

Impact of Structured Yoga Intervention on Musculoskeletal Health among Working Adults

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ABSTRACT

Repetitive, abnormal, continuous actions and postures are the cause of musculoskeletal discomfort and pain at work. In work environments, yoga therapy is helpful for pain and impairment. The present study aimed to evaluate the impact of a structured yoga intervention on musculoskeletal pain, perceived stress, sleep quality, and quality of life among working adults. The participants were divided into three categories: sedentary people (less than 150 minutes per weekly), physically active non-yoga practitioners, and normal yoga practitioners (at least three classes per weekday). In comparison to the sedentary subjects, the physically active and yoga-practicing groups had significantly higher QoL scores across all dimensions, according to one-way ANOVA and Pearson correlation ($p < 0.01$). Furthermore, the yoga practitioners had improved mental and social well-being, suggesting that yoga had greater benefits for mental health than general physical activity. Both the degree of regular physical activity and overall quality of life ($r = 0.61$) and the rate of yoga practice and psychological health ($r = 0.68$) showed a significant positive link, according to the correlation analysis. The findings highlight the need of implementing yoga and exercise programs systematically as part of a workplace good health initiative to lower stress levels, increase productivity, and improve people's general well-being. The study emphasizes the need for a policy-based approach that encourages active lifestyles in order to improve the mental health and quality of life of India's increasingly urbanizing working class.

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1. INTRODUCTION

Globally [1], musculoskeletal issues continue to be the primary cause of missed work. This includes MSK issues related to work-related musculoskeletal disorders, also known as work-associated musculoskeletal disorders (WRMSDs or MSDs), which are linked to poor occupational ergonomics and physiological exposures or psychosocial dangers at work. It also includes MSK issues related to lifestyle behaviors, illnesses, and injuries that people bring to work with them [2].

According to data from the EU-28 labor force survey, the percentage of people in the EU who self-reported having MSDs increased from 54.2% in 2007 to 60.1% in 2013; no more information is currently available. MSDs have the greatest influence on an organization's total health care expenses in the US and Canada (53%), followed by carcinoma (47%) [3], hypertension (44%), and heart disease failure/heart disease (32%). Approximately 40% of all lost-time job accidents in the US are caused by MSDs. WRMSDs comprise 40% and 38% of all lost-time complaints in Canada and Ontario (2018), thereby making them the most common type of lost-time work illness.

MSDs alone cost Canada's economy \$25.6 billion annually, of which \$13.9 billion comes from productivity losses. The Ontario government claims that because of employee absences and reduced efficiency [4], MSDs cost Ontario businesses tens of billions of pounds. When an employee has an MSD, extra indirect costs include extra and substitute pay, gear and workstation adjustments, administrative expenses, replacement worker education costs, and worse production quality. According to the global burden of Disease survey, 20% to 33% of individuals worldwide suffer with a painful MSK disease, making it the second largest cause of disability worldwide [5]. Approximately 120 million individuals in Europe alone suffer from a chronic MSK problem.

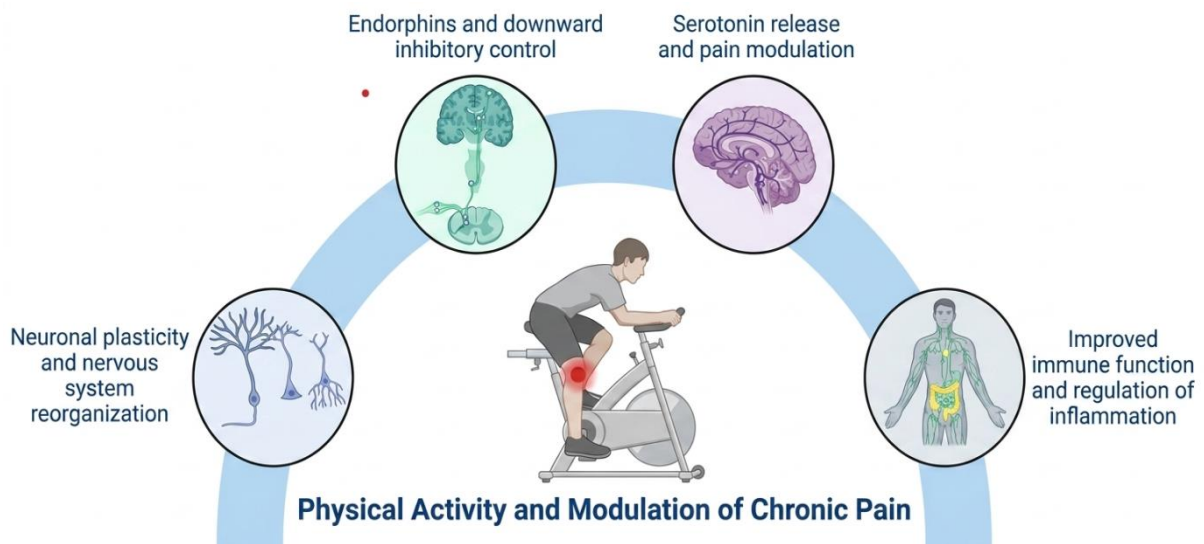


Figure 1. An Overview of the Advantages of Exercise for Managing Chronic Pain

Figure 1 summarizes the primary ways that exercising can reduce chronic pain [7]. It's crucial to remember that certain of these processes may not be completely established in people with chronic pain, despite preclinical investigation supporting them. Tumor inflammatory factor- α , interleukin-6, and interleukin-8 are higher in fibro patients, according to recent research. Serum levels of IL-6 and IL-8 are substantially correlated with the severity of the disease. Similarly, elevated intra-articular markers of acute injury are linked to peripheral sensitivity in knee osteoarthritic patients, whereas indicators of cartilage degradation and persistent inflammation are linked to central sensitization. In this regard, exercise can enhance immune system performance, which is crucial for controlling inflammatory conditions [6]. Exercise affects the immune response by releasing exercise, which are signals made by different bodily tissues sufferers with knee osteoarthritis may have vascular and intra-articular anti-inflammatory benefits from physical exercise, while fibromyalgia sufferers may experience an immune-modulating response marked by a reduction in pro-inflammatory mediators, particularly IL-8. Lastly, exercise lowers oxidative

stress and enhances mitochondrial activity, both of which are important components in the persistence of ongoing inflammation.

"Those that last more than 12 weeks [8], such as persistent back pain or chronic upper limb ailment, as well as rheumatic illnesses, degenerative illnesses like arthritis or vascular disease, or non-specific pain disorders categorized as chronic" is the definition of chronic MSK terms used in this chapter. As a result, while the term "chronic MSK disorders" refers to a wide range of physical signs as well as various illness outcomes, common symptoms include pain, exhaustion, weariness, and occupational restrictions. People with MSK problems also frequently have co-morbidities and multimorbidities [9], such as depression, diabetes, and cardiovascular illness. All of this has an effect on people's quality of life as well as societies, with potential economic repercussions of up to 2% of the EU's GDP.

2. LITERATURE REVIEW

We examined the cross-sectional associations between WA and mental requirements, physical exertion at work, firm grip, and upper extremity musculoskeletal discomfort, as well as the associations between these factors and WA 11 years later. We used a dataset from a future cohort study with 157 workers from an engineering plant. Tests and written inquiries on job pressures, skeletal condition [10], WA score (WAS; 0–10), and physical and mental WA were used to survey the cohort. Logistic regression modeling and Spearman correlated coefficients were employed. We discovered weak associations between gripping power and current and prospective physical WA among manual laborers. Among the instruction manual workers, we were unable to identify any indicators of future poor WA.

We discovered a significantly unfavorable correlation between musculoskeletal discomfort and both physical WA and present WAS among ordinary employees. This will look at how the workforce has changed since 2000, how employment affects chronic MSK illnesses and how we might support individuals with these disorders in continuing to work. Since 2000, there has been little professional action to reduce exposure to dangers, despite an improvement in our understanding of the causes of WRMSDs [11]. People of all ages have reported MSK issues; hence a life cycle strategy is required. Occupational safety and health (OSH) protection is thought to have decreased concurrently with changes in how individuals work and an increase in the formalization of work agreements. A risk management strategy and adherence to applicable safety, health, and diversity laws are necessary for keeping employees with MSK issues at work. Finding additional sources of support and maintaining open lines to communicate at work are also essential.

A structured textual analysis was carried out. We used phrases associated with lifestyle and persistent pain to search MEDLINE/PubMed, Embase, and Systematic Reviews. Included were observational research, systematic examinations, narrative evaluations, and randomized controlled tests that reported on the relevant themes. The findings were summarized and given a narrative description [12]. Exercise enhances analgesia, fosters mental toughness, and lessens the gratification response linked to addictive habits like smoking by releasing neuromodulatory substances such opiates, neurotransmitters, dopamine, and norepinephrine. While melatonin modulation encourages circadian synchronisation and deeper sleeping phases, its actions on the hypothalamic-pituitary-adrenal system decrease cortisol levels. Additionally, exercise helps regulate hunger and energy balance by improving insulin sensitivity and changing hormones like ghrelin and leptin. These systems facilitate an all-encompassing strategy for managing chronic pain.

In accordance with PRISMA guidelines, a thorough systematic review was carried out. A thorough search of databases was conducted to find pertinent research. Studies involving kids and teenagers getting LY treatments and reporting results pertaining to mental wellness, cognitive abilities [13], or physical well-being were among the eligibility requirements. Independent reviewers carried out the data collection and study selection. The variety among the research led to a narrative synthesis of the results. There were found to be six relevant studies. Research indicates that LY may relieve anxiety in kids with high-functioning autism spectrum disorder and lessen attachment and nonspecific anxiety in school-age youngsters. Other possible advantages include increased verbal working memory, better gross motor abilities, and higher emotional well-being (less despondency, isolation, and academic burnout). Nevertheless, there is a dearth of data due to the wide range of study creates, treatments, and outcomes metrics.

To find research on yoga therapies and the efficacy of yoga in individuals with the illnesses, a thorough database search was conducted. This study compiled and integrated evidence of yoga's efficacy and found intervention studies that employed both randomised and non-randomized controlled tests [14]. Thirty-one intervention studies that satisfied the inclusion criteria were found through literature searches and incorporated into this review. According to the evaluated research, yoga intervention is relatively practicable and is probably going to be just as effective as exercise or standard treatment in lowering pain and the need for painkillers. Numerous studies have methodological flaws, including sample size, the absence of trustworthy sham controls, and the failure to blind researchers to treat and non-treatment categories.

In addition to introducing and promoting yoga as a medical discipline among dentists for the prevention and management of work-related skeletal disorders, the paper presents several notions and theories that the authors have established and refined. We discuss everything from meditation/concentration science [15], interoceptive focus, self-awareness, mind-body connection, and receptive mood to stretching out utilizing the vinyāsa method (breath-driven movement) and inward-focused concentration. Tensegrity skeletal tissue structures join, draw together, and approach the bone sections where they are fixed, according to the premise that "muscles are bones ties".

The purpose of this study is to quantitatively evaluate the influence of workplace yoga treatments on workers' work-related stress in a methodical manner. Clinical studies contrasting workplace Eligibility was determined by comparing yoga therapies to control groups and measuring felt stress as a result [16]. Every type of yoga was taken into account for the analysis. Six studies with 266 practising individuals were incorporated in the meta-analysis out of the 3392 that were first found. 221 participants in the control group were evaluated versus yoga interventions at the workplace. Studies that were included revealed "some limitations." Regarding various areas where bias may arise. The total effect size of the yoga treatment in lowering stress outcome metrics was -0.67 , according to quantitative analysis. Therefore, office yoga treatments were more successful in managing work-related stress than no treatment at all.

3. METHODS AND MATERIALS

3.1 Musculoskeletal Health

Grip strength and musculoskeletal complaints were used to implement skeletal wellness. "Do you presently feel pain, hurting numbness, or stiffness in the next body region?" was used to gauge musculoskeletal issues for each body region in 1997 and 2008. A hand dynamometer was used to determine a hand's maximum grasping force in 1997 and 2008. A laboratory-developed

handle with a digital amplification unit and a Bofors tension gauge bridge was used to measure the maximal static grasping force at base. A Jamar® hand dynamometer was used for evaluations in 2008 [17]. The methods used for assessment were similar. The subject was placed with their wrist erect, elbow at a 90-degree angle, and underarm backed by the table surface. Then, beginning with dominant hand, they were told to grab the handle three times with each hand at ten-second intervals. In this investigation, the maximal grip strength (N) was employed.

3.2 Exercise and Quitting Smoking

Individuals with persistent pain are more likely to have been identified with nicotine dependency and to remain active smokers throughout their lives. Additionally, smoking has been linked to both chronic broad pain and an increased likelihood of recurrent episodes of chronic pain, according to future studies. Furthermore, smokers typically have more afflicted areas and more intense pain, which may be caused by malfunctioning endogenous pain modulation systems [18]. Fitness and strenuous activity are particularly successful non-pharmacological methods of lowering tobacco usage. Exercise significantly reduces cigarette smoking in non-chronic pain groups in the short term, particularly during the treatment period, according to a meta-analysis. This is because exercise causes behavioral and lifestyle modifications that are influenced by affective, physiologic, and cognitive aspects.

Exercise dramatically lowers smoking pleasure and cravings in those without chronic pain by lessening the psychological benefits of smoking, pleasant airway feelings, and withdrawal signs. Additionally, it lessens anxiety and sadness and enhances self-efficacy, managing, and restful sleep. Exercise replaces the rewarding benefits of smoke and counteracts addictive habits by physiologically stimulating the production of dopamine, which activates neural the incentive system and endorphins. Additionally, exercise raises serotonin levels, controls the emission of GABA [19], an inhibitory neurotransmitter that lowers anxiety, and modifies glutamate levels, neurotransmitters that's over excitation exacerbates withdrawal signs. In conclusion, exercise is suggested as a possible tactic to assist individuals with chronic pain in giving up smoking and improving their health by increasing neuronal rewards, easing withdrawal signs, and lowering anxiety. However, more research is needed to see whether the encouraging results from people with non-chronic pain can be applied to those with constant discomfort.

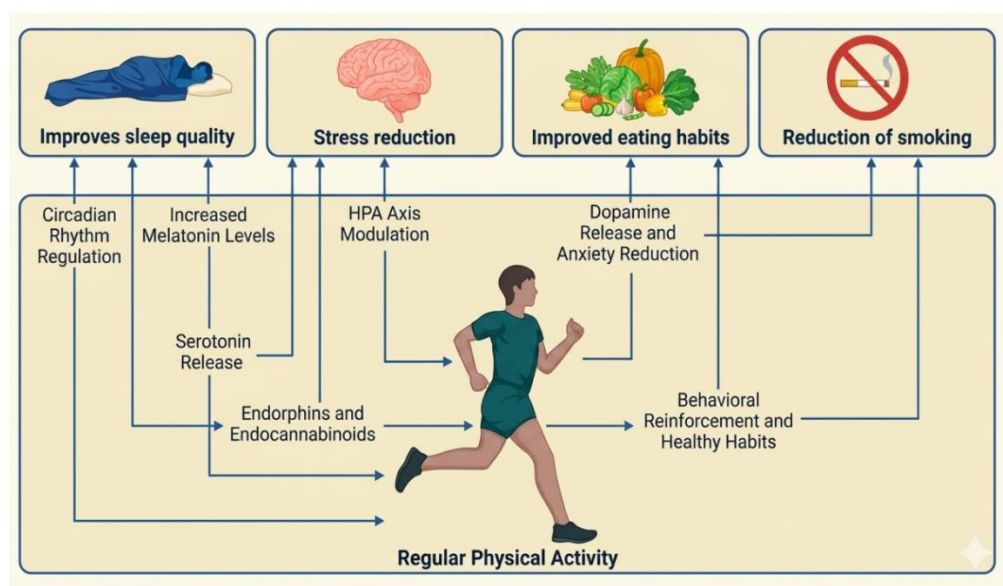


Figure 2. Proposed Framework Illustrating the Impact of Structured Exercise on Healthy Lifestyle Behaviors and Persistent Musculoskeletal Discomfort

Figure 2 shows the Proposed Framework Illustrating the Impact of Structured Exercise on Healthy Lifestyle Behaviors and Persistent Musculoskeletal Discomfort.

3.3 Doing yoga when under stress

Yoga (prana, breathing exercises, and mindfulness) enhances consciousness and self-control while promoting serenity and mindfulness. Hatha yoga, which consists solely of yoga poses and little to no exercise, regulates cardiac balance, reduces HPA axis dysfunction, and promotes homeostasis by accelerating stress recovery [20]. A 10-week Hatha yoga treatment significantly reduced stress and anxiety and improved calm in a research including 131 people with low to regulate stress levels. Another study found that 90-minute Hatha yoga sessions significantly lowered cortisol, titers, and negative affect. The allostatic burden of the stress reaction is lessened by yoga. Heart rate, oxygen intake, and the high-frequency part of heart rate variability all show that it improves parasympathetic response and decreases sympathetic activation in stressful situations.



Figure 3. Yoga helps to Improve Various Health Parameters Related to Immunity

Yoga practitioners can improve their self-awareness and coping skills, as well as cultivate a good attitude when under stress as shown in Figure 3. It was determined to be a successful strategy for reducing melancholy in a meta-analysis. Yoga has been shown in numerous trials to lower depression and enhance mood and cognitive abilities in individuals with mild to regulate melancholy. This is accomplished by improving the function of the HPA axis, raising serotonin and brain-derived neurotrophic factor (BDNF) levels [21], and lowering cortisol and inflammatory markers. Both anxiety and depression are characterized by circulatory malfunction; frequent pranayama yoga practice can help restore autonomic balancing by reducing sympathetic hyperactivity and increasing parasympathetic functions. Additionally, yoga improves the the aminobutyric system, which is linked to depression and anxiety.

4. IMPLEMENTATION AND EXPERIMENTAL RESULTS

4.1 Demographic Features

The study included 420 employed individuals in the city between the ages of 25 and 50, with a mean age of 36.2-6.8 years [22]. 52% of them had worked over nine hours a day and 64% commuted more than an hour a day, demonstrating the highly inactive nature of their working habits, which is typical of urban employment markets. The sample size was broad, with about equal numbers of men and women. Respondents from a variety of industries, including banking, IT, medical care, and higher education, were included, providing an accurate representation of the metropolitan community. These demographic trends highlight the existence of lengthy workdays and little free time, which are frequently linked to low levels of exercising and poor mental wellness in today's workforce.

4.2 Physical exercise, yoga, and quality of life ratings

According to a study on exercise patterns, 32% of individuals regularly practiced yoga, 41% were energetic but did not practice yoga, and 27% were inactive. Each of the four WHOQOL-BREF domains showed significant variations between groups. In terms of physical health (81.4 ± 8.2), mental wellness (84.2 ± 7.5), social interaction (80.1 ± 8.4), and economic contentment, the yoga group had the highest mean scores. The sedentary group had the lowest overall quality-of-life results ($p < 0.01$ in all comparisons), while the bodily active and medium-score intervals were linked to the physically active group. These findings confirm that regular yoga or physical exercise practice is strongly associated with better quality of life, particularly in high-level experts [23]. It is important to recognize that the effect sizes ($\eta^2 > 0.14$) are large in terms of association and that leading an active lifestyle contributes significantly to both energy and psychological equilibrium.

4.3 A correlation and Clarification

The contemplative and attentive aspects of yoga probably promote self-awareness, emotional equilibrium, and tranquility, all of which improve quality of life in the social and psychological domains.

Table 1. Comparing Activity Groups' Quality-of-Life (QoL) Category Scores

QoL Domain	Yoga Group (Mean $\pm$ SD)	Physically Active Group (Mean $\pm$ SD)	Sedentary Group (Mean $\pm$ SD)	F-value	p-value	Effect Size (η^2)
Physical Health	81.4 $\pm$ 8.2	75.3 $\pm$ 7.6	68.1 $\pm$ 9.4	52.31	< 0.001	0.19
Psychological Well-being	84.2 $\pm$ 7.5	77.6 $\pm$ 8.1	70.4 $\pm$ 9.2	57.62	< 0.001	0.21
Social Relationships	80.1 $\pm$ 8.4	74.9 $\pm$ 7.8	69.5 $\pm$ 8.9	48.15	0.002	0.17
Environmental Satisfaction	78.3 $\pm$ 7.2	73.1 $\pm$ 6.8	67.8 $\pm$ 8.1	43.84	0.004	0.16
Overall QoL Score	81.0 $\pm$ 7.8	75.2 $\pm$ 7.6	68.9 $\pm$ 8.9	—	< 0.01	—

However, traditional physical exercise seems to have a higher positive impact on both physical and environmental problems by boosting endurance, decreasing fatigue, and promoting active commuting as shown in Table 1.

The results support earlier research that demonstrated yoga can integrate mental health and overall functionality [24]. The relatively low QoL scores of the immobile respondents further indicate the need to develop workplace wellness initiatives, such as yoga, ergonomic programs, and incentives to exercise, in order to mitigate the harmful health consequences of activity in the urban environment.

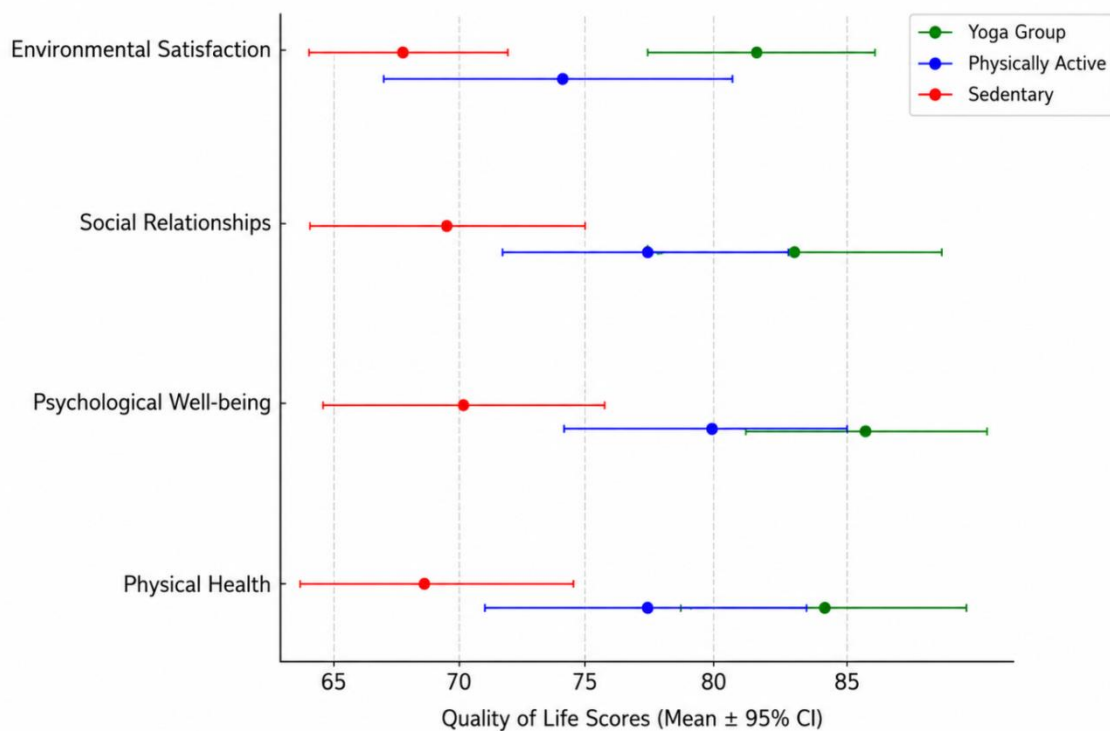


Figure 4. Forest Plot of Quality of Life Domain Scores for Yoga Practitioners, Physically Active Individuals, and Sedentary Urban Professionals

Furthermore, the correlational analyses showed a strong and positive association between the time frame of practicing yoga and mental wellness ($r = 0.78$, $p < 0.002$) and between total activity level and a greater standard of life ($r = 0.62$, $p < 0.02$). These findings confirm that yoga is a unique contribution to social and spiritual happiness in addition to the physical advantages of consistent exercise as show in Figure 4.

5. CONCLUSION

The highest level of mental and social wellbeing was reported by yoga practitioners, which emphasizes the special significance that mindfulness and mindbody integration have in lowering stress at work. These findings demonstrate how the holistic approach associated with yoga can enhance not only physical wellness but also psychological harmony, coping skills, and self-regulation—all of which are critical in a stressful urban setting. However, regular moderate exercise demonstrated significant usefulness to the body's vitality and positive attitudes toward the surroundings, which supports the importance of an active life in mitigating the detrimental effects of sedentary job behavior.

In summary, research suggests that frequent work-based physical activity wellness initiatives that include structured yoga sessions may have significant positive effects on staff engagement, efficiency, and mental wellness. Therefore, in order to foster a sustained atmosphere of well-being, such activities ought to be incorporated into the organizations' occupational health policy. The establishment of combined yoga-exercise programs might also be discussed by the health-care authorities as a way to enhance the work and reduce the likelihood of lifestyle-related illness in urban populations. Future longitudinal and interventional research is recommended to establish causal relationships and evaluate the long-term impacts of integrated wellness practices on professional quality and performance of life.

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