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The Effectiveness of Mindfulness-Based Therapy on Treatment Adherence and Health Anxiety in Patients with Non-Alcoholic Fatty Liver Disease

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ABSTRACT

The aim of the present study was to determine the effectiveness of mindfulness-based therapy on treatment adherence and health anxiety in patients with non-alcoholic fatty liver disease. This study was a quasi-experimental design with pretest-posttest and a control group. The statistical population included all patients with non-alcoholic fatty liver disease in Tehran in 2024. From this population, 30 individuals were selected using convenience sampling and randomly assigned to two groups (15 in the experimental group and 15 in the control group). The measurement instruments included the Morisky Medication Adherence Scale (MMAS, 2008) and the Health Anxiety Questionnaire (HAQ-18, 2002). The experimental group underwent mindfulness-based therapy in eight weekly sessions of 90 minutes each, while the control group received no intervention. Data were analyzed using multivariate analysis of covariance (MANCOVA). The results of the analysis indicated that, after controlling for pretest scores, there was a significant difference at the 0.05 level between the experimental and control groups in posttest scores of treatment adherence and health anxiety. It is concluded that mindfulness-based therapy is effective in improving treatment adherence and reducing health anxiety in patients with non-alcoholic fatty liver disease.

Keywords: Health anxiety, treatment adherence, mindfulness-based therapy.

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Introduction

Non-alcoholic fatty liver disease (NAFLD) has emerged as one of the most common chronic liver conditions worldwide, representing a major public health concern due to its strong association with obesity, metabolic syndrome, diabetes, and cardiovascular morbidity (1). As diagnostic methods advance, particularly with the development of fluorescent probes and molecular imaging technologies, the detection of NAFLD at earlier stages has improved, providing new opportunities for clinical interventions (1). At the

same time, nutritional strategies and functional food supplements, such as flaxseed powder, have demonstrated positive effects in improving liver function, reducing fat accumulation, and alleviating systemic inflammation among NAFLD patients (2). Furthermore, emerging pharmacological and nutraceutical treatments, including synergistic polyphenol-based therapies, highlight the multifactorial approaches needed to manage NAFLD in modern healthcare systems (3).

While biomedical advances are essential, patient outcomes in NAFLD are highly dependent on psychosocial and behavioral factors, particularly treatment adherence and health-related anxiety. Treatment adherence refers to the degree to which patients follow medical recommendations, dietary changes, physical activity regimens, and prescribed medication schedules (4). Inadequate adherence has been associated with poor clinical outcomes, reduced quality of life, and increased risk of disease progression in many chronic conditions (5). For instance, in populations with HIV and tuberculosis, poor adherence to therapeutic regimens significantly diminishes treatment efficacy, while psychosocial and structural interventions, such as telemedicine support or nutritional aid, have shown effectiveness in enhancing adherence (6-8). Within the NAFLD population, the challenge of adherence is compounded by the requirement for substantial lifestyle modifications, which demand high levels of motivation and consistency (9).

Research indicates that adherence is not merely a behavioral outcome but also a psychological process influenced by factors such as therapeutic alliance, self-efficacy, cultural context, and mental health status (10, 11). Patients with chronic illnesses often struggle with maintaining adherence due to fatigue, emotional distress, stigma, or limited access to supportive resources (6, 11). In this regard, the integration of psychological therapies targeting emotional regulation, motivation, and mindfulness has been proposed as a pathway to reinforce adherence and improve long-term outcomes (5).

Parallel to the issue of adherence, health anxiety represents another critical factor in the management of NAFLD. Health anxiety is defined as a persistent and excessive worry about one's health, often accompanied by misinterpretations of bodily sensations as indicators of serious illness (12). Elevated health anxiety has been linked to maladaptive behaviors such as unnecessary medical consultations, avoidance of healthcare, or conversely, neglect of actual medical advice (13). During recent public health crises, such as the COVID-19 pandemic, health professionals and the general public exhibited heightened levels of health anxiety, which directly affected their stress levels and coping strategies (14, 15). In children and adolescents, health anxiety demonstrates developmental and intergenerational patterns, further underscoring its long-term psychological implications (16).

Given these challenges, mindfulness-based interventions (MBIs) have gained increasing attention as effective psychological treatments for enhancing adherence and reducing health anxiety. Mindfulness-based cognitive therapy (MBCT), mindfulness-based stress reduction (MBSR), and related approaches aim to cultivate awareness, acceptance, and non-judgmental attention to the present moment (17). Research has demonstrated that mindfulness not only improves mental health outcomes but also enhances cognitive flexibility, emotional regulation, and adaptive coping (17, 18). For example, MBCT has been shown to reduce depressive symptoms in adults with high levels of recurrence risk, with systematic reviews affirming its efficacy across randomized controlled trials (19). Furthermore, mindfulness-based therapies have shown promise in clinical populations with generalized anxiety disorder, demonstrating that past trauma does not negate the potential effectiveness of these interventions (20).

In addition to clinical populations, mindfulness interventions have been extended to educational and professional contexts. Studies among clinical psychology students show that mindfulness-based therapy improves emotional intelligence and self-awareness, thereby supporting professional development (18). Similarly, in higher education settings, mindfulness-based cognitive approaches are considered transformative, promoting knowledge integration, wisdom, and life-long resilience (17). These findings underline the broad applicability of mindfulness beyond traditional psychiatric contexts, making it a viable adjunct in chronic medical conditions such as NAFLD.

The mechanisms through which mindfulness enhances adherence and reduces health anxiety are multifaceted. By fostering a non-reactive awareness of bodily sensations, mindfulness reduces catastrophic misinterpretations that fuel health anxiety (12, 13). By improving self-regulation, attention, and emotional resilience, mindfulness supports patients in maintaining adherence to demanding treatment regimens (5, 9). Moreover, digital and blended mindfulness interventions, especially those supported by human guidance, have been shown to significantly improve depression, well-being, and adherence, thereby offering scalable solutions for chronic disease management (21). Emerging research also suggests that neuroscience-informed mindfulness programs, combined with behavioral economics and mobile health applications, can enhance patient engagement and adherence in digital health contexts (22).

Health systems worldwide are increasingly acknowledging the importance of integrating psychological therapies like mindfulness into chronic disease management. For instance, studies on tuberculosis and HIV highlight that psychosocial support combined with biomedical treatment is critical for adherence (6, 8). In NAFLD, where medical treatment alone may be insufficient without behavioral compliance, mindfulness may serve as an essential complementary therapy (2, 3). Additionally, mindfulness can address the emotional burden of NAFLD patients, who often experience shame, stress, and health anxiety due to the lifestyle implications of their condition (15).

Cross-disciplinary perspectives further strengthen the rationale for mindfulness in NAFLD management. For example, psycho-neuroimmunological frameworks highlight the connection between psychological states, immune functioning, and chronic disease outcomes (5). Health communication studies emphasize that exposure to alarming health messages without psychological coping resources can exacerbate anxiety, particularly in vulnerable populations (13). Likewise, global health research underscores that cultural and social determinants must be considered in promoting adherence and reducing psychological barriers (11). These insights converge on the notion that interventions like mindfulness, which address both psychological and behavioral processes, can play a pivotal role in bridging biomedical and psychosocial aspects of chronic disease care.

The present study builds upon this growing body of research by examining the effectiveness of mindfulness-based therapy on treatment adherence and health anxiety in patients with non-alcoholic fatty liver disease. While prior research has demonstrated the potential of acceptance and commitment therapy for improving adherence in NAFLD patients (9), little is known about the direct role of mindfulness-based interventions in this specific population. Furthermore, although MBCT and related therapies have been extensively studied in psychiatric and educational settings (17, 19, 20), their application in chronic metabolic conditions such as NAFLD remains underexplored. This study addresses this gap by assessing whether

mindfulness-based therapy can improve adherence behaviors and alleviate health anxiety among NAFLD patients, thereby contributing to both the psychological and medical management of the disease.

Methods and Materials

Study Design and Participants

The present study employed a quasi-experimental design with a pretest-posttest and control group. The statistical population consisted of individuals with non-alcoholic fatty liver disease who, through a public call, referred to the Talieh Salamat Clinic in Tehran in 2024. From this population, 30 individuals were selected using non-random convenience sampling (based on the G*Power 3 software and considering the parameters: effect size = 0.36; alpha coefficient = 0.05; test power = 0.95). The sample size for each of the experimental and control groups was set at 15, making the total sample size 30. Thus, in this study, two groups of 15 participants each were selected, and their assignment to the experimental and control groups was done randomly.

Inclusion criteria included patients aged 35 to 55 years with non-alcoholic fatty liver disease diagnosed by an internal medicine specialist, the ability to participate in therapy sessions, no history or current diagnosis of acute psychosis (diagnosed based on clinical evaluations), and providing informed consent for participation. Exclusion criteria included absence in more than two sessions, incomplete completion of questionnaires, withdrawal from participation, lack of commitment to intervention practices, and simultaneous involvement in other counseling or psychotherapy programs.

The procedure was as follows: after selecting the sample group based on the inclusion criteria, the questionnaires were administered. Subsequently, mindfulness-based therapy was delivered at the Talieh Salamat Clinic in Tehran, which was equipped with appropriate facilities and educational resources. All participants who agreed to cooperate completed the questionnaires in groups at both pretest and posttest stages, with no time limitation for completion. The intervention consisted of mindfulness-based therapy conducted in 8 group sessions, each lasting 90 minutes and held once a week.

From an ethical standpoint, participants were assured that no personal or family information would be collected, and that all information provided would remain strictly confidential and safeguarded by the researcher.

Data Collection

Treatment Adherence (MMAS). The Morisky Medication Adherence Scale was designed and published by Morisky et al. in 2008. This questionnaire was specifically developed to assess treatment adherence among patients, with the aim of improving medication management and increasing physicians' awareness of patients' potential difficulties. It consists of 8 self-report items rated on a 5-point Likert scale (0 = never to 4 = always). Morisky et al. (2008) reported the validity coefficient of this instrument as $r = 0.56$ and its reliability using Cronbach's alpha as 0.91. In Iran, the questionnaire was validated by Ghanei Qeshlaq et al. in 2015, reporting a Cronbach's alpha of 0.72 and a content validity index of 0.74 (Ourki et al., 2021). The Cronbach's alpha reported in the present study was 0.91.

Health Anxiety (HAQ-18). The short form of this questionnaire, with 18 items, was developed by Salkovskis and Warwick in 2002. It includes two subscales: items 1–14 measure the likelihood of illness, and

items 15–18 measure the consequences of illness. Each item is rated on a 4-point Likert scale from 0 to 3. Higher scores indicate greater health anxiety. The test-retest reliability with a one-week interval was reported as 0.90, and its convergent validity, assessed through correlation with the Illness Belief Questionnaire, was 0.63 (Salkovskis et al., 2002). Internal consistency using Cronbach's alpha was reported as 0.59 for general health worry, 0.60 for likelihood of illness, and 0.70 for illness consequences, indicating acceptable reliability. Furthermore, construct validity confirmed the presence of three factors —likelihood of illness, illness consequences, and general health worry—as fit indices (CFI, AGFI, GFI) were above 0.80, demonstrating excellent model fit in factor analysis (Yousefi Salkadeh et al., 2023). The Cronbach's alpha reported in the present study was 0.88.

Intervention

In the present study, the intervention was based on Kabat-Zinn's mindfulness-based therapy protocol (1992), administered in eight weekly sessions of 90 minutes each for the experimental group. The structure of the program began with an introduction to mindfulness, orientation to the sessions, and home assignments. In the second session, participants practiced meditation and body scan exercises, along with applying mindfulness to a daily activity. The third session emphasized awareness through the senses, deep breathing, and mindfulness in unpleasant events. The fourth session focused on seated meditation with attention to breathing, bodily sensations, and thoughts, as well as stress management. In the fifth session, seated meditation and mindfulness practice during adverse events were introduced. The sixth session included the three-minute breathing space and four distinct meditation practices. In the seventh session, participants practiced four-dimensional meditation and cultivated awareness of any experience entering consciousness in the present moment. Finally, the eighth session involved a body scan, review of prior sessions and home practices, addressing participants' questions, and formally concluding the intervention.

Data analysis

For data analysis, multivariate analysis of covariance (MANCOVA) was used with the assistance of SPSS software version 26.

Findings and Results

The mean age reported for the research sample by group was 44.8 ± 4.53 for the experimental group and 45.4 ± 5.89 for the control group. The minimum age of participants in this study was 35, and the maximum age was 55. Furthermore, given that the significance level was greater than 0.05, there was no significant difference between the two groups, indicating that they were homogeneous in terms of age. The results of the descriptive findings of the study at the three stages for both groups are presented in Table 1.

Table 1. Descriptive Indices of Treatment Adherence and Health Anxiety in the Two Groups at Pretest and Posttest

Variable	Group	Pretest M	Pretest SD	Posttest M	Posttest SD
Treatment adherence	Experimental	17.3	1.39	20.1	1.35
	Control	16.4	2.13	17.4	2.14
Health anxiety	Experimental	18.6	1.44	12.06	2.84
	Control	19.4	1.12	17.1	0.915

As shown in Table 1, the mean scores of treatment adherence and health anxiety for the intervention and control groups are presented. As can be seen, the mean values of these two variables between the groups in the pretest phase did not show considerable differences; however, after the intervention, the experimental group demonstrated significant improvements compared to the control group.

To assess the equality of covariance matrices, Box's M test was conducted. The results for the study variables (Box's M = 13.3, F = 1.96, $p > 0.06$) showed that the significance level of the obtained F was greater than 0.05. This result indicates that the assumption of homogeneity of covariance matrices was confirmed. Furthermore, homogeneity of variances for treatment adherence (F = 1.26, $p > 0.05$) and health anxiety (F = 0.531, $p > 0.05$) was reported, confirming the assumption of homogeneity of variances. Another important assumption of multivariate analysis of covariance is the homogeneity of regression slopes. With the significance level obtained ($p < 0.01$) for the interaction between group × pretest scores on treatment adherence (F = 27.3, $p = 0.01$) and health anxiety (F = 17.6, $p = 0.01$), this assumption was not supported. However, this violation can be addressed by adopting a stricter alpha level (using $\alpha = 0.025$ instead of $\alpha = 0.05$). Given that the assumptions of multivariate analysis of covariance were sufficiently met, the use of this test was permissible. Therefore, to test the study hypotheses, multivariate analysis of covariance (MANCOVA) was performed.

Table 2. Results of Wilks' Lambda in Multivariate Analysis of Variance

Test	Value	F	Effect df	Error df	Sig.	Eta²
Pillai's Trace	0.935	76.01	4	21	0.001	0.935
Wilks' Lambda	0.065	76.01	4	21	0.001	0.935
Hotelling's T²	14.4	76.01	4	21	0.001	0.935
Roy's Largest R	14.4	76.01	4	21	0.001	0.935

The Wilks' Lambda index obtained for the study variables (F = 76.01, $p < 0.001$) was significant at the level of $p < 0.01$. Accordingly, it can be stated that at least one of the dependent variables, treatment adherence or health anxiety, differed significantly between the experimental and control groups. To further investigate these differences, ANCOVA was conducted within the framework of MANCOVA on the posttest scores. The results are presented in Table 3.

Table 3. Results of ANCOVA for Posttest Scores of Study Variables

Source of Variation	Variable	Sum of Squares	df	Mean Squares	F	Sig.	Partial Eta²
Group	Treatment adherence	83.9	1	83.9	423.7	0.001	0.817
	Health anxiety	1653.7	1	1653.7	116.4	0.001	0.959
Error	Treatment adherence	18.7	26	0.721			
	Health anxiety	71.1	26	2.73			
Total	Treatment adherence	129440	30				
	Health anxiety	67676	30				

As shown in Table 3, the results of ANCOVA revealed that, after controlling for the pretest, there was a significant difference between the experimental and control groups in terms of treatment adherence (F = 423.7, $p = 0.001$) and health anxiety (F = 116.4, $p = 0.001$). In other words, mindfulness-based therapy had a significant effect on treatment adherence and health anxiety. Considering the reported partial eta squared, it can be concluded that 81.7% of the variance in treatment adherence differences and 95.9% of the variance in health anxiety differences between the experimental and control groups were attributable to the effect of the independent variable, mindfulness-based therapy.

Discussion and Conclusion

The purpose of this study was to investigate the effectiveness of mindfulness-based therapy on treatment adherence and health anxiety in patients with non-alcoholic fatty liver disease (NAFLD). The findings demonstrated that participants who received mindfulness-based therapy significantly improved in both adherence to treatment regimens and reduction of health anxiety when compared to the control group. Specifically, after controlling for pretest scores, patients in the intervention group reported higher scores in adherence behaviors and lower levels of anxiety related to health. These findings are consistent with the theoretical underpinnings of mindfulness-based approaches, which emphasize cultivating present-moment awareness, acceptance of bodily sensations, and emotional regulation, thereby reducing avoidance and enhancing compliance with health-promoting behaviors (17, 20).

The improvement in treatment adherence observed in the present study aligns with earlier evidence that psychological and behavioral interventions can significantly influence patients' compliance with medical regimens. Adherence is a multidimensional construct, shaped by patients' cognitive, emotional, and social resources (4). Studies in populations with tuberculosis and HIV have shown that psychosocial support interventions such as nutritional programs, counseling, and digital adherence tools enhance treatment engagement and reduce dropout rates (6-8). Similarly, in the current study, mindfulness-based therapy provided patients with skills to observe urges and distractions without acting on them, to tolerate discomfort, and to regulate emotions, all of which likely contributed to improved adherence to the complex lifestyle and medical demands of NAFLD. These findings are in line with previous results demonstrating that acceptance and commitment therapy improved treatment adherence among NAFLD patients in Iran (9), confirming that interventions rooted in mindfulness principles may hold a particularly strong utility in this clinical population.

In addition to adherence, the significant reduction in health anxiety among patients receiving mindfulness-based therapy supports previous findings linking mindfulness interventions with improved psychological well-being. Health anxiety has been described as a maladaptive preoccupation with illness, often maintained by catastrophic misinterpretations of bodily symptoms and heightened vigilance to health-related cues (12). In this study, the decline in health anxiety may be explained by mindfulness techniques encouraging patients to approach bodily sensations with curiosity and non-judgment rather than fear. This interpretation is consistent with the findings of Otmar and Merolla (13), who showed that exposure to alarming health information without coping strategies can intensify anxiety in vulnerable populations. By contrast, mindfulness cultivates tolerance for uncertainty and helps patients decouple their emotional reactions from intrusive health-related thoughts.

The results are also consistent with recent developmental and contextual studies on health anxiety. For instance, cross-generational research has indicated that health anxiety often has roots in family modeling and early stress exposure (16). During the COVID-19 pandemic, elevated anxiety among health professionals in Ghana was closely related to poor coping resources (14). Similarly, in Iranian populations, irrational health beliefs and maladaptive locus of control were shown to predict higher COVID-related anxiety (15). The reduction of health anxiety in our participants highlights the capacity of mindfulness to counteract these maladaptive beliefs by reinforcing a grounded, present-focused mindset, thus offering a culturally and contextually relevant intervention across different populations.

Importantly, the effectiveness of mindfulness observed in the present study is consistent with global literature highlighting the versatility of mindfulness-based approaches. Tang and colleagues (20) demonstrated that mindfulness-based cognitive therapy (MBCT) is effective for generalized anxiety disorder, even when childhood trauma moderates outcomes. Similarly, Kaiser et al. (19) provided systematic evidence that MBCT consistently reduces depressive symptoms in adults across randomized controlled trials. The present findings extend this literature to NAFLD patients, suggesting that mindfulness has transdiagnostic benefits that go beyond psychiatric conditions to include chronic physical illnesses requiring long-term self-regulation. This argument is further reinforced by Deroche et al. (17), who emphasized that mindfulness training fosters the transformation of information into knowledge, wisdom, and life application, outcomes that resonate strongly with the behavioral changes needed in NAFLD management.

Another noteworthy finding is that mindfulness-based therapy may indirectly influence clinical outcomes in NAFLD by promoting healthier lifestyle choices. Research shows that dietary modifications, such as flaxseed powder supplementation, and nutraceutical approaches using polyphenols can substantially ameliorate NAFLD progression (2, 3). However, these interventions require strict adherence and sustained motivation. By reducing anxiety and fostering adherence, mindfulness may act as a behavioral facilitator for these biomedical strategies. This integrative perspective suggests that NAFLD treatment requires both medical and psychological interventions, with mindfulness serving as a bridge to ensure that patients sustain recommended health practices.

The role of digital and blended interventions in adherence and mindfulness is also relevant to interpret our findings. Zheng et al. (21) showed that digital mindfulness-based programs are effective in reducing depression and enhancing well-being, particularly when supplemented with human support. Likewise, Minen et al. (22) demonstrated that neuroscience education therapy combined with digital navigators improved treatment adherence in migraine patients using mobile health applications. Although the present study employed a face-to-face intervention, the growing evidence base on digital mindfulness programs underscores the scalability of these approaches for NAFLD patients, who may benefit from continuous, remote support.

The improvement of adherence in the present study also resonates with cross-cultural findings on adherence in chronic disease management. Kamote et al. (6) highlighted the importance of social and contextual factors influencing adherence among adolescents with HIV. Negash et al. (11) reported similar themes among African immigrant and refugee women navigating prenatal healthcare in Canada, where cultural barriers, systemic inequalities, and psychological stress influenced treatment adherence. These studies suggest that adherence is not simply a matter of willpower but is deeply embedded in psychosocial contexts. The positive impact of mindfulness in this study can therefore be understood as providing patients with psychological tools to navigate these contexts more effectively, enhancing resilience and motivation despite external challenges.

Additionally, the findings resonate with broader psycho-neuroimmunological frameworks, which highlight the interplay between psychological states, immune functioning, and chronic disease (5). By reducing stress and health anxiety, mindfulness-based therapy may indirectly modulate immune responses and inflammatory pathways implicated in NAFLD, thereby offering benefits beyond behavioral change. This

interpretation underscores the importance of integrating psychological interventions into holistic medical care for chronic illnesses.

The present study also complements regional and cultural research on mindfulness and therapy. In Iran, for example, Farhadi Navroud et al. (23) found that mindfulness-based therapy was more effective than cognitive-behavioral therapy in reducing negative automatic thoughts in students preparing for competitive exams, suggesting that mindfulness has unique strengths in modifying maladaptive cognitive processes. Similarly, Yurayat et al. (18) demonstrated that mindfulness training improved emotional intelligence in clinical psychology students, highlighting its role in cultivating adaptive interpersonal and intrapersonal skills. These findings, together with the present study, indicate that mindfulness is both contextually adaptable and universally beneficial across populations.

Taken together, the current results confirm that mindfulness-based therapy is a promising and effective intervention for improving adherence and reducing health anxiety among patients with non-alcoholic fatty liver disease. By aligning with previous research across diverse populations and conditions, this study contributes new evidence to the growing recognition of mindfulness as a transdisciplinary therapeutic approach. Beyond its psychological benefits, mindfulness supports long-term disease management by fostering compliance with medical and lifestyle regimens, reducing maladaptive anxiety, and promoting overall well-being.

This study, despite its significant findings, has several limitations that should be acknowledged. First, the sample size was relatively small (30 participants), which may restrict the generalizability of the results to the broader NAFLD population. Second, the study employed a convenience sampling strategy, which introduces the possibility of selection bias and limits representativeness. Third, the study design was quasi-experimental, and while random assignment was used, the lack of longitudinal follow-up prevents conclusions about the long-term sustainability of the observed improvements. Additionally, the reliance on self-report questionnaires may have been influenced by social desirability bias or limited self-awareness, particularly in measuring adherence behaviors. Finally, cultural and contextual variables specific to the Iranian healthcare environment may limit the transferability of findings to other regions without further replication.

Future studies should expand on these findings by employing larger, more diverse samples and randomized controlled trial designs to enhance internal and external validity. Longitudinal studies are recommended to assess whether improvements in adherence and reductions in health anxiety are maintained over time, particularly given the chronic and progressive nature of NAFLD. Researchers should also explore the integration of digital mindfulness-based interventions, which may provide scalable and cost-effective approaches for ongoing patient support. Additionally, incorporating physiological biomarkers and clinical endpoints, such as liver enzyme levels or imaging assessments, would strengthen the evidence for the biomedical impact of mindfulness-based therapies. Comparative studies evaluating mindfulness against other established psychological interventions, such as cognitive-behavioral therapy or acceptance and commitment therapy, would also provide valuable insights into relative efficacy and contextual suitability.

In practice, healthcare providers should consider integrating mindfulness-based interventions into comprehensive care plans for patients with NAFLD. Training medical staff in mindfulness principles and offering structured group programs in clinical settings could provide patients with essential coping and self-

regulation skills. Furthermore, embedding mindfulness practices into patient education sessions may enhance motivation and engagement with prescribed treatments. Collaboration between psychologists, dietitians, hepatologists, and primary care providers will be critical to ensure that mindfulness interventions are seamlessly aligned with dietary, pharmacological, and lifestyle management strategies. By adopting a multidisciplinary approach, healthcare systems can address both the medical and psychological dimensions of NAFLD, improving patient outcomes and quality of life.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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