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The Effect of Yoga on Substance Use Disorder: A Systematic Review

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ABSTRACT

Introduction: Substance use disorder become pervasive global issue, and have the impacts on disability and mortality. Substance use disorder within the context of drug addiction is a multifaceted disorder characterized by recurrent psychological and physiological dysfunction resulting from the continued use of drugs. This systematic review aims to evaluate the impact of yoga as a complementary therapy for people with substance use disorder to promote yoga as complementary therapy in drug rehabilitation to prevent relapse.
Methods: This systematic review utilised secondary data retrieved from four electronic databases: PubMed, SAGE, ScienceDirect, and SpringerLink. The keywords are: "yoga" and "substance use disorder", used the Boolean Operator, utilizing both AND and OR codes to refine the search parameters. The data collection applying PICOS (Populations, Interventions, Comparisons, Outcomes, Study Design) as a full inclusion criteria framework to refine literature selection.
Results: A total of 10 selected articles were eligible based on the criterias. Most reviewed articles show the beneficial effects of yoga as a complementary therapy for SUD. Yoga had positive effects to decrease several physical and psychological issues, also reduce addictive behaviors. Yoga is low cost and low risk treatment, both culturally acceptable and accessible treatment. Overall, yoga recommended as complemenntary therapy in drug rehabilitation.
Conclusion: This study contributes to understanding the effects of yoga on substance use disorder. Yoga has positive effects on physiological, psychological, and behavioral domain. This review provides insight into promote yoga as complementary for comprehensive drug rehabilitation. A future meta-analysis can yield a quantitative assessment of yoga's efficacy as a therapeutic intervention.

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INTRODUCTION

Drug addiction is a pervasive global issue, causing significant mortality and disability. Mostly people acknowledge it as a significant public health concern and this understanding encompasses both developing and affluent nations (1). The most recent World Drug Report reported that in 2020, over 284 million individuals aged 15-64 globally (5.6% of the population) had utilized a drug in the preceding 12 months and it was 26% higher than in 2010. More than 29 million drug users (13.6%) are suffer from substance use disorder (SUD). Various types of substances are misused, with cannabis as the predominant drug, succeeded by opiates, amphetamines, cocaine, and ecstasy (2). Drug addiction is a multifaceted disorder characterized by recurrent psychological and physiological dysfunction resulting from the continued use of psychoactive substances. It is marked by a behavioral shift from the positive reinforcement of drug-induced rewards to the negative reinforcement aimed at alleviating withdrawal symptoms (3). Drug addiction is typically characterized as a behavioral pattern of persistent, habitual consumption of addictive psychotropic substances and an inability to cease usage by voluntary effort (1). Addiction is shaped by several genetic, epigenetic, biochemical, and neuro-endocrine pathways, as well as environmental factors, behavioral, cognitive, emotional, and motivational states, and neural responses to reward and stress stimuli (3). Drug addicts encounter numerous challenges in overcoming addiction, with recurrence being a primary factor contributing to the failure of rehabilitation efforts (1).

Pharmacological and behavioral therapies are some therapeutic approaches for SUD. Many treatment modalities include short-term or long-term residential treatment, outpatient programs, and medically supervised interventions, such as methadone, buprenorphine, and naltrexone. Moreover, these pharmacological therapies may be integrated with behavioral therapy, particularly when substance use disorder coexists with other mental diseases such as depression. Behavioral therapies encompass cognitive behavioral therapy, dialectical behavior therapy, motivational enhancement therapy, and 12-step facilitation therapy (4). Relapse rates after treatment can reach 60% during the subsequent year, particularly among individuals with more severe substance-related issues and co-occurring disorders who exhibit the highest rates of relapse and comorbidity. Due to the inadequate efficacy of current treatments in addressing the requirements of individuals with addiction, there is a significant necessity to enhance the treatment of SUD (5,6).

Yoga categorized as a form of complementary and alternative medicine, is typically employed as an adjunct therapy in addiction treatment. Yoga's intellectual foundations are based in ancient Indian philosophy. The term of "Yoga" derived from Sanskrit, signifies 'union' or 'to yoke,' and refers to a collection of physical, mental, and spiritual activities. Yoga in its original formconsists of an arrangement of ethical, physical, and psychological practices. Yoga was initially developed as a method to utilize the body to calm the mind and attain an elevated sense of awareness, both human and the universe's consciousness are integrated. Within yoga philosophies, physical, mental, and spiritual aspects of the individual are fundamentally linked (7–9). Ashtanga Yoga is a comprehensive stage of yoga that aims to achieve physical, mental, socail, and spiritual well-being. Ashtanga Yoga is a philosophical framework that encourages the practice of yoga consisting of eight (i.e., *ashta*) limbs (i.e., *anga*), including *yama* (social ethics), *niyama* (personal ethics), *asana* (posture), *pranayama* (breath control), *pratyahara* (withdrawal of senses), *dharana* (concentration), *dhyana* (meditation), and *samadhi* (self-realization or enlightenment) (9,10). Modern yoga schools and styles possess unique proportions of *yama* and *niyama*, *asana*, *pranayama*, and meditation practices, all aimed to enhance awareness; integrate the mind, body, and soul; mitigate suffering; and ultimately achieve elevated states of consciousness. Meditation techniques encompass sensory withdrawal (*pratyahara*), concentration (*dharana*), meditation (*dhyana*), and a profound state of focus or absorption known as self-transcendence (*samadhi*) (7,8). Recent meta-analyses and review papers endorse the efficacy of yoga as a supplementary intervention in the treatment of substance use disorders. Several literature reviews explain that yoga is effective in helping reduce symptoms in people with SUD, from physical symptoms, psychological symptoms, to behavioral symptoms. There are few studies that discuss yoga comprehensively. This systematic review integrates multidimensional outcomes (psychological, physiological, behavioral aspect) with recent post-2014 research.

Yoga serves as an adjunctive therapy to mitigate comorbidities linked to substance use disorder, including depression, anxiety, chronic pain, and the long-term management of the condition. Yoga interventions have been incorporated as adjunctive therapy for the management of SUD due to its propensity to alleviate withdrawal symptoms and diminish relapse rates, alongside their potential to enhance resilience, treatment adherence, and overall

quality of life. Yoga is devoid of social stigma and is both culturally acceptable and accessible. Yoga has been found to be as safe as conventional physical exercise. Recent studies have shown that including various form consists of yoga can aid in relapse prevention and may have a more enduring benefit alongside or in conjunction with typical substance use disorder treatment strategies (4,11,12). Limited research exists evaluating the impact of yoga on substance use disorder (11). This article aims to determine the effects of Ashtanga Yoga as an adjunct treatment for people with SUD. After we know how yoga affect people with SUD, then we can promote yoga as complementary therapy in drug rehabilitation to prevent relapse.

METHOD

Search Strategy

This study is a systematic review, used secondary data from several studies to explore yoga as adjunct treatment for drug addiction. The secondary data were obtained through a comprehensive search of several electronic databases, including PubMed, SAGE, ScienceDirect, and SpringerLink that published between 2014-2020. The basic keywords used were: yoga AND substance use disorder. This data search process used the Boolean Operator, utilizing both AND and OR codes to filter the search parameters (Figure 1).

YOGA		SUBSTANCE USE DISORDER
"yoga" OR "yoga intervention" OR "yoga therapy" OR "yoga treatment"	AND	"Substance use disorder" OR "SUD" OR "drug addiction" OR "drug abuse" OR "drug use"

Study Criteria

The data collection using PICOS (Populations, Interventions, Comparisons, Outcomes, Study Design) (13) as a framework for selecting literature. There are some criterias based on PICOS framework with additional time and language to selecting articles (Table 1).

Table 1. Eligibility Criteria for Literature

Category	Inclusion Criteria	Exclusion Criteria
Population	Drug addicts that receive treatment in the process of their drug's rehabilitation	No exclusion
Intervention	Yoga as an adjunctive treatment for drug addictions	No exclusion
Comparison	• Treatment As Usual (TAU) • Other treatment in the rehabilitation programme	No exclusion
Outcomes	Comparison of the effect of yoga on substance use disorder in the intervention group and the control group	No exclusion
Study Design	• Case-control • Pilot Study • Quasi-Eksperimental Design • Eksperimental Design • Randomized Control Trial (RCT)	• Qualitative Study • Literatur Review • Study Protocol • Pre-Eksperimental Design • Cross-sectional • Cohort
Date Restrictions	2014-2024	Before 2014
Language	English Language	Non-English Language

Study Selection

The selection method of this study were based on Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocol (PRISMA) protocol (14). PRISMA is a flow diagram that processing selection consist of identification, screening, and inclusion of the literature. A total of 723 literatures were retrieved, of which 102 literatures were deleted because of duplicity leaving 621 literatures. After the detailed screening process, 600 articles were excluded (505 literatures due to tittle and abstract screening and 95 literatures due to access availability on full

articles). The remaining 21 literatures were assessed for eligibility, with 11 literatures being excluded based on fulfilling requirements and criterias (inclusion and exclusion) on the full articles. Ultimately, 10 literatures were included to be analyzed (Figure 2).

Data Extraction and Data Analysis

The data extraction tool was used to find information from the included articles that appropriate with the study objective. Data were extracted from some research articles using a data collection form, included: literature, study design, sample characteristics, yoga characteristics, and outcomes. Data synthesis was carried out qualitatively. Data analysis using a narrative synthesis approach as recommended by systematic review guidelines. A PRISMA flow diagram was used to illustrate the process of study selection, providing transparency and a clear overview of the systematic approach employed in this review. By adhering to the PRISMA framework, this study ensures rigor and reliability in synthesizing evidence on the effectiveness of yoga on subtance use disorder.

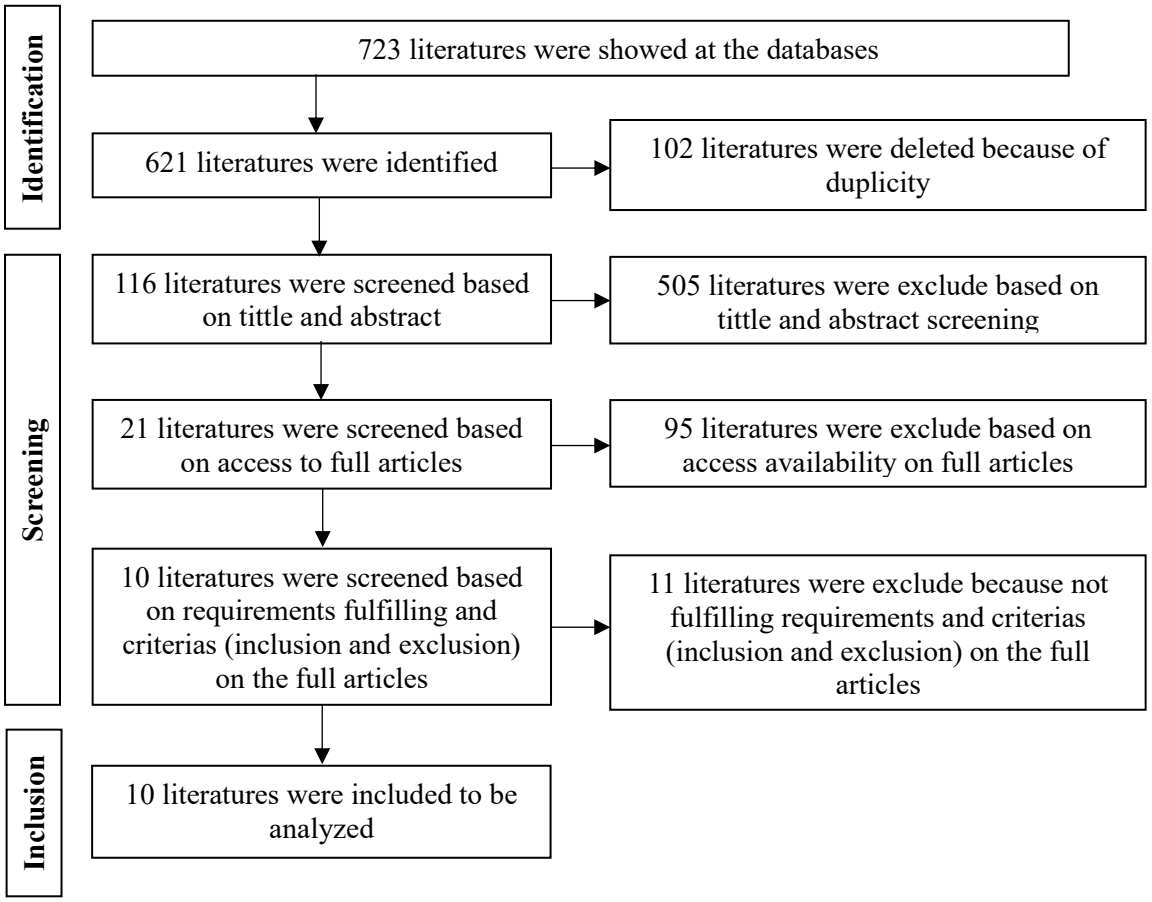

Figure 2. Study Selection Results Using PRISMA Flow Chart

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RESULTS

According to the selection criteria, we identified 10 studies from a total of 723 for systematic review. The flow diagram depicting the identification, screening, and inclusion of research is presented (Figure 1). Table 2 presents a summary of the research considered.

Table 2. The Summary of Included Studies (n = 10)

Literature	Study Design	Sample Characteristics		Yoga Characteristics		Outcomes		
		Sample Criterias	**Sample Sizes**	**Type**	**Duration**	**Physiological Domain**	**Psychological Domain**	**Behavioral Domain**
Devi, et.al (2014)	RCT	Drug abused male 18 – 40 years old	IG: 33 CG: 33 TS: 66	Yoga Practices: Asanas Pranayama Relaxation	4 weeks (6 days per week) @ 70 min		• There was significant decrease in depression scores (using BDI-II) after yoga practices • Quality of Life (QoL) in domain 1, 2 and 3 increas significantly; however, no statistically difference in QOL domain 4 (using WHOQOL-BREF) after yoga practices	
Dhawan, et.al (2015)	RCT	Male opioid dependent users seeking treatment at a community outreach clinic of a large hospital	IG: 55 CG: 29 TS: 84	Yogic Breathing Sudarshan Kriya Yoga (SKY) Program: Pranayama	3 days @ 12 hours		The scores shown a substantial rise during the 6-month follow-up on QOL (using WHOQOL-BREF)	All participants in intervention group exhibited negative urine test results; signifying no recent usage in past 48 hours
Gaihre and Rajesh (2018)	Single-blind, randomized comparative design	Male participants, between 18- 40 years in a residential rehabilitation treatment unit	IG: 44 CG: 43 TS: 87	Yoga-based Program: Asana Pranayama Meditation	12 weeks (6 sessions weekly) @ 90 min	Yoga significantly enhanced cognitive functions, include: response inhibition, immediate memory span, working memory, sustained and selective attention (using Stroop Color-Word Test, WAIS-		

						R Digit Span Task, Six Letter Cancellation Task)		
Wimberly, et.al (2018)	RCT	Clients of a service provider (18 years of age, English-speaking ability, HIV diagnosis, problematic substance use or dependence, returned from prison in the previous 12 months, verbal agreement to the screening assessments, and written informed consent)	IG: 37 CG: 36 TS: 73	Hatha Yoga: Yogic Philosophy (Yama and Niyama) Asana Pranayama Meditation (Dhyana)	12-session @ 90 min		Yoga participants exhibited reduced stress levels compared to those in TAU after three months (using Perceived Stress Scale (PSS))	Yoga participants exhibited reduced substance use compared to those in TAU at 1, 2, and 3 months (using The Timeline Followback (TLFB))
Lander, et.al (2018)	A prospective pilot study used a quasi-experimental design using matched controls	A buprenorphine + naloxone Medication-Assisted Treatment (MAT) program after having been adherent in treatment for at least 90 days (diagnosis of opioid use disorder within the last 12 months; active in the clinic based buprenorphine/ naloxone MAT program for >90 days; male or a non-pregnant female age ≥ 18; understand and provide written informed consent; provide contact information;	IG: 13 CG: 13 TS: 26	Vinyasa Hatha Yoga: Asana Pranayama Meditation	12 weeks		The intervention group showed a significant time effect on stress level (using PSS)	

		comprehend and communicate in English)					
Mallik, et.al (2019)	A Pilot Study	An intensive outpatient treatment program in the Southeastern United States, in which all participants were involved in psychosocial treatment	IG: 9 RG:10 CG: 21 TS: 40	Raja Yoga: Meditation	6-week (4 times per week @ 20 min		• Participants in the intervention group shown an increased ability for managing abstinence • Participants in the intervention group were less likely to engage in overt substance use behaviors that indicate of reducing reactivity to distress and dysfunction; variables that frequently being the relapse trigger (using General Psychological Distress and Dysfunction (GPDD))
Willy-Gravley, et.al (2021)	RCT	Female inmates at a midwestern correctional center	IG: 35 TG: 43 CG: 35 TS: 114	EMBER Yoga: Asanas Pranayama Mindfulness -based Meditation (Open awareness/ Pratyahara, Interested Attention/ Dharana, Meditation/ Dhyana, Emotional Resilience/ Samadhi)	6-week (twice weekly) @ 90 min	• The results indicated the significant variations in emotional regulation after EMBER yoga (using Difficulties in Emotion Regulation Scale (DERS)) • A study of covariance indicated significant disparities in body dissociation after EMBER yoga (using Scale of Body Connection (SBC))	• A research analysis of covariance found substantial variance in relapse warnings after EMBER yoga (using Advanced Warnings of Relapse (AWARE) Questionnaire)

Petker, et.al (2021)	Pre-liminary naturalistic evaluation	Patients enrolled in Womankind Addiction Service's (primary treatment program, a residential inpatient program for adult women with SUD) in Hamilton, Ontario, Canada	IG: 42 CG: 33 TS: 75	YogaFit for Warriors: Asanas Pranayama Emotional Grounding Skills (Pratyahara, Dharana, Dhyana, and Samadhi)	14 sessions (3 days per week) @ 60 min	• The intervention group reported significant enhancements in ROM and the Lack of Premeditation aspect of impulsivity	• Intervention and control groups exhibited differences within-subject in somatic and psychiatric symptoms, self-efficacy, and also in various aspects of impulsivity and mindfulness significantly •	• Intervention and control groups exhibited differences within-subject in cravings significantly
Chauhan and Negi (2024)	RCT used a pre-post test design	Male participants from a drug addiction rehabilitation centre who were addicts of substances like heroin, cannabis, alcohol, or a combination thereof, and after they had undergone the initial severe withdrawal symptoms	IG: 40 CG: 40 T: 80	Yoga Training Program: Asanas Pranayama Meditation	8-week (daily excluding Sunday) @ 60 min		There were significant increases in the intervention group; 97.5% of participants had normal stress levels, 95% indicated decreases in anxiety, and 85% reported decreased symptoms of depression (using Depression, Anxiety, and Stress (DASS-21))	
Habibzadeh, et.al (2024)	Quasi-experimental study used a pre-post test design	Individuals incarcerated in the prisons of Uremia City, Iran, in 2022, who abused industrial drugs (being 30-50 years old, absence of significant physical	IG: 15 CG: 15 T: 30	Yoga Training Package: Asanas Pranayama Trite Exercise (Dharana and Dhyana)	6-sessions @ 90 min	• Yoga greatly influenced sleep quality, with the eta value indicating the possibility of enhancements in quality of sleep, minimised latency for	• Yoga significantly impacted psychological wellness. The eta result suggested yoga might improve independence, environmenta	

		diseases, and absence of psychological disorders, with the exception of substance abuse disorder)			falling asleep, extend the duration of sleep, improving of sleep efficiency, minimising of sleep disorders, decreased reliance on sleeping pills, and minimised of daily functional disorders (using Pittsburgh Sleep Quality Index (PSQI))	l domination, personal growth, positive relationships, life's goal, self-acceptance (using Psychological Well-Being Scale) • Yoga had a substantial effect on emotion regulation and its components; that indicates yoga might lower self-blame, enhance acceptance, diminish rumination, encourage positive re-focusing, improve re-focusing on planning, improve posit ive re-evaluation, encourage perspective-taking, decrease catastrophic thinking, and minimize the tendency to blame others (using Emotion Regulation Scale)

*RCT = Randomized Control Trial; n = all participants; IG = Intervention Group; CG = Control Group; RG = Relaxation Group; TG = Therapeutic Group; TS = Total Sample

DISCUSSION

This systematic review included 10 studies investigating the effects of yoga as adjunct treatment for drug addicts in drug rehabilitation treatment. Most of the studies included in this review were RCTs. The sample characteristics of the studies, include: the sample size varied from 26-114 people with SUD; most of the sample were male; and the mean of the sample's age ranged from 25-48 years old. Most studies just provided only some parts of yoga, included: asana, pranayama, and meditation. The timeline of yoga implementation varied greatly, from a range of 3 days to 12 weeks with each duration were 20-120 minutes; and varied between 6-48 sessions. The effects of yoga will differ depending on the type of yoga and the duration of the yoga practice. The duration of yoga practice affects the results which will affect physical domain, psychological domain, and behavioral domain (15).

This study devided the effects of yoga in physiological domain, psychological domain, and behavioral domain. The results showed that most of the included studies outcomes discuss the psychological domain, especially about depression, anxiety, stress, and emotion regulation. The following is a summary of the review outcomes shown in Figure 2.

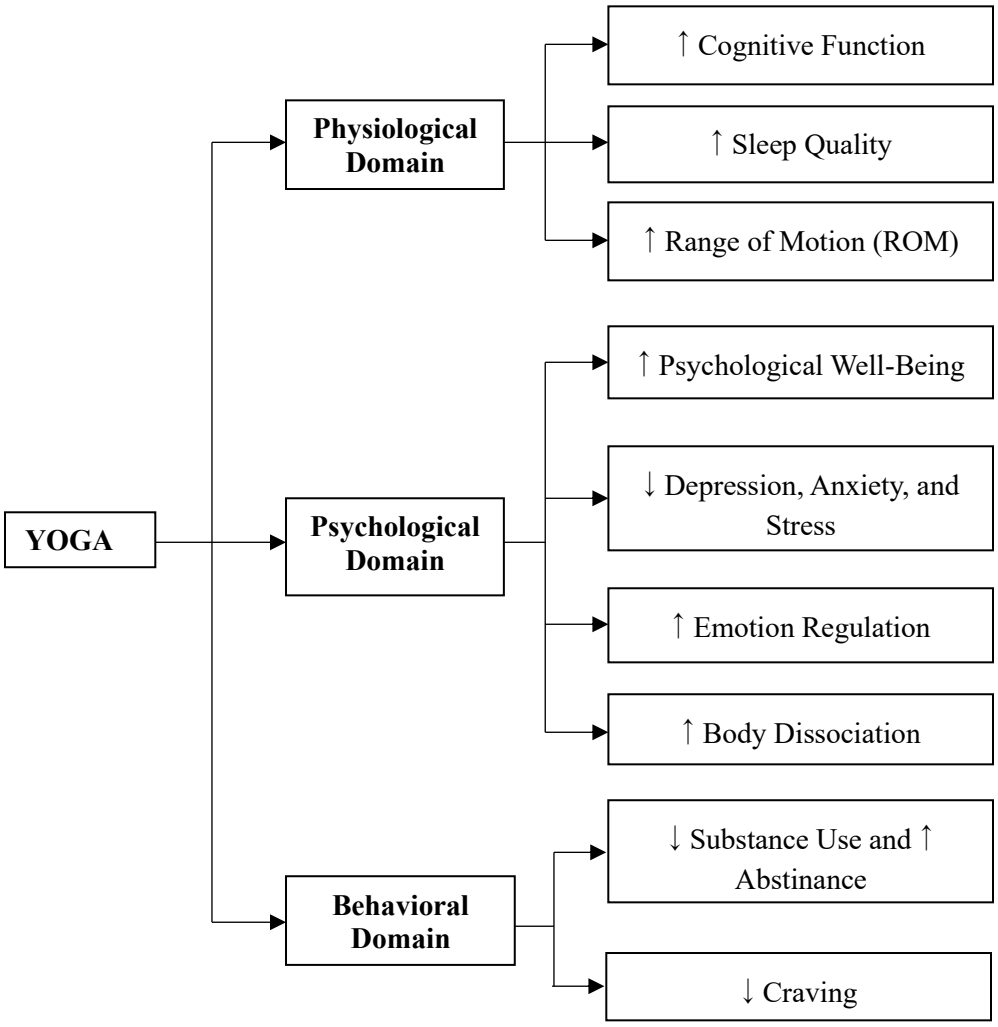

Figure 2. The Effect of Yoga on Substance Use Disorder

The Effects of Yoga on Physiological Domain

Some research posits that yogic practices address several processes, encompassing both physiological and psychological aspects associated with SUD. The molecular mechanism underlying yoga therapy and addiction entails alterations in the autonomic nerve system and the hypothalamic–pituitary–adrenal axis. Yoga techniques facilitate the lowering of cortisol levels and the elevation of naturally occurring endorphins, oxytocin, and Gamma-Aminobutyric Acid (GABA). These modifications provide analgesia and enhance sleep quality. Yoga may elevate pain thresholds and induce a sense of natural euphoria by facilitating profound relaxation and tranquility of the mind. This may be facilitated by the elevation of GABA, oxytocin, and endorphin concentrations (4,11,12). Another physiological advantages of consistent in practicing yoga, such as improved flexibility, strength, and overall fitness, enhance significantly to well-being and a positive body image (16). Yoga practice may be advantageous in treating SUD by activating reward circuits analogous to those engaged with substances of abuse, particularly the dopaminergic pathways within the mesolimbic system (17). Based on this review, there are some studies outcomes discuss the physiological aspect, such as: cognitive function, sleep quality, and ROM.

Cognitive Function

The nerve cells of people with substance addiction that are located in the brain's reward circuit prone to adapt epigenetically during repeated exposure to the substance. These adaptations changes the brain functions that assist to dysfunctional behaviors related to the substance use disorder. Cognitive harmful as the results of substance use disorder can be inverted by prolonged abstinance. The interventions that increase cognitive functioning can support the success of the long-term treatment for addiction. The cognitive interventions could guide the improvement of general cognitive skills, the training tasks concerning in inhibitory control and cognitive flexibility (reasoning and problem-solving skills), produce the changes in functional and anatomical of the neural system that induce the improvement in cognitive function (18).

One of the effects of yoga on physiological aspect is cognitive functions. Gaihre and Rajesh discovered that 12 weeks period add-on yoga intervention achieved significant enhancement in improving cognitive functions, included: response inhibition, immediate memory span, working memory, sustained and selective attention (19). Cognitive impairments are widespread among individuals seeking treatment for SUD. Substance dependency causes cognitive deficits that primarily impact the inhibitory control, information storage coordination, manipulation of information, and visuospatial functions (19,20). Yoga-based practices have shown a beneficial impact on neuropsychological functioning, particularly in selective and executive functions, including attention, memory, verbal fluency, and cognitive flexibility. The consumption of illicit substances was associated with structural brain changes, consistently indicating abnormalities in hippocampus volume that affect cognitive functions. Yoga effectively reverses hippocampus volume reduction, correlating with enhanced memory function. The reversal of hippocampus volume may be a potential mechanism by yoga improves cognitive function in individuals with SUD (21,22). Abstinence in the behavioral treatment procedures appears to depend on cognitive capabilities. Moreover, the study indicates that it is crucial to consider the cognitive aspects of people with SUD to effectively tailor and maximize the benefits of therapy offered in addiction medicine units (19).

Sleep Quality

The next effect of yoga on the physiological domain is sleep quality. Habibzadeh et al. reported that yoga has a substantial effect on sleep quality (23). Sleep quality is a complicated phenomenon which is challenging to measure; yet, this is able defined according to subjective indicators associated to the sleep experience, for example, sleep satisfaction (24). Habibzadeh, et.al using Pittsburgh Sleep Quality Index (PSQI) in their study, with the internal consitency ($\alpha = 0,83$) and the reliability ($\alpha = 0,81$). The measure contains seven components, such as: quality of sleep, delay in falling asleep, sleep duration, sleep efficiency, sleep disorders, sleeping pills usage, and daily functional disorders. Results from this study indicated yoga might enhance quality of sleep (12.4%), minimize the delay in falling asleep (20.03%), extend the duration of sleep (12%), improve sleep efficiency (20.1%), minimize sleep disorders (21.8%), lower the dependence on sleeping pills (12.2%), and lower daily functional disorders (12.1%) (23). The energy and joyfulness experienced by drug abusers result from a temporary elevation in dopamine levels within the brain. This raised awareness can directly affect sleep, and prolonged usage may result in reduced REM

sleep (24). Yoga exercise enhances sleep quality and overall health by impacting performance-related Hypothalamus-Pituitary-Adrenal (HPA) and regulating associated hormones, such as cortisol and Adrenocorticotropic Hormone (ACTH). The optimal functioning of physiological systems, principally regulated by the HPA axis, is crucial for the physical and mental well-being of individuals. Yoga may successfully release tension and mental pressures, enabling improved sleep quality (23).

In addition to yoga, Cognitive Behavioral Therapy (CBT) is a complementary therapy that is often used to help overcome problems people with SUD. Insomnia is common in SUD and a robust predictor of relapse (25). Alavi, et.al on their study showed that the scores for insomnia among opioid users in the intervention group decreased significantly after CBT (26). Speed, et.al. carried out a RCT among 21 SUD patients to compare the efficacy of 8-sessions of CBT on insomnia. The results found that insomnia symptoms were reduced in both groups over time, but the decline rate of the intervention group (80%) was higher as compared to the control group (25%) (25).

Range of Motion (ROM)

ROM is one of the physiological effects of yoga. Petker et al. discovered that yoga practice for women with SUD contributed in a significant improvement in ROM (Petker et al., 2021). ROM measures the extent of movement around a particular joint or body segment. ROM describes the capacity to articulate a joint and alleviate muscular stiffness, which is crucial for athletic performance and daily activities, and may affect the likelihood of muscle strain injuries and overall performance (27). Petker, et.al developed an 8-item questionnaire ($\alpha = 0,90$) to evaluate the ROM in different body joints over the preceding week. This measurement was established to indicate the impact of the yoga intervention on joint flexibility (6). Yoga practices include various stretching, strengthening, and balancing activities that can affect mobility through many physiological pathways. These mechanisms engage specific muscles, enhance flexibility, stabilize joints, and foster synergy between muscles and nerves. Comprehending these pathways can elucidate the impact of yoga therapies on improving ROM (28).

The Effects of Yoga on Psychological Domain

The utilization of yoga as a complementary therapy have so many advantages of the various psychophysiological of it's component. Physical exercises (asana) may increase flexibility, coordination, and strength. Breathing techniques (pranayama) and meditation may calming and concentrate the mind to develop greater awareness and reducing anxiety, ultimately leading to an improved quality of life. Additional advantageous benefits may include a decrease in distress and blood pressure, along with enhancements in resilience, mood, and metabolic regulation (29). Physical activity in yoga practice and its focus on regulated breathing are essential in mitigating the response stress of the body. Moreover, yoga's sense and support from community within yoga courses may cultivate feelings of connectedness and self-worth as participants share common goals and experiences. The holistic aspect of yoga undoubtedly renders it an essential instrument for improving self-esteem, promoting positive emotions, and alleviating negative emotions, therefore bolstering an individual's entire mental health and well-being (16). Based on this review, there are some studies outcomes discuss the psychological aspect, such as: psychological well-being, depression, anxiety, stress, emotion regulation, body dissociation.

Psychological Well-Being

Psychological well-being is characterized as a condition in which individuals recognize their potential capabilities, significantly contributing to the alleviation of anxiety, sadness, and other emotional issues. One of the things that influences psychological well-being is interoception. Interoception involve to the process by which the nervous system senses, interprets, and integrates signals from within the body, supplying a moment-by-moment mapping of the body's internal landscape across conscious and unconscious levels. The signal of interoceptive has been considered a component process of reflexes, urges, feelings, drives, adaptive responses, and cognitive and emotional experiences, highlighting its contributions to the maintenance of homeostatic functioning, body regulation, and survival (30). Interoceptive pathways have two directional interactions between the central nervous system and other physiological systems (31). When the interoception doesn't work, it is identified as an important's different mental health conditions (30). Some physical and mental clinical disorders are associated with interference in interoceptive processes that comprise some physiological systems and interactions among them. Interoceptive

pathways and processes offer ripe opportunities for experimental manipulations of mind-body interactions, leading to promising clinical interventions for a wide variety of conditions (such as: SUD). The representation of interoceptive information may be altered through yoga, which include: (i) Asana (training awareness of sensations, such as: movement, pressure, tingling, and temperature); (ii) Pranayama (training awareness of internal respiratory signals from bodily areas associated with breathing, such as: the nostrils, throat, lungs, and diaphragm); and (iii) Meditation (training awareness of cognitive and affective qualities of attention, such as: sustained focus with a nonjudgmental attitude). Yoga may cultivate compassion and kindness in response to pain and suffering, which can be directly applied to sensory experiences. These skills may lead to better monitoring and regulation of physical, emotional, and social processes, contributing to improved healthpromoting decision-making and behaviors. This may be why yoga may lead to improvements in people with SUD (31).

There is a significant correlation between psychological well-being and the tendency for using drugs, as well as the components of ability and acceptance of addiction. Habibzadeh et al. observed the impact of yoga on psychological well-being. The studies adopted the shortened version (18 items) of Ryff's psychological well-being scale (10 were scored directly, while 8 were scored inversely). It is featuring six subscales: independence, environmental dominance, personal growth, positive relationships with others, life's goal, and self-acceptance. The study results proved that the practice of yoga has a significant effect on psychological well-being. The statistic result suggested that practicing yoga would enhance independence (0.07%), environmental domination (0.09%), personal growth (0.08%), positive relationships with others (0.08%), life's goals (0.08%), and self-acceptance (13.7%). Yoga practices can improve both physical and mental well-being by reducing body tension and enhancing psychological adaptability and resilience. Yoga practise may help individuals in managing their psychological and emotional problems, reducing the excitability of the cerebral cortex, and fostering both body, mind, and soul peacefulness from the perspective of psychology (23).

Depression, Anxiety, and Stress

Depression, anxiety, and stress are commonly outcomes of yoga as adjunct treatment for drug addiction in included studies. Devi, et.al found the significant decrease of depression scores after yoga practices. They used Beck Depression Inventory (BDI-II). BDI-II is a 21-item, self-report questionnaire that assesses depressive symptoms experienced in the past two weeks. The BDI-II was showing good agreement and the test was also shown to have a high one-week test–retest reliability. The higher scores indicating higher levels of depressive symptoms. The result told us that there was a significant reduction after yoga practice in depression scores (32). Wimberly, et.al also found that yoga participants reported less stress at three-months yoga intervention. This study used the 10-item Perceived Stress Scale (PSS). It demonstrated good internal consistency and validity across multiple studies. In particular, Cronbach's alpha and test-retest reliability were found to be >0.70. This study shown that the mean of PSS score in yoga intervention group was 4,37 points lower than the controlled group (33). Lander, et.al also used PSS to measure the degree to which situations in one's life are appraised as stressful. PSS assesses how partisipants cope with unpredictable, uncontrollable, and overwhelming in their life situations. The study revealed that 22 out of 26 participants exceeded the normative scores on the stress scale. Participants exhibited significant improvement at all time points in yoga intervention group and at most time points in control group, with the effect size being markedly bigger in the intervention group (17). Chauhan and Negi used Depression, Anxiety, and Stress Scale-21 (DASS-21) to measuring Depression, Anxiety, and Stress levels, but they did not described the validity and the reliability of the scale. Post-intervention of 8-week yoga practices that conducted for 60 minutes daily (excluding Sunday) was shown that there were significant improvements in the intervention group ($p < 0.001$), with 97.5% of participants exhibiting normal stress levels, 95% reporting decreases in anxiety, and 85% indicating a decrease in symptoms of depressive disorder (34).

Stress is a significant issue for drug abusers, as substance use may serve as their primary coping technique. Chronic stress exposure, along with individual and genetic predispositions for substance use, influences neurobiological pathways, heightening the likelihood of maladaptive stress responses and the propensity for substance use as a coping mechanism. Stress-reduction therapies are essential for reintegrating persons to navigate this difficult period and to mitigate the likelihood of substance use (35). Yoga can rectify imbalances in the stress response by diminishing sympathetic nervous system activity and enhancing parasympathetic nervous system activity

(33). The practice of yoga may increase body and mind awareness, maintaining mental clarity and emotional stability that vital for people with SUD. Yoga has been related to raised levels of GABA, a neurotransmitter integral to the regulation of anxiety and mood. Yoga could minimize stress and anxiety by reducing cortisol levels and encouraging for a transition towards parasympathetic nervous system predominance. Additionally, yoga induces the secretion of neurotransmitters such as dopamine, serotonin, oxytocin, and endorphins, that are essential for regulating emotions and the quality of life (34).

CBT as a complementary therapy for people with SUD showed the effectiveness to reduce the depression, anxiety, and stress. Alavi, et.al on their study observed a statistically significant difference in anxiety between the control and intervention groups after brief CBT (26). Bador and Kerekes evaluated an integrated intensive cognitive behavioral therapy within addiction care. The study could measure significant reductions in the experiences of anxiety and depression after four months of integrated intensive CBT treatment, it is important because reductions of a person's depression and anxiety symptoms serve as protective factors against relapse in substance use (36). The other complementary therapies that are widely used in SUD are Mindfulness Based Intervention (MBI). Black and Amaro studied the MBI that called Moment-by-Moment in Women's Recovery (MMWR). MMWR is part of MBI and an adaptation of Mindfulness Based Stress Reduction (MBSR) that focused on SUD treatment retention and relapse prevention and being suitable for women from low-income and and racially and ethnically diverse group in SUD treatment. The result showed that the intervention group with MMWR increased positive affect levels and reduced distress levels (37).

Emotion Regulation

Emotion regulation is a distinct sort of self-regulation that significantly influences the regulation of cognitive emotions is seen as an essential element of emotional response tendencies. Challenges in regulating emotions and related elements may account for 37.5% of addiction tolerance (23). Willy-Gravley, et.al studied about effect yoga on emotion regulation. They used the Difficulties in Emotion Regulation Scale (DERS) that indicate high internal consistency, good test–retest reliability, adequate construct and predictive validity. The DERS assesses challenges in regulating emotions in adults. Emotion regulation is encompasses of emotional arousal, awareness, understanding, acceptance, and the ability to behave in accordance with one's intentions irrespective of emotional state. This measurement comprises 41 items of self-report spanning six measurement factors, such as: emotional responses, goal-directed behaviour, impulse control, emotional awareness deficits, access to emotional regulation techniques, and emotional clarity deficiencies. The results revealed significant differences in emotion regulation among the intervention group and general population groups ($p = .01$) (38). Habibzadeh, et. al also studied effects of yoga on emotion regulation. They used emotion regulation scale with 36-items and confirmed its reliability ($\alpha = 0{,}86$). This scale identifies nine components, each representing a specific technique of emotional cognitive regulation, such as: self-blame, acceptance, rumination, positive re-focusing, planning re-focusing, positive reevaluation, viewpoint-taking, catastrophic thinking, and external attribution of blame. The findings demonstrated that yoga statistically influenced regulation of emotion and its subscales ($P < 0.05$). The results representing that yoga might decrease self-blame (0.08%), enhance acceptance (11.1%), minimise rumination (34.5%), encourages positive re-focusing (10.1%), optimise re-focusing on planning (0.08%), contribute to positive re-evaluation (11.1%), encourage taking a point of view (38.1%), minimise catastrophic thinking (25.7%), and minimise blaming others (18.6%) (23).

The people undergoing treatment for SUD have challenges in emotional regulation (39). Drug addiction impacts and disturbs the brain's behavioural systems, particularly the Behavioural Approach System (BAS) and Behavioural Inhibition System (BIS) of the individuals affected. This disturbance leads to heightened sensitivity, which then affects the sensitivity of the BAS and the BIS, directly influencing emotional regulation and responses. Disruptions regarding the vulnerability of those mechanisms influence emotional dysregulation and prevent the implementation of adaptive regulating emotion mechanisms (Habibzadeh et al., 2024). Yoga affects people in regulating adverse feelings and arousal, enabling individuals to regulate the emotions by focussing on positive objectives and thoughts, so strengthening both their body and mind capabilities. Cognitive connections have been applied in yoga practices to encourage positive emotion regulation strategies among individuals with substance use disorders and improve their overall emotional regulation. Improved the activity of frontal lobe and reduced the activity of parietal lobe during yoga sessions facilitate concentration and spatial awareness (Habibzadeh et al., 2024).

Yoga might improve dimensions of regulating emotion, such as impulse regulation, emotional consciousness, and the use of emotion regulation tools, which could be essential in preventing relapse (38). Another complementary therapy for people with SUD is MMWR. Black and Amaro research found that women with residential SUD treatment that given the MMWR treatment reported increased the emotion regulation that associated better in navigate stress (37).

Addiction is associated with defects in the network of self-control that itself is associated with the prefrontal cortex. The prefrontal cortex is associated with emotion regulation, improving the function of the prefrontal crotex may increase emotion regulation. Increasing the emotion regulation can increase the levels of awareness during the experiences of negative emotions, reduced conflict and stress, and lead to self-control incressed. The self-control improvement help to control behaviors that are automatically triggered by stimulants with negative emotional that is associated with the signs of craving. This self-awareness and self-control help to break the cycle of repetitive behavior of drug use; detect the high-risk situations and triggers; cognitive, emotional, and physiological processes, that lead to drug abuse are reduces the risk of relapse (40).

Body Dissociation

One of the effects of yoga on psychological aspect is body dissociation. Body dissociation is one of the psychotic symptoms of trauma (or post-traumatic stress disorder). Dissociative processes and disrupted contextual integration at the time of the trauma leave an individual vulnerable to experiencing anomalous experiences. Intrapersonal and interpersonal traumas lead to maladaptive schema and appraisals of self and others, predisposing to paranoia and delusional beliefs. Maladaptive schema about self and others are also closely related to the concept of metacognitive capacity i.e., an integrated representation of the self and others, which is suggested to be a foundation for resilience (41). Body dissociationwas measured by Scale of Body Connection (SBC). It is a two-dimensional self-assessment instrument that evaluates body awareness and bodily dissociation. This instruments has 20 items of self-report (12 items of body awareness and 8 items of bodily dissociation) adopting the five-point Likert scale that indicate acceptable internal consistency reliability ($\alpha = 0,70$). (38). This body dissociation symptoms can be decreased by increasing body awareness. Body awareness involves sensory awareness (the capacity to identify and detect internal bodily sensations, such as: muscle tension) and the general emotional/physiological condition of the body (e.g., relaxed, tense). Body awareness encompasses the recognition of body information in daily life, including the observation of physical changes and responses to emotions and environmental factors. Bodily dissociation is defined by the rejection of internal sensations. Bodily dissociation includes experiential dimensions, including commonplace occurrences, such as: distraction from physical sensations. This dissociation consists of the sensation of detachment from physiological experience or self, as well as emotional disassociation, characterised by difficulties in identifiying, expressing, and attending to emotions. Bodily dissociation is seen as a defensive mechanism employed to mitigate distressing memories, thoughts, or emotions, and is frequently utilized to manage physical pain and trauma. Assessments of body awareness and bodily dissociation are essential to elucidate the mechanisms behind enhancements in physical and psychological health, especially in therapies targeting populations with somatic issues linked to dissociation or insufficient body awareness (42).

Yoga can uniquely address the physical needs of a trauma survivor and provide a way for a trauma survivor to cultivate a friendly relationship to his or her body through gentle breath and movement practices. Yoga participants showed improvements in some traumatic symptoms, i.e: an increase in positive affect, decrease in negative affect, an increase in their physical vitality, and an increase in their body attunement (43). The increasing of body attunement can improve the body awareness to treat the body dissociation. Willy-Gravley, et.al studied about effect yoga on body dissociation. They also used SBC for measured body dissociation. They found that there were significant disparities in body dissociation among the treatment and control groups. The results indicating that six-week EMBER yoga program can decrease the symptoms related to body dissociation. Yoga categorized as an integrated mind–body–spirit modality, may not operate through a singular change mechanism affecting mental health and substance-related consequences; instead, change could arise from interrelated processes. A substantial association was identified between body dissociation and emotion regulation scores, suggesting a notable linkage between these outcomes, typically linked to the physical aspect of well-being (38).

The Effects of Yoga on Behavioral Domain

Yoga as holistic approach integrating the physical postures, breathing exercises, and meditation for enhancing physical and mental health (16). Yoga as a supportive therapy has the beneficial to support individuals with SUD and associated issues by practicing yoga to manage specific personal concerns, thereby improving health and quality of life (QOL), which is generally inferior to that of the general population (44). Willy-Gravley, et.al studied the effectiveness of six-week yoga intervention on warnings of substance use relapse used Advanced Warnings of Relapse (AWARE) Questionnaire, the self-reported symptoms that acceptable validity ($\alpha = 0,92$) and reliability ($\alpha = 0,80$). The AWARE Questionnaire seeks to evaluate the probability risk of relapse in addicted people, in order to customise successful treatment strategies. The evaluation comprises a concise symptom checklist of 28 items reflecting warning signals of relapse. The findings indicate a statistically significant reduction in relapse warns from pretest to posttest among the intervention group. According to these findings, participants who engaged in 6-weeks yoga therapy experienced a reduced probability of relapse concerning addiction issues. Yoga not only offers reducing warnings of relapse, yoga also reinforces the connection of mind and body to prevalent in holistic techniques (38). Based on this review, there are some studies outcomes discuss the efect of yoga on risk of relapse, such as: substance use and abstinence, and craving.

Substance Use and Abstinence

Dhawan, et. al (2015) studied about yoga, named Sudarshan Kriya Yoga (SKY). SKY is a technique of breathing that rhythmic and very simple for male opioid dependent users. The result showed that all participants in the intervention group had not use the drugs in past 48 hours based on negative urine test results at six months follow-up. It indicated the absence of drug use, lapse, or relapse within each participant in the intervention group. The incorporation of SKY breathing technique assisted the study group in overcoming addiction and mitigating any relapses (44). Wimberly, et.al (2018) found that a 12-week yoga intervention significantly influenced the percentage of days of substance use at one, two, and three months. The Timeline Followback (TLFB) was utilised to evaluate the frequency of drug and alcohol consumption throughout the 90 days preceding the baseline and the 90 days prior to incarceration. The TLFB has strong test-retest reliability (0.80 or greater). (33). Mallik, et.al found the participants in the Meditation Group tend to be more persistent in maintaining abstinence. Abstinence was identified by negative weekly urinalysis (UA) results, indicating compliance with abstinence or Medication-Assisted Treatment (MAT) objectives established at the treatment's starting; thus, participants exhibiting abstinence were either completely abstinent from all substances or utilised only prescribed buprenorphine throughout the 6-week intervention. The concentrate on meditation may have cultivated a new coping mechanism wherein stable connection to the sacred replaced prior dysfunctional tactics, such as substance use; a mechanism that may not be triggered or supported by mindfulness and other secular approaches (45). Petker, et.al studied about the assasment of yoga program for women with SUD. They found that 14-sessions YogaFit for Warriors Program can increased views of self-efficacy towards abstinence. Self-efficacy have been recognised as significant determinants of treatment outcomes and relapse risk, may be particularly crucial for sustained abstinence. The yoga program may serve as an effective adjunct therapy that decreases the risk of relapse attributable to impulsivity (6). Yoga helped people to promote a healthy lifestyle for maintaining abstinence from substances usage. Yoga is a community of some people that trying to have a health lifestyle. The participants shared their life’s experience and it inderictly related to share the experince not to using substances. Yoga community provided a positive social experience which have perceived to enhance participants’s life without substance use (46).

CBT is a time-limited, multisession strategy that targets cognitive, affective, and environmental risks for substance abuse and teaches behavioral self-control skills to assist a person to achieve and maintain abstinence or reduce the risk of harm (47). Kiluk et al.'s research found that CBT was significance to reduce the frequency of drug or alcohol use compared to standard treatment (48). Magill, et.al also showed CBT emphasis on relapse prevention suggests that this is a treatment well-suited to abstinence maintenance and long-term functioning (47). Yaghubi, et.al compared the effectiveness of Mindfulness Based Relapse Prevention (MBRP) with Treatment As Ususal (TAU) for methadone-threated patients. MBRP is a intervention of addiction that integrates mindfulness technique with traditional behavioral therapy. MBRP could reduce impulsivity levels and relapse risk by multiple mechanisms of

mindfulness based interventions. The results showed that MBRP was effective on reducing relapse in the two months follow-up(40).

Craving

Yoga is getting more popular as complementary therapy for addiction. Based on the researchs, yoga has been shown to influence cognitions and emotions associated with relapse as well as behaviors related to cravings (49). Petker, et.al (2021) studied about YogaFit for Warriors (traditional yoga poses and technique of breathing from Hatha Yoga that aprroach trauma-informed) for adult women with SUD. The result showed that yoga may affect drug cravings significantly. They found that 14-sessions YogaFit for Warriors Program can decreases drug craving. Drug craving has been independently recognised as significant determinants of treatment outcomes and relapse risk, may be particularly crucial for sustained abstinence. Based on the experience, cravings may diminish the capability to denial substances in early recovery. The yoga program may serve as an effective adjunct therapy that decreases the risk of relapse attributable to impulsivity (6). Yoga is useful therapy to preventing relapse by building awareness of thinking and it relates to cravings. Yoga makes participants to expressed awareness of using their senses to help reduce cravings. The part of withdrawing the sense (pratyahara) allowed participants to learn how to slow down the interpretation of sensory reactions. This enabled participants to go inward and become a little quieter and not feel so drawn to external things outside. Yoga helped people to develop tolerance to negative internal cues, negative emotions, and obsessive thinking. Yoga enhanced self-efficacy to cope with internal experiences to prevent relapse. Yoga preventing relapse by assisting people to habituate and raise self-efficacy to address internal and external events that are considered high risk that could lead to relapse (46).

Another complementary therapy for people with SUD is MBI. MBI have several development methods, included: Mindfulness Based Relapse Prevention (MBRP), Mindfulness-Oriented Recovery Enhancement (MORE), etc. Davis, et.al studied about the effects of MBRP on low-income clients with SUD. In this research, participants reported statistically significant declines in their level of craving during the treatment phase (50). Garland, et.al studied about comparison MORE, CBT, and Treatment As Usual (TAU). The results indicated that MORE was associated with significantly greater decreases in craving than CBT and there were no significant differences between MORE and TAU on changes in craving over 10-weeks of treatment (51).

Limitations and Cautions

This systematic review has several limitations. First, the results are based on the availability of literature that depends on access to literature as data sources that are appropriate to the research objectives which cannot cover all existing literature. Second, this study uses a framework that limits the population, intervention, study design, and time in selecting data sources, thus influencing the generalizability of the results. Third, the included studies reviewed reported any bias and data limitations that affect the accuracy of the resuts. Cautionary remarks include the importance of considering the yoga's characteristics and the intervention timing as they will influence outcomes. It is important to explore comprehensive yoga models that provide positive effects for people with SUD.

Recommendations for Future Research

Further research is needed to comprehensively determine the effects of Ashtanga Yoga (comprehensive yoga) as a complementary therapy for drug addicts. Research is conducted to establish definitive evidence of its efficacy as an adjunct and/or primary treatment for various substance abuse. A future meta-analysis can yield a quantitative assessment of yoga's efficacy as a therapeutic intervention.

CONCLUSION

Some complementary therapy were effective to decrease several problems people with SUD in physiological aspect, psychological aspect, or behavioral aspect. This review explored yoga on people with SUD and aimed to determine the effects of yoga as complementary therapy in drug rehabilitation for people with SUD. There are few studies that discuss yoga comprehensively. This systematic review integrates multidimensional outcomes (psychological, physiological, behavioral aspect) with recent post-2014 research. The findings showed that yoga may decrease several physical and psychological problems, and also reduce addictive behaviors in people with SUD.

However, there are not many drug rehabilitation centers that provide yoga as a complementary therapy even though yoga is a low-cost and low risk treatment, devoid of social stigma, both culturally acceptable and accessible treatment. The limitations of this review was on the limitation of data sources and the variability of population, sample size, and study design that can affect the generalizability of the results. Overall, yoga is recommended as complementary therapy for comprehensive drug rehabilitation.

AUTHOR'S CONTRIBUTION STATEMENT

Putu Emy Suryanti as first author conceived the study, collected data, analysed data, interpretated data, and wrote the manuscript. Ella Nurlaella Hadi as second author contributed critical feedback, provided relevant scientific expertise, and supervised the project progress. All authors discussed the results and contributed to the final manuscript.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding this manuscript.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

No content generated by AI tools has been presented as my own work.

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