–body therapies, finding no significant differences compared to standard therapy (SMD = −0.33; Z = 1.76; $p = 0.08$) [45].

Mind–body programs show considerable variability in their techniques (e.g., Yoga, Tai Chi, Qigong, Chan-Chuang), which often combine breathing, meditation, and mental focus to promote physical and mental well-being. While they may benefit individuals with low physical activity levels, they likely fail to meet the minimum physical demands necessary to induce the biophysiological responses required to reduce cravings in SUD populations. This raises questions about their suitability as effective physical exercise interventions for this issue.

Programs focusing on muscle strength development are typically not standalone interventions but are combined with aerobic exercises [15,44,54,55,75]. Two distinct concurrent exercise program structures are noted: sequential programs (aerobic training followed by strength training) [55] and simultaneous or combined approaches [102]. In one study by Giménez-Meseguer et al. (2015) [37], a 12-week program focused on improving muscular endurance and aerobic capacity. Qualitative analyses (interviews) supported incorporating physical exercise into SUD rehabilitation programs, achieving significant improvements in parameters such as quality of life across various dimensions, including physical functioning ($F(1,35) = 8.72$; $p < 0.01$; ES = 0.20), general health ($F(1,35) = 4.16$; $p < 0.05$; ES = 0.10), vitality ($F(1,35) = 17.00$; $p < 0.01$; ES = 0.33), social functioning ($F(1,35) = 15.74$; $p < 0.01$; ES = 0.31), and mental health ($F(1,35) = 14.74$; $p < 0.01$; ES = 0.30) compared to the control group.

In summary, aerobic exercises, such as running or cycling, are the most widely used and effective exercises for reducing cravings in individuals with SUD due to their accessibility and social interaction benefits. While mind–body practices (e.g., Yoga, Tai Chi) show potential, their effectiveness is less consistent in the literature, with only high-frequency or long-duration programs achieving significant reductions. Strength training is typically employed as a complementary intervention and has less impact on craving.

3.3.2. Craving and Duration, Frequency, and Intensity of Intervention Programs.

The duration and frequency of exercise are key variables in reducing cravings, as evidence suggests that programs lasting 8 to 12 weeks, with three to five 60 min sessions per week, are the most effective programs for significantly reducing cravings in individuals with SUD [13,15,70,92,100]. In these studies, regular and consistent sessions allow participants to experience stable improvements in cravings, with significant reductions observed after a minimum of eight weeks.

Conversely, interventions lasting less than eight weeks or with fewer than three weekly sessions tend to show limited or non-significant effects. This may be because changing craving behaviors requires continuous exposure to exercise to establish an effective habit. Programs lasting 12 weeks or more [55,70,92,94,100] offer more durable results, indicating that longer interventions with higher weekly frequencies are more likely to maintain stable reductions in cravings.

Moderate-intensity exercise (e.g., running or cycling) is particularly beneficial and is the most commonly used method [13,52,55,61,92,97,100]. It is sufficiently demanding to engage participants effectively without causing excessive fatigue, thereby supporting program adherence. In the latest meta-analysis, moderate-intensity exercise showed greater reductions in cravings than standard therapy, though with a small overall effect size (SMD = −0.30; Z = 2.33; $p = 0.01$) [45].

Only three studies focused on the effects of high-intensity programs, showing substantial heterogeneity, with durations ranging from 21 days [62] to 32 weeks [42]. Two of these studies used the VAS. Chen et al. (2021) [92] compared moderate- and high-intensity exercise over a 12-week intervention, finding significant pre-post craving reductions only in the high-intensity group. Similarly, the latest meta-analysis reported that high-intensity exercise showed the greatest reductions in cravings, with a large effect size (SMD = −1.33; Z = 4.58; $p < 0.01$) [45].

These findings suggest that high-intensity exercise may be the most effective for reducing cravings, though moderate-intensity exercise also shows potential. However, the physical demands of high-intensity exercise may not be suitable for individuals with low or no prior physical activity. From that perspective, it may be advisable to initiate moderate-intensity exercise programs and gradually increase intensity over the course of several weeks. This progressive approach allows individuals to adapt physically and psychologically to the demands of exercise, reducing the risk of dropout due to fatigue or injury while promoting long-term adherence.

The evidence indicates that physical exercise is an effective and complementary tool for reducing cravings in individuals with SUD, outperforming traditional interventions. Aerobic programs stand out for their accessibility, effectiveness, and potential to foster social interaction, while mind–body therapies show inconsistent results due to their lower physical intensity. Nevertheless, the positive effects of intensive programs within these therapies warrant further exploration. High-intensity and concurrent (aerobic and strength) programs appear promising, though their applicability is limited for individuals with low initial physical fitness. This underscores the importance of designing interventions tailored to the participants' initial capabilities and contexts, optimizing their therapeutic impact.

3.4. Assessment and Impact of Physical Exercise on Physical Fitness and Cognitive Function in Individuals with SUD

A wide spectrum of variables related to fitness has been analyzed in this population, including anthropometric measurements, cardiovascular indicators, body mass index (BMI), neuromuscular factors, balance, and flexibility, among others [43,57,103]. Regarding physical fitness, the literature suggests that regular physical exercise programs, especially those incorporating aerobic and strength activities, contribute to improvements in endurance, muscular strength, and cardiovascular capacity in individuals recovering from SUD [43,54].

These benefits are particularly significant as many individuals with SUD experience deteriorated physical fitness due to prolonged substance use, which can affect both cardiovascular health and general strength and endurance. Additionally, individuals with SUD often exhibit high levels of sedentary behavior, making improvements in physical fitness more pronounced.

Cardiovascular variables studied in the reviewed literature include resting heart rate (RHR), blood pressure, and maximal oxygen uptake (VO_2max). These are key indicators of both cardiovascular and overall health [104].

Regarding RHR, lower values (below 60 bpm) are associated with better cardiovascular health and greater life expectancy [105]. Significant reductions in RHR have been observed in most studies analyzing individuals with SUD following physical exercise programs [42,43,57,97].

VO_2max is an indicator of the body's ability to supply oxygen to active muscles and is considered a strong predictor of longevity [106,107]. Among male SUD populations aged around 30, VO_2max values range from 29 to 36.5 $mL \cdot kg^{-1} \cdot min^{-1}$, which is below the average for the general population [42,106–108]. Physical exercise is key to increasing this variable, with studies reporting its effectiveness in SUD populations [42,108].

For blood pressure, favorable reductions have been observed in SUD populations [42,57,109]. Some articles differentiate between systolic blood pressure (SBP; pressure in the arteries during heart contraction) and diastolic blood pressure (DBP; pressure when the heart is at rest between beats). SUD populations tend to exhibit average values within the normal range (120–125 mmHg for SBP and <80 mmHg for DBP) [57,109].

Several studies have analyzed the effects of physical exercise on heart rate variability (HRV) in individuals with SUD, using both time-domain and frequency-domain measures [73,108–110]. In the time domain, variables such as SDNN (standard deviation of NN intervals) and RMSSD (root mean square of successive differences between NN intervals) are frequently evaluated. Higher values of these variables are associated with better cardiovascular health and parasympathetic activity, respectively. Frequency-domain variables include LFn (low-frequency component influenced by sympathetic nervous system activity) and HFn (high-frequency component reflecting parasympathetic activity). SUD populations exhibit an impaired HRV compared to the general population, with lower SDNN, RMSSD, and HF values and higher LF values ($p < 0.01$) [108].

Physical exercise programs have demonstrated significant improvements in HRV variables in SUD populations. Interventions resulted in significant increases in SDNN ($p < 0.01$), RMSSD ($p < 0.01$), and HF ($p < 0.01$), along with significant reductions in LF ($p < 0.01$) compared to control groups [108,109].

Numerous studies support the notion that regular physical exercise can improve key aspects of cognitive function, including memory, attention, and executive control, all of which are frequently impaired in individuals with SUD [111,112]. Cognitive function is often assessed using tasks such as the Go/NoGo task (evaluating inhibitory control and reaction time) [113], the Stroop test (measuring inhibitory control and reaction time) [114], and the N-back test for working memory [115].

Physical activities requiring coordination, concentration, and sustained effort appear to influence cognitive function positively, enhancing essential daily life skills and decision-making abilities, which are crucial in the recovery context [111].

These findings underscore the effectiveness of exercise as a tool for promoting cardiovascular health and recovery.

3.4.1. Physical Fitness, Cognitive Function, and Types of Physical Exercise in Intervention Programs

Intervention programs aimed at improving physical fitness and cognitive function in individuals with SUD have incorporated various types of physical exercise. These include aerobic exercise programs [43,61] combined with aerobic and strength exercises [54,102] and the previously mentioned mind–body programs[50,57,103].

For RHR in SUD populations, interventions have employed aerobic treadmill programs [97], HIIT workouts [42], aerobic exercises combined with static stretching [43], and programs combining aerobic and strength exercises [108].

Significant increases in VO_2max have been reported in several studies [42,109]. In one study [42], participants engaged in a high-intensity interval training (HIIT) program incorporating strength exercises and recreational games like basketball, resulting in a significant VO_2max increase compared to the control group ($F = 7.77$; df = 2; $\eta^2 = 0.23$; $p < 0.01$). Another study reported similar improvements, with significant differences between the start and end of the program ($t = -6.37$; $p < 0.01$) during high-intensity aerobic exercises, such as shoulder raises and forward–backward steps [109].

Blood pressure has also shown favorable reductions in SUD populations following physical exercise. Mind–body therapies, such as Chan-Chuang, resulted in significant reductions in DBP (MD = −9.69; 95% CI = −13.79 to −5.59; $p < 0.01$) compared to control groups. Strength training reduced SBP (MD = −5.59; 95% CI = −10.62 to −0.56; $p = 0.02$) in the same study [57]. Aerobic interventions consistently showed significant SBP reductions pre-intervention, though only one study found greater reductions compared to the controls [109].

For HRV, two studies reported significant improvements in time-domain (SDNN and RMSSD) and frequency-domain (LF and HF) variables following aerobic and strength interventions lasting 8 and 12 weeks, respectively [108,109].

Cognitive function improvements, particularly in inhibitory control and working memory, have been observed in moderate-intensity aerobic interventions lasting at least 8 weeks with three weekly sessions [100,110,116,117].

3.4.2. Physical Fitness, Cognitive Function, and Duration, Frequency, and Intensity of Intervention Programs

Regarding blood pressure, high-intensity exercise programs have demonstrated significant reductions in both SBP and DBP. One study reported greater reductions in the intervention group compared to controls for SBP ($F = 7.42$; $p < 0.01$) and DBP ($F = 9.78$; $p < 0.01$) after 12 weeks of intervention [109].

For RHR, significant reductions were observed following moderate-intensity exercise, although they were not greater than those achieved with standard therapy [43]. However, high-intensity training reported greater reductions compared to controls ($F = 13.10$; $p < 0.01$) after an 8-month intervention [42].

Regarding cognitive functions, inhibitory control and working memory improved in moderate- and high-intensity interventions lasting at least 8 weeks, with three weekly sessions of approximately 40 min [110,116–118].

In conclusion, physical exercise provides substantial benefits for physical fitness and cognitive function in individuals recovering from SUD. Improvements in strength, endurance, and cognitive abilities enhance the capacity to face recovery challenges, supporting both physical and mental health. Evidence supports the implementation of well-structured, regular exercise programs as a valuable tool in rehabilitation, promoting more comprehensive and effective recovery for individuals with SUD.

4. Conclusions by Types of Physical Exercise Programs

4.1. Mind–Body Disciplines

Disciplines such as yoga, Tai Chi, and Qigong have demonstrated benefits for populations with low baseline physical activity levels, particularly for reducing anxiety and stress. These interventions, which focus on meditation, breathing, and mindful movement, are valuable as complementary strategies in rehabilitation programs. However, their effects on variables such as craving and sleep quality are less conclusive, possibly due to the heterogeneity of programs and a lack of standardized protocols.

To maximize their effectiveness, mind–body disciplines should be implemented at least three times a week, with sessions lasting 60 to 90 min over a minimum period of 12 weeks. While their typically low intensity enhances accessibility, it may limit the biophysiological responses necessary for significant improvements across all studied dimensions. Consequently, these interventions are better suited as complements within comprehensive programs that include higher-intensity exercises.

4.2. Aerobic Exercise

Moderate-intensity aerobic exercise interventions stand out as the most effective and accessible interventions, showing consistent benefits in reducing depressive and anxiety symptoms, improving sleep quality, and enhancing overall physical fitness. Activities such as walking, running, or cycling are easy to implement in various contexts, including group settings, fostering social interaction and treatment adherence.

Effective programs typically include a minimum frequency of three to five weekly sessions, lasting 60 min per session, for at least 12 weeks. This design ensures significant cardiovascular and psychosocial adaptations. Moreover, aerobic exercises have demonstrated a positive impact on cravings, attributed to their ability to modulate neurobiological systems related to pleasure and reward. Despite their effectiveness, further studies are needed to analyze their specific impact on variables such as sleep quality.

4.3. Strength Training and Concurrent Programs

Programs integrating strength exercises, either alone or combined with aerobic training, offer a comprehensive approach to improving muscular strength, cardiovascular health, and cognitive function. Although their effects on anxiety and craving are not as consistent as those of aerobic exercises, their inclusion provides additional benefits across physical and mental dimensions.

The ideal frequency for these programs is three weekly sessions lasting 60 to 90 min, with moderate-to-high intensities (65–85% of maximum strength). Effective interventions typically last between 8 and 12 weeks and focus on large muscle groups through resistance exercises. While the evidence is promising, the limited number of methodologically robust studies restricts the generalization of findings. Future research should standardize protocols and explore combinations with other exercise types to maximize benefits.

4.4. High-Intensity Interval Training (HIIT)

HIIT is a promising modality, particularly for reducing cravings and improving cardiovascular fitness in SUD populations. This training involves alternating periods of high intensity (76–96% HRmax) with brief rest intervals, achieving significant benefits in a relatively short time. However, its high physical demand limits its applicability for individuals with low baseline fitness levels.

Successful programs typically have a minimum duration of 8 weeks, with three to five weekly sessions lasting 30 to 45 min. While the results are encouraging, the need for careful supervision and gradual progression highlights the importance of personalized program design. Additionally, future research should explore how to effectively integrate HIIT into protocols combining different intensities and exercise types.

5. Future Perspectives and Areas for Improvement

The integration of physical exercise into rehabilitation programs for individuals with SUD represents a viable and effective strategy, not only for improving treatment adherence but also for fostering comprehensive recovery. However, significant challenges remain that require attention:

Heterogeneity in Interventions: The variability in exercise types, intensities, frequencies, and duration limits the comparability of results and makes it difficult to establish standardized recommendations. Well-defined protocols would optimize interventions and ensure replicable outcomes.

Need for Comprehensive Evaluation: The diversity of measurement instruments and the lack of studies focusing on strength-based programs highlight areas requiring further investigation. Comprehensive evaluations combining physical, cognitive, and emotional parameters would facilitate the design of more holistic interventions.

Technology and Adherence: Incorporating wearable devices, such as daily HRV monitoring via smartphones or pulse bands, can provide valuable insights into participants' physiological responses and overall adaptation to the exercise program. They offer a more comprehensive understanding of changes in the autonomic nervous system, sleep quality, and mood states. Moreover, hybrid models (combining in-person and autonomous sessions) could enhance adherence to programs and ensure their sustainability. This approach may be particularly beneficial for populations struggling to maintain consistent routines.

While moderate-intensity aerobic programs currently represent the most effective modality, mind–body disciplines, HIIT, and concurrent programs also play important roles in an integrative therapeutic approach. Moving toward standardized protocols, incorporating technology, and addressing diverse populations will maximize their therapeutic impact and improve the quality of life for this population.

Supplementary Materials: The following supporting information can be downloaded at: www.mdpi.com/xxx/s1, Table S1: Quality assessment of reviewed articles using the PEDro scale.

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