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Mind-Body Exercises: What Do We Know So Far? An Update

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ABSTRACT

Background: Mind-body exercises encompass yoga, Tai Chi, Body-Oriented Psychotherapy, mindfulness-based therapies and meditation, Feldenkrais, the Alexander Method, Breath Therapy, and massage, as well as mental training. These exercises focus on enhancing athletic performance and sports performance, improving overall health, and developing body awareness. This extensive study aims to understand the philosophical tenets, methodologies, motivations, extent, and efficacy of the Mind-Body Exercises and their role in artificial intelligence.

Methods: Global studies were included to analyse the impact of mind-body exercises.

Results: Research has demonstrated that mind-body exercises can significantly improve a spectrum of health outcomes, intricately influencing neural structures to promote physical and mental well-being. The exercises can also help with cognitive, balance, and pulmonary functions, mitigate pain perception, anxiety, and depression, and elevate subjective well-being. Even cancer survivors can benefit from practicing mind-body exercises, which can improve factors such as physical fitness, fatigue, sleep quality, depression, anxiety, and body mass index. The theoretical framework of mind-body emphasizes the connection between the mind and body. Disturbances in these connections evoke distress, necessitating practices that elevate body awareness, emphasising the pivotal role of patient-therapist interactions in fostering integration and profound unity between self and body.

Conclusion: Mind-body exercises have the potential to enhance physical and cognitive health, promote body awareness, and improve overall well-being. The integration of artificial intelligence in yoga shows promise for enhancing practice and preventing injuries. Future research should investigate age- and gender-specific effects and conduct nuanced comparisons between meditation-only, conventional exercise-only, and mind-body exercises to examine their impact on the brain. Rigorous randomised controlled trials are strongly recommended for a precise understanding across diverse populations, necessitating judicious interpretation of findings, robust study designs, and comprehensive assessments to unveil the multifaceted benefits of mind-body exercises.

Keywords: Mind-Body Therapies, Artificial Intelligence, Physical Activity, Exercise.

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INTRODUCTION

The mind-body exercises encompass a diverse array of therapeutic strategies such as yoga [1,2], Tai Chi, Body-Oriented Psychotherapy [3], mindfulness-based therapies/meditation [4], Feldenkrais [5], Alexander Method [6], Breath Therapy [7], and massage [3,8,9], along with mental training aimed at enhancing athletic exercise and sports performance [10-12]. These methodologies have gained prominence in the Western world [13]. While not universally intended to enhance body awareness, they have been recognised as fundamental elements or mechanisms through which they confer health benefits [14,15]. Most of these contemporary mindful exercise programs have their roots in Asian yoga and Tai Chi (TC) disciplines [14,15]. These ancient practices blend physical and spiritual elements, often deeply connected to spirituality and the natural world [14,15]. In countries like Sweden, Norway, and the Netherlands, physical therapists even offer therapeutic approaches with specific names such as Body Awareness Therapy (BAT) or Body Awareness Program (BAP) [14,15].

Mind-body exercise (MBE) and emerging approach to fitness in health management [16]. Mind-body exercise programs have increasingly gained recognition as valuable components of both individual and group fitness routines [16]. The essence of mindful exercise lies in engaging in low to moderate-intensity physical activities while maintaining a meditative and consciously aware mindset, focusing on breath control and internal focus [16]. This form of exercise is characterised by profound mental concentration, allowing practitioners to cultivate a non-judgmental awareness of their body and movements rather than focusing on external metrics, such as target heart rates or athletic performance [16]. While all levels of exercise intensity can incorporate mindful elements, less intense activities often provide greater cognitive benefits [16]. A hallmark of this practice is the attention given to breathing, proprioception (body awareness), and muscle engagement [16]. For example, although the cobra pose in Hatha Yoga may seem like a simple back extension to an outsider, a dedicated practitioner experiences a deep cognitive and kinaesthetic engagement, enhancing both physical and mental well-being [16]. Research increasingly supports the efficacy of various mindful exercise modalities in promoting diverse health outcomes [17-21]. Key findings indicate significant benefits, including a reduction in blood pressure, improved balance, diminished perception of physical pain, enhanced pulmonary function, and decreased levels of anxiety and depression [17-21]. Moreover, these techniques can be seamlessly integrated into traditional group exercises and personal training environments. As mind-body exercises continue to evolve, they are increasingly recognised as effective strategies, not only for fitness enhancement but also for disease management. The growing body of scientific literature supporting mindful exercise practices has motivated many individuals to incorporate these approaches into their health and wellness regimens.

As a result, this study aims to understand the philosophical tenets, methods, and motivations of Mind-Body Exercises, as well as the role of artificial intelligence in their practice and the extent of their effectiveness.

1. *Philosophical Tenets*

Mind-body practices constitute a category of complementary health approaches aimed at facilitating the interconnections between the brain and behaviour to enhance overall health and well-being by empowering the mind to regulate the body effectively for optimal daily functioning [22,23]. Unlike conventional physical exercise, which emphasizes bodily movements, mind-body exercises focus on synchronizing breathing, awareness of bodily sensations, and the execution of movements [24,25]. The philosophical tenets of mind-body exercise can be delineated in two primary dimensions: Theoretical Stance and Practical Implementation [25]. The theoretical stance emphasizes the integral connection between the mind and body, challenging the notion of their separation [25]. Practitioners emphasise the "integrity of self," where the mind and body are viewed as interconnected entities [25]. This perspective includes the concept of "embodiment," recognizing the body's inherent capacity for knowledge and favouring the term "self-awareness" over "body awareness" [25]. The integrity of self and the dynamics of the embodiment process significantly influence practitioners' work with patients [25]. These theoretical foundations are pivotal, as disruptions in the embodiment process can lead to tensions and distress, activating an "innate tendency to embodiment" in patients [25]. Patients frequently pursue mind-body practices to relieve pain or emotional distress; however, practitioners suggest that this conscious desire may stem from a more profound, precognitive need to restore an interrupted sense of embodiment [25]. The practical implementation of mind-body exercises exhibits fundamental similarities, particularly in their therapeutic approaches [25]. These common elements include breathing techniques, training, repetition, and sensory awareness [25]. Breathing is central to the practice, serving as a crucial instrument for practitioners to facilitate healing [25]. It serves as a key connector between the mind and body, enabling patients to reestablish their bodily awareness [25]. Through systematic practice, patients cultivate this skill to observe bodily sensations, thoughts, and emotions in the present moment [25]. Through these practices, they learn to notice, discriminate, and discuss their internal states, which is essential for achieving body-mind integration [25]. Ultimately, this transformative process promotes a sense of embodiment and integration as individuals consistently engage in mind-body exercise [25]. This alignment of body and mind is essential for enhancing overall well-being [25].

2. *Benefits of Mind-Body Exercise*

Mind-body exercises and their associated benefits can be systematically organised according to frameworks of Expressive Therapies [26]. Increasing scientific research has focused on elucidating the neurobiological and physiological mechanisms underlying the therapeutic effects of mind-body exercises, revealing diverse benefits [27]. Mind-body therapies can emphasise kinaesthetic/

sensory, perceptual/affective, or cognitive/symbolic experiences to varying degrees, thereby eliciting a spectrum of psychological and physiological responses [27].

Recent research has provided compelling evidence that mind-body exercises can enhance and promote physical and mental well-being [28-30]. These exercises have been shown to improve general cognition, executive function, learning, memory, and verbal fluency [31-33]. Additionally, they are effective in alleviating stress [34, 35], anxiety, depression, and other negative emotional states [36, 37], while also enhancing an individual's subjective well-being [38, 39]. Mind-body exercises have been shown to have a significant effect on both physical and mental health, accompanied by changes in the structure and function of specific brain regions and networks [40]. This relationship suggests that studying the effect of such exercises on brain plasticity could provide valuable insights for developing scientific interventions aimed at enhancing cognitive and behavioural health in both healthy individuals and clinical populations [41-43]. Research, including a notable study by Zhang et al (2021), has demonstrated that mind-body exercise significantly affects brain structure, neural activity, and functional connectivity, particularly in areas such as the prefrontal cortex, hippocampus, lateral temporal lobe, Insula, cingulate cortex, and key networks like the cognitive control and default mode networks [44]. These neurobiological modifications are believed to play a crucial role in the health benefits associated with mind-body exercises [44]. In a comprehensive systematic review meta-analysis conducted by Yvonne M. Y. Han and colleagues in 2023, the biological effects of mind-body exercise were examined in detail [21]. This review encompasses 34 empirical studies, while the meta-analysis analyses data from 13 functional magnetic resonance imaging studies [21]. Their findings suggest that mind-body exercise affects resting-state functional connectivity within both task-negative and attentional control networks [21]. Furthermore, research indicates that mind-body exercise leads to a change in activation patterns and functional connections in the frontal areas of the brain during various cognitive tasks [21]. Preliminary findings also suggest that engaging in short-term MBE can result in fluctuations in neural activity at rest, particularly in frontal, temporal, and hippocampal regions [21]. Notably, short-term Qigong practice has been shown to increase both cortical and subcortical grey matter volume [21]. The authors of the review recommend that future studies integrate neuropsychological assessments with neurophysiological and neuroimaging techniques to understand better the neural mechanisms underlying the effects of MBE [21].

A noteworthy umbrella review by Blomstrand and colleagues in 2023 aimed to consolidate the effects of physical exercise on cognitive functions, including global cognition, executive function, memory, attention, and processing speed, in healthy adults aged 55 or older [45]. The results suggest that aerobic and resistance exercises have a relatively modest and potentially negligible effect on cognitive functions in this age group [45]. Remarkably, mind-body exercise was found to exert a moderate impact on cognition [45]. The choice of cognitive outcomes, as well as the timing and dosage of exercise, is identified as a crucial factor influencing cognitive function and, therefore, warrants further investigation [45]. Based on these findings, it is recommended that MBE can be incorporated into the regular exercise regimens of individuals aged 55 and older to promote healthy ageing, with a particular emphasis on complementing other exercise modalities like endurance training, resistance training, and balance activities, all of which have demonstrated improvements in physical functions [45]. These findings can significantly contribute to the development of study standardisation and guidelines for the inclusion of mind-body exercises in interventions aimed at promoting healthy ageing [45]. A study conducted by Hejia Cai et.al in 2023 aimed to evaluate the clinical efficacy of physical and mental exercises on cognitive performance in middle-aged individuals with mild cognitive impairment [46]. This research incorporated 27 papers and revealed that MBE significantly improved overall cognitive function scores in the Montreal Cognitive Assessment (MoCA) and the Mini-Mental State Examination (MMSE) [46]. Additionally, it showed positive effects on executive function, mood, memory, balance, and the restoration of Tau protein and αβ1–42 protein levels to normal levels [46]. Importantly, no adverse effects associated with MBE were reported in the included review [46]. Thus, MBE appears to be a safe and effective method for enhancing cognitive function in middle-aged and older adults [46].

In a separate study conducted in 2019, Greenberg et al. explored the combination of physical activity with MBE to improve both physical and emotional well-being in a diverse cohort of patients experiencing chronic pain [47]. This study aimed to assess the effectiveness of this combined approach and evaluate its potential for sustaining improvements in emotional and physical health [47]. The study's findings have significant implications for chronic pain management and may catalyse a shift in the standards for pain assessment and treatment [47]. Furthermore, the findings advocate for the adoption of the International Classification of Functioning, Disability and Health (ICF) framework, as well as the criteria established by the Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT), within various clinical settings [47]. Notably, the research also suggests that digital activity trackers may serve as beneficial tools to reinforce chronic pain interventions [47].

Similarly, in 2020, Lining Duan et al. conducted a study aimed at evaluating the safety and effectiveness of mind-body exercises in enhancing overall quality of life and managing symptoms among survivors [48]. Their finding indicated significant positive impacts of mind-body exercises on various health parameters, including physical fitness, fatigue, sleep quality, depression, anxiety, and body mass index in this population [48]. Correspondingly, recent research has corroborated these findings by demonstrating the ability of mind-body exercise to improve sleep outcomes in cancer patients who exhibit poor sleep quality following interventions [49,50]. Zhu

and colleagues conducted an RCT in 2020 to analyse and compare changes in physical fitness and quality of life among individuals with substance use disorder (SUD) who underwent either conventional or tailor-made Mind-Body Exercises [51]. The results indicate that the Mind-Body Exercises group showed statistically significant changes in physical function and mental outcomes compared to those in the control group [51]. Additionally, the Mind-Body Exercises group demonstrated more favourable effects on BMI, systolic blood pressure, pulse rate, and PACER test results [51]. The study suggests that the Mind-Body Exercise intervention has the potential to contribute to weight control and the management of hypertension [51]. Furthermore, it can help individuals maintain their body weight, slow the decline in aerobic capacity, and reduce the risk of cardiovascular diseases [51]. This approach holds promise for enhancing the quality of life among individuals with SUD, both during and after the intervention [51]. In a prospective non-randomised pilot trial, Esch et al. (2007) evaluated Tai Chi's potential as a mind/body technique for stress reduction in 21 participants in Berlin [52]. The study assessed the effect of Tai Chi on perceived mental stress and physiological stress indicators, revealing a significant reduction in perceived mental stress following the Tai Chi intervention [52].

The study investigates the impact of Qigong on stabilising vegetative patterns, which is associated with a reduction in anxiety levels [53]. In a related study, Goldbeck et al. (2020) assessed the acute physiological impact of Qigong on heart rate variability and self-reported emotional states among 42 experienced practitioners [54]. Their findings, centred on the standardised Baduanjin Qigong exercise, indicated notable improvements in post-exercise metrics, such as subjective calmness, body activation, attentional focus, and vitality [54]. Furthermore, a study by Morgan et al. 2014, explored the effects of various mind-body exercises, including Tai-chi, Qigong, meditation, and yoga, on the immune system, specifically targeting inflammatory and antiviral responses [55]. This comprehensive analysis, comprising 34 studies, found a moderate effect of these therapies in reducing C-reactive protein (effect size = 0.35), while interleukin-6 exhibited a small and non-significant reduction (effect size = 0.35) [55]. The effects on tumour necrosis factor α were found to be negligible [55]. Additionally, mind-body exercises showed promise in enhancing virus-specific immune responses following vaccination [55]. In terms of stress-related physiological markers among students, the study was conducted, encompassing 26 interventions with a total of 1,625 participants [56]. This analysis concludes that mind-body exercise has significant effects in reducing heart rate, cortisol levels, and systolic/diastolic blood pressure, with a particularly pronounced impact observed in higher education environments [56].

3. *Integration of Artificial Intelligence (AI) in Mind-Body Exercise and Future Perspectives*

As we live in the era of Artificial Intelligence, it is essential to discuss its applications in Mind, Body, and Exercise. Recent studies have shown promising results regarding the integration of artificial intelligence with mind-body exercise regimens. AI algorithms can analyze movement patterns in real-time, providing instant feedback to individuals practicing mind-body exercises such as yoga, tai chi, and qigong. This real-time feedback enhances performance and mindfulness, leading to improved physical and mental well-being. Moreover, AI-driven virtual reality (VR) and augmented reality (AR) technologies offer immersive environments for mind-body exercises, significantly enhancing engagement and adherence to these practices. AI could create personalized programs that adapt to an individual's progress in real-time, making mind-body exercises accessible to all, including persons with disabilities.

AI in yoga, one of the essential components of MBE, is being widely utilized. Pose identification algorithms significantly enhance the precision of yoga practice by enabling accurate recognition of postures [57]. Computer vision and AI offer promising avenues for automating the assessment and evaluation of postures [57]. By tracking a person's movement and posture, AI compares it against standard prescribed postures for specific poses [57]. This comparison aids in evaluating performance and offers feedback for enhancing the posture's angle [57]. AI also recommends personalized sequences of poses to maximize the benefits of practice [57]. Furthermore, it detects irregularities in body movements that may indicate potential issues [58]. Leveraging AI, practitioners can accurately monitor their progress and receive timely feedback, thereby enhancing their practice [58]. The convergence of postures and Artificial Intelligence presents novel opportunities to enhance and democratize practice globally [58]. The Intelligent Internet of Things (IIoT), which combines machine learning and the Internet of Things (IoT), has emerged as an effective solution for detecting and monitoring postures [59-61]. With a growing number of practitioners, the integration of IIoT in yoga has led to the development of successful yoga training systems based on IIoT technology [60]. An AI-based system, aided by image processing, provides real-time feedback to practitioners even without a live instructor posture [59-61].

CONCLUSION

In conclusion, this research paper emphasises that the practice of mind-body exercises, such as yoga and meditation, are designed to enhance overall health and body awareness. Research shows that these exercises can enhance physical and mental well-being, cognitive function, and alleviate pain, anxiety, and depression. They have also been beneficial to survivors. Integrating artificial intelligence in yoga holds promise for enhancing practice and preventing injuries. Future research should explore age-related gender-specific effects and conduct comparisons between different accessory types to understand their impact on the brain. Further research studies are essential to uncover the various benefits of these MBEs.

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REFERENCES

[1] Sherman KJ, Cherkin DC, Erro J, Miglioretti DL, Deyo RA. Comparing yoga, exercise, and a self-care book for chronic low back pain: a randomized, controlled trial. Annals of internal medicine. 2005 Dec 20;143(12):849-56.

[2] Daubenmier JJ. The relationship of yoga, body awareness, and body responsiveness to self-objectification and disordered eating. Psychology of women quarterly. 2005 Jun;29(2):207-19.

[3] Price C. Body-oriented therapy in recovery from child sexual abuse: an efficacy study. Alternative therapies in health and medicine. 2005;11(5):46.

[4] Lazar SW, Kerr CE, Wasserman RH, Gray JR, Greve DN, Treadway MT, McGarvey M, Quinn BT, Dusek JA, Benson H, Rauch SL. Meditation experience is associated with increased cortical thickness. Neuroreport. 2005 Nov 28;16(17):1893-7.

[5] Ives JC. Comments on "The Feldenkrais Method®: a dynamic approach to changing motor behavior". Research Quarterly for Exercise and Sport. 2003 Jun 1;74(2):116-23.

[6] Ernst E, Canter PH. The Alexander technique: a systematic review of controlled clinical trials. Forschende Komplementärmedizin und Klassische Naturheilkunde/Research in Complementary and Classical Natural Medicine. 2003 Dec 1;10(6):325-9.

[7] Mehling WE. The experience of breath as a therapeutic intervention–psychosomatic forms of breath therapy. A descriptive study about the actual situation of breath therapy in Germany, its relation to medicine, and its application in patients with back pain. Forschende Komplementärmedizin und Klassische Naturheilkunde/Research in Complementary and Classical Natural Medicine. 2001 Jun;8(6):359-67.

[8] Smith MC, Stallings MA, Mariner S, Burrall M. Benefits of massage therapy for hospitalized patients: a descriptive and qualitative evaluation. Alternative Therapies in Health and Medicine. 1999 Jul 1;5(4):64.

[9] Kahn J. Massage Clients' Perceptions of the Effects of Massage. MTI Foundation and Massage Therapy Research Consortium. 2007.

[10] Netz Y, Lidor R. Mood alterations in mindful versus aerobic exercise modes. The Journal of psychology. 2003 Sep 1;137(5):405-19.

[11] Morgan WP, Pollock ML. Psychological characterization of the elite distance runner. Annals of the New York Academy of Sciences. 1977 Oct;301(1):382-403.

[12] Lorey B, Bischoff M, Pilgramm S, Stark R, Munzert J, Zentgraf K. The embodied nature of motor imagery: the influence of posture and perspective. Experimental brain research. 2009 Apr;194:233-43.

[13] Barnes PM, Powell-Griner E, McFann K, Nahin RL. Complementary and alternative medicine use among adults: United States, 2002. InSeminars in integrative medicine 2004 Jun 1 (Vol. 2, No. 2, pp. 54-71). WB Saunders.

[14] Ryding C, EDVARD RUDEBECK CA, Roxendal G. Assessing Body Awareness in Healthy Subjects? The First Steps Towards the Construction of the BAS-Health. Advances in Physiotherapy. 2000 Jan 1;2(4):176-82.

[15] Landsman-Dijkstra JJ, van Wijck R, Groothoff JW. The long-term lasting effectiveness on self-efficacy, attribution style, expression of emotions and quality of life of a body awareness program for chronic a-specific psychosomatic symptoms. Patient Education and Counseling. 2006 Jan 1;60(1):66-79.

[16] La Forge R. Mind-body (mindful) exercise in practice. ACSM's Health & Fitness Journal. 2016 Jul 1;20(4):6-8.

[17] Adhana R, Gupta R, Dvivedi JY, Ahmad S, Dvivedii J, Ahmad S. The influence of the 2: 1 yogic breathing technique on essential hypertension. Indian J Physiol Pharmacol. 2013 Jan 1;57(1):38-44.

[18] Haider T, Sharma M, Branscum P. Yoga as an alternative and complimentary therapy for cardiovascular disease: A systematic review. Journal of evidence-based complementary & alternative medicine. 2017 Apr;22(2):310-6.

[19] Liu X, Clark J, Siskind D, Williams GM, Byrne G, Yang JL, Doi SA. A systematic review and meta-analysis of the effects of Qigong and Tai Chi for depressive symptoms. Complementary Therapies in Medicine. 2015 Aug 1;23(4):516-34.

[20] Ospina MB, Bond K, Karkhaneh M, Tjosvold L, Vandermeer B, Liang Y, Bialy L, Hooton N, Buscemi N, Dryden DM, Klassen TP. Meditation practices for health: state of the research. Evidence report/technology assessment. 2007 Jun 1(155):1-263.

[21] Han YM, Chan MM, Choi CX, Law MC, Ahorsu DK, Tsang HW. The neurobiological effects of mind–body exercise: a systematic review and meta-analysis of neuroimaging studies. Scientific Reports. 2023 Jul 6;13(1):10948. https://doi.org/10.1038/s41598-023-37309-4.

[22] National Center for Complementary and Integrative Health. Framework for developing and testing mind and body interventions. (National Center for Complementary and Integrative Health Bethesda, 2017).

[23] Chan AS, Sze SL, Siu NY, Lau EM, Cheung MC. A Chinese mind-body exercise improves self-control of children with autism: a randomized controlled trial. PloS one. 2013 Jul 10;8(7):e68184.

[24] Hartley L. Wisdom of the body moving: An introduction to body-mind centering. North Atlantic Books; 1995 Oct 17.

[25] Mehling WE, Wrubel J, Daubenmier JJ, Price CJ,

Kerr CE, Silow T, Gopisetty V, Stewart AL. Body Awareness: a phenomenological inquiry into the common ground of mind-body therapies. Philosophy, ethics, and humanities in medicine. 2011 Nov;6:1-2.
[26] Kagin SL, Lusebrink VB. The expressive therapies continuum. Art Psychotherapy. 1978. https://doi.org/10.1016/0090-9092(78)90031-5
[27] Minton SC, Faber R. Thinking with the dancing brain: Embodying neuroscience. Rowman & Littlefield; 2016 Sep 14.
[28] Huang Y, Liu X. Improvement of balance control ability and flexibility in the elderly Tai Chi Chuan (TCC) practitioners: a systematic review and meta-analysis. Archives of gerontology and geriatrics. 2015 Mar 1;60(2):233-8.
[29] Roland KP, Jakobi JM, Jones GR. Does yoga engender fitness in older adults? A critical review. Journal of aging and physical activity. 2011 Jan 1;19(1):62-79.
[30] Zou L, Sasaki JE, Wang H, Xiao Z, Fang Q, Zhang M. A systematic review and meta-analysis of baduanjin qigong for health benefits: randomized controlled trials. Evidence-Based Complementary and Alternative Medicine. 2017 Oct;2017.
[31] Wang S, Yin H, Jia Y, Zhao L, Wang L, Chen LI. Effects of mind-body exercise on cognitive function in older adults with cognitive impairment: a systematic review and meta-analysis. The Journal of nervous and mental disease. 2018 Dec 1;206(12):913-24.
[32] Wu C, Yi Q, Zheng X, Cui S, Chen B, Lu L, Tang C. Effects of mind-body exercises on cognitive function in older adults: A meta-analysis. Journal of the American Geriatrics Society. 2019 Apr;67(4):749-58.
[33] Zhang Y, Li C, Zou L, Liu X, Song W. The effects of mind-body exercise on cognitive performance in elderly: a systematic review and meta-analysis. International Journal of Environmental Research and Public Health. 2018 Dec;15(12):2791.
[34] Chong CS, Tsunaka M, Chan EP. Effects of yoga on stress management in healthy adults: a systematic review. Alternative therapies in health and medicine. 2011;17(1):32.
[35] Rogers CE, Larkey LK, Keller C. A review of clinical trials of tai chi and qigong in older adults. Western journal of nursing research. 2009 Mar;31(2):245-79.
[36] Chan JS, Ho RT, Chung KF, Wang CW, Yao TJ, Ng SM, Chan CL. Qigong exercise alleviates fatigue, anxiety, and depressive symptoms, improves sleep quality, and shortens sleep latency in persons with chronic fatigue syndrome-like illness. Evidence-Based Complementary and Alternative Medicine. 2014 Oct;2014.
[37] Cramer H, Lauche R, Langhorst J, Dobos G. Yoga for depression: A systematic review and meta-analysis. Depression and anxiety. 2013 Nov;30(11):1068-83.
[38] Büssing A, Michalsen A, Khalsa SB, Telles S, Sherman KJ. Effects of yoga on mental and physical health: a short summary of reviews. Evidence-based complementary and alternative medicine. 2012 Oct;2012.
[39] Wang F, Lee EK, Wu T, Benson H, Fricchione G, Wang W, Yeung AS. The effects of tai chi on depression, anxiety, and psychological well-being: a systematic review and meta-analysis. International journal of behavioral medicine. 2014 Aug;21:605-17.
[40] Desai R, Tailor A, Bhatt T. Effects of yoga on brain waves and structural activation: A review. Complementary therapies in clinical practice. 2015 May 1;21(2):112-8.
[41] Schidlowski M, Stirnberg R, Stöcker T, Rüber T. Reliability of quantitative transverse relaxation time mapping with T 2-prepared whole brain pCASL. Scientific reports. 2020 Oct 27;10(1):18299.
[42] Giedd JN, Raznahan A, Alexander-Bloch A, Schmitt E, Gogtay N, Rapoport JL. Child psychiatry branch of the National Institute of Mental Health longitudinal structural magnetic resonance imaging study of human brain development. Neuropsychopharmacology. 2015 Jan;40(1):43-9.
[43] Fox MD, Snyder AZ, Vincent JL, Raichle ME. Intrinsic fluctuations within cortical systems account for intertrial variability in human behavior. Neuron. 2007 Oct 4;56(1):171-84.
[44] Zhang X, Zong B, Zhao W, Li L. Effects of mind–body exercise on brain structure and function: A systematic review on MRI studies. Brain Sciences. 2021 Feb 7;11(2):205. https://doi.org/10.3390/brainsci11020205
[45] Blomstrand P, Tesan D, Nylander EM, Ramstrand N. Mind body exercise improves cognitive function more than aerobic-and resistance exercise in healthy adults aged 55 years and older–an umbrella review. European Review of Aging and Physical Activity. 2023 Aug 9;20(1):15. https://doi.org/10.1186/s11556-023-00325-4
[46] Cai H, Zhang K, Wang M, Li X, Ran F, Han Y. Effects of mind-body exercise on cognitive performance in middle-aged and older adults with mild cognitive impairment: A meta-analysis study. Medicine. 2023 Aug 25;102(34):e34905. https://doi.org/10.1097/MD.0000000000034905
[47] Greenberg J, Lin A, Zale EL, Kulich RJ, James P, Millstein RA, Shapiro H, Schatman ME, Edwards RR, Vranceanu AM. Development and early feasibility testing of a mind-body physical activity program for patients with heterogeneous chronic pain; the GetActive study. Journal of Pain Research. 2019 Dec 11:3279-97. DOI: 10.2147/JPR.S222448
[48] Duan L, Xu Y, Li M. Effects of mind-body exercise in cancer survivors: a systematic review and meta-analysis. Evidence-Based Complementary and Alternative Medicine. 2020 Oct;2020. https://doi.org/10.1155/2020/7607161
[49] Kreutz C, Schmidt ME, Steindorf K. Effects of physical and mind–body exercise on sleep problems during and after breast cancer treatment: a systematic

review and meta-analysis. Breast cancer research and treatment. 2019 Jul 15;176:1-5.
[50] Takemura N, Cheung DS, Smith R, Deng W, Ho KY, Lin J, Kwok JY, Lam TC, Lin CC. Effectiveness of aerobic exercise and mind-body exercise in cancer patients with poor sleep quality: A systematic review and meta-analysis of randomized controlled trials. Sleep Medicine Reviews. 2020 Oct 1;53:101334.
[51] Zhu D, Jiang M, Xu D, Schöllhorn WI. Long-term effects of mind-body exercises on the physical fitness and quality of life of individuals with substance use disorder—a randomized trial. Frontiers in psychiatry. 2020 Dec 18;11:528373. https://doi.org/10.3389/fpsyt.2020.528373
[52] Esch T, Duckstein J, Welke J, Braun V. Mind/body techniques for physiological and psychological stress reduction: Stress management via Tai Chi training–a pilot study. Medical Science Monitor. 2007 Nov 1;13(11):CR488-97.
[53] Matos LC, Sousa CM, Gonçalves M, Gabriel J, Machado J, Greten HJ. Qigong as a traditional vegetative biofeedback therapy: long-term conditioning of physiological mind-body effects. BioMed research international. 2015 Jun 7;2015. https://doi.org/10.1155/2015/531789
[54] Goldbeck F, Xie YL, Hautzinger M, Fallgatter AJ, Sudeck G, Ehlis AC. Relaxation or regulation: The acute effect of mind-body exercise on heart rate variability and subjective state in experienced Qi Gong practitioners. Evidence-Based Complementary and Alternative Medicine. 2021 Oct;2021. https://doi.org/10.1155/2021/6673190
[55] Morgan N, Irwin MR, Chung M, Wang C. The effects of mind-body therapies on the immune system: meta-analysis. PloS one. 2014 Jul 2;9(7):e100903. https://doi.org/10.1371/journal.pone.0100903
[56] Strehli I, Burns RD, Bai Y, Ziegenfuss DH, Block ME, Brusseau TA. Mind–body physical activity interventions and stress-related physiological markers in educational settings: A systematic review and meta-analysis. International journal of environmental research and public health. 2021 Jan;18(1):224. https://doi.org/10.3390/ijerph18010224
[57] Mishra, P. Yoga with AI. International Research Journal of Engineering and Technology, 2022; 9(8):40-42.
[58] Verma P, Sharma R, Rajput NS. Enhancing Yoga Practice through Real-time Posture Detection and Correction using Artificial Intelligence: A comprehensive Review. NeuroQuantology. 2023;21(6):1053.
[59] Pal R, Adhikari D, Heyat MB, Ullah I, You Z. Yoga meets intelligent internet of things: recent challenges and future directions. Bioengineering. 2023 Apr 9;10(4):459.
[60] Balakrishnan S., Shriya S., Srajana., Vaishnavi N., Kavitha C. The AI yoga trainer using artificial intelligence and machine learning. International Journal of Creative Research Thoughts, 2023; 11(1):a319-a322.
[61] Nikam D A., Gharge H., Minchekar V., Todakar A., Patil S. Yoga mentoring using AI. International Research Journal of Modernization in Engineering Technology and Science, 2022; 4(6):3304-3313.