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Original Article

Evaluating the Impact of a Digital Integrative Medicine Assistant with Holistic Coaching in Inflammatory Bowel Disease

Guillaume Bonnaud[1], Katia A Henry[2], Nathalie Feuche[3], Audrey Arlix[4], Najima Bouta[5], Clémentine Moulin[6], Caroline Fine[7,8], Sailish Honap[9], Laurent Peyrin-Biroulet[10], Karl J Neeser[10], Nyan Linn[10]

[1]Clinique Ambroise Paré, 31000 Toulouse, France. Clinique de Valère,1950 Sion, Switzerland
[2]International Society for Applied Preventive Medicine, I-GAP, Munich, Germany
[3]209 boulevard Pereire,75017 Paris. CHU Louis Mourier,92700 Colombes, France
[4]Clinique Rive Gauche, 31000 Toulouse, France
[5]Clinique Montréal, 11090 Carcassonne, France
[6]Hopital Nord, APHM, Obstetrics and Gynecology Department 13015 Marseille, France
[7]Clinique de l'infirmerie Protestante de Lyon, 69300 Caluire et Cuire, France
[8]Department of Gastroenterology, St George's University Hospital, London UK
[9]Department of Gastroenterology, CHRU Nancy, INSERM NGERE, Université de Lorraine, F-54500 Vandœuvre-lès-Nancy, France
[10]College of Public Health Science, Chulalongkorn University Bangkok, Thailand

Correspondence

Dr Guillaume Bonnaud
Department of Gastroenterology and Hepatology, Clinique Ambroise Pare, 31000 Toulouse, France.

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Keywords

Inflammatory bowel disease, quality of life, digital health, holistic care, nutrition, physical activity, stress management..

Abstract

Introduction: *Inflammatory bowel disease (IBD) requires patient-centered care beyond pharmacological therapy. DOCLIVI, a holistic digital assistant integrating nutrition, physical activity, and stress–emotion regulation with personalized coaching, was developed to promote lifestyle modification in IBD. This study evaluated its impact on quality of life and behavioral indicators of health.*

Methods: *This prospective, single-arm, multicenter study enrolled patients with Crohn's disease or ulcerative colitis on stable biologic therapy. Participants used the DOCLIVI app, which included three programs (nutrition, physical activity/sedentary lifestyle, and stress–emotion regulation), and attended three personalized video coaching sessions over six months. Outcomes included the IBD Disk (quality of life and functional disability), PSS-10 (stress), and behavioral questionnaires assessing nutrition, physical activity (RICCI & GAGNON), sedentary lifestyle, sleep, circadian rhythm, connection to nature, and social-emotional well-being.*

Results: *Forty-one patients were included; 34 completed the program (mean age 35.5 years, 28 women). IBD Disk scores improved significantly (55.8 → 37.1; mean difference = 18.7; $p < 0.001$; Cohen's $d = 1.01$), with 40% achieving satisfactory quality of life (score < 40). Improvements were observed in 9 of 10 domains, including anxiety, fatigue and sleep. Healthy eating habits improved (+0.97; $p = 0.010$), physical activity increased by 23.6% ($p = 0.043$), and contact with nature rose from 58.8% to 76.5% ($p = 0.014$). Adherence and satisfaction were high, with 65% of participants achieving their goals.*

Conclusion: *Digital holistic care combining lifestyle modules and personalized coaching significantly improved quality of life and lifestyle behaviors in IBD patients. Sustained engagement may enhance long-term benefits.*

Introduction

Inflammatory bowel disease (IBD) is a chronic, progressive, and debilitating disorder of the gastrointestinal tract that includes two main phenotypes: ulcerative colitis (UC) and Crohn's disease (CD). Both are characterized by an exaggerated mucosal immune response to luminal antigens, resulting in sustained inflammation [1,2]. The pathogenesis of IBD is multifactorial, involving genetic susceptibility, dysregulated immune responses, and environmental factors. Its rising global prevalence and associated healthcare burden highlight the need for advances in diagnosis and, particularly, management [3].

Despite therapeutic advances, only a minority of patients with IBD achieve deep remission, and nearly half continue to experience impaired quality of life, particularly due to fatigue and functional limitations [4]. In response, many seek complementary approaches, often lacking robust scientific validation [5]. While drug therapies are essential for controlling inflammation, they rarely address quality of life in the absence of active disease, except in cases complicated by psychiatric comorbidities.

Targeted interventions focusing on nutrition, physical activity, stress management, and sleep have shown benefits in patients with IBD [5]. However, these dimensions are interrelated and are rarely assessed within a holistic, integrative

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framework, despite the potential for synergistic effects on well-being and disease outcomes. While some academic centers have piloted such multidisciplinary approaches, their implementation is often complex, resource-intensive, and difficult to scale beyond specialized settings [6].

The emergence of digital tools opens up new perspectives: they allow the dissemination of scientifically validated information, support therapeutic education, and promote behavior change, while reducing human resource requirements. It provides evidence-based information and integrates practical tools to facilitate personalised behaviour change [7]. Platforms such as MyIBDcoach have demonstrated the value of remote monitoring in improving adherence and reducing hospitalizations [8]. However, most of these solutions are limited to symptom monitoring, without systematically integrating lifestyle and overall well-being dimensions. To date, no study has evaluated the impact of a digital coaching system specifically designed for integrative health in IBD.

Doclivi is a digital integrative medicine assistant combined with personalized coaching, designed to address unmet needs in IBD management. The platform integrates three key pillars of holistic health - nutrition, adapted physical activity, and emotional regulation - to support sustainable behavior change. The primary objective of this study was to evaluate the effectiveness of Doclivi in improving quality of life for patients with IBD, with the broader goal of promoting holistic remission and enhancing patient care. Secondary objectives included assessing changes in nutritional habits, physical activity, sedentary behavior, perceived stress, connection to nature, circadian rhythm, sleep, and overall well-being, as well as patient adherence to and satisfaction with the program.

Methods

Study design and settings

This prospective, single-arm observational study was conducted between February and October 2024 in an outpatient clinical setting in four centers specializing in IBD - two centers in Toulouse, one center in Lyon, and one center in Carcassonne. The protocol combined in-person and remote components, including self-administered questionnaires, virtual coaching, and mobile app use, under clinical supervision.

Eligibility Criteria

1diac or renal failure, or planned surgery within six months. Participation in another clinical trial, or any medical or psychological condition judged by the investigator to interfere with participation, also led to exclusion.

Digital Health Program

The digital health program was delivered through the Doclivi application developed by Livodoc Sarl, which included modules on nutrition, physical activity, and stress and emotion regulation, presented in text, video, and podcast formats with motivational features to support adherence. Program content was personalized using the exposome questionnaire, and participants also engaged in three individualized one-hour video-coaching sessions delivered by trained coaches to ensure standardized techniques. These sessions addressed movement and circadian rhythm regulation (including sleep–wake cycles, meal timing, light exposure, and activity patterns), nutritional guidance based on the Mediterranean diet with reduced intake of ultra-processed foods, and emotional regulation strategies to enhance self-awareness, coping skills, and overall well-being. The physical activity module includes nine different programs based on the patient's level of sedentary lifestyle and physical activity. The stress and emotion regulation module offers breathing techniques, cardiac coherence, and MBSR-type mindfulness meditation exercises.

Study Procedures

At baseline, participants completed the exposome questionnaire and the IBD-Disk. They then received free access to the Doclivi mobile application and were scheduled for three remote coaching sessions via video conference.

The sequence in which the digital application programs were introduced was tailored to each patient during the initial consultation, based on an analysis of responses to a pre-consultation online questionnaire that evaluated dietary habits, physical activity and sedentary behavior, and perceived stress. Three remote coaching sessions were planned over a six-month follow-up period. The proposed schedule comprised an initial session around week 3, a second approximately four weeks later, and a third around week 12. However, the exact timing of each session was adjusted individually based on patient availability to enhance adherence to the program.

The first session (week 3) focused on verifying proper use of the digital platform and providing education on maintaining a regular circadian rhythm. The second session (week 7) offered guidance on adopting a Mediterranean-style diet, while the third session (week 12) provided support for emotional regulation and stress management. At the six-month follow-up, participants repeated the baseline assessments and completed a satisfaction questionnaire evaluating their experience with the program.

Outcome Measures

Primary Outcome: The primary outcome was quality of life, assessed using the IBD-Disk tool, which employs visual analogue scales to evaluate fatigue, sleep quality, interpersonal relationships, stress, mood, body image, self-esteem, and extra-digestive joint pain [10]. Scores were collected at baseline and at the 6-month follow-up to look for an improvement from baseline.

Secondary Outcomes: Secondary outcomes included perceived stress, measured with the Perceived Stress Scale (PSS-10) [11], and changes in dietary behaviors assessed with a structured questionnaire. Sedentary behavior and physical activity were evaluated using the Ricci and Gagnon questionnaire [12] (supplementary material). Additional outcomes included nature connection, circadian rhythm, sleep, and overall well-being, captured through a pre-developed questionnaire. All secondary outcomes were measured at baseline and follow-up.

Data Collection

Data were collected at baseline (inclusion visit) and at the six-month follow-up. At both time points, participants completed the exposome questionnaire and the IBD-Disk, along with additional instruments assessing stress, dietary behavior, physical activity, and psychosocial well-being. At follow-up, participants also completed a satisfaction questionnaire regarding their experience with the digital program. All data were collected electronically and managed securely in accordance with ethical and confidentiality standards.

Statistical analyses

Descriptive statistics were used to summarize subject characteristics, including means and standard deviations for continuous variables, and frequencies and percentages for categorical variables.

Paired sample t-tests were conducted to assess within-subject changes from pre- to post-program for normally distributed continuous outcomes, including IBD-Disk domain scores, total symptom burden, and measures of well-being such as energy levels, sleep quality, and self-image. For continuous data with non-normal distribution, Wilcoxon signed-rank tests were applied as non-parametric alternatives. Effect sizes were calculated using Cohen's d to quantify the magnitude of observed changes, interpreted according to standard thresholds (small ≥ 0.2, medium ≥ 0.5, large ≥ 0.8).

To account for potential confounding variables, mixed-effects linear regression models were employed for continuous outcomes. These models included fixed effects for time (pre/post), age, gender, and body mass index (BMI), and random intercepts to account for repeated measures within individuals. For binary outcomes and categorical variables (e.g., eating habits, physical activity status), McNemar's tests were performed to compare paired proportions. Additionally, panel logistic regression models with robust standard errors clustered at the individual level were used to estimate odds ratios and 95% confidence intervals, adjusting for relevant covariates including age, gender, and BMI.

All statistical analyses were conducted with a two-sided significance level of $p < 0.05$ considered statistically significant. Data were analyzed using Stata 17.0 (StataCorp, College, Station, TX, USA).

Results

Study Population

A total of 56 patients were screened by recruiting physicians across three centers. Fifteen did not respond to the invitation for the inclusion visit, leaving 41 participants enrolled who completed the baseline assessments between February and October 2024. At this visit, participants completed the exposome questionnaire and the IBD-Disk [10], and were provided free access to the Doclivi application. Additionally, three visio-coaching sessions were scheduled as part of the program. Over the course of follow-up, seven participants were lost: five became unresponsive, one experienced internet access issues, and one was involved in a car accident. Ultimately, 34 participants completed the full 6-month program, including the end-of-study visit, during which they repeated the exposome questionnaire and IBD Disk and completed a satisfaction questionnaire. Among those who completed the study, 28 were women (82%) and 6 were men (18%).

Baseline Characteristics

As described in Table 1, participants (n = 34) had a mean age of 35.5 years (Standard deviation: SD 8.4), ranging from 22 to 57 years, with a median of 36 years. The average weight was 68.0 kg (SD 20.2), and height averaged 1.65 m (SD 0.08). The mean BMI was 24.8 kg/m² (SD 6.9), 73.5% are normal weight and 26.5% are overweight. Most participants were female (82.4%), with 17.6% male. These characteristics are not measured again after the program.

***Table 1**. Baseline characteristics of participants (n = 34)*

Characteristic	Total (n = 34)
Age (years)	
Mean (Standard deviation)	35.5 (8.4)
Median (Interquartile Range)	36 (30–38)
Range	22–57
Weight (kg)	
Mean (Standard deviation)	68.0 (20.2)
Median (Interquartile Range)	62 (56–76.7)
Range	47–134
Height (m)	
Mean (Standard deviation)	1.65 (0.08)
Median (Interquartile Range)	1.645 (1.60–1.69)
Range	1.49–1.90
BMI (kg/m²)	
Mean (Standard deviation)	24.8 (6.9)
Median (Interquartile Range)	22.6 (21.05–27.03)
Range	18.8–49.8
Normal (<25)	25 (73.5)
Overweight (≥ 25)	9 (26.5)
Gender	
Female	28 (82.4%)
Male	6 (17.6%)

Changes in Primary Outcome (IBD Disk/ Quality of Life)

As described in Figure 1, total symptom scores showed a significant reduction post-program (mean difference = 18.74, $p < 0.001$; Cohen's d = 1.01), indicating a large and clinically meaningful improvement across multiple health domains.

In the sub-domain analyses (Figure 2), significant improvements were observed. Joint pain decreased with mean difference (MD) = 1.03, $p = 0.046$, and effect size (d) = 0.32, as did abdominal pain (MD = 1.68, $p < 0.001$, d = 0.57) and defecation difficulties (MD = 1.56, $p = 0.028$, d = 0.50). Social life (MD = 1.44, $p = 0.013$, d = 0.53) and professional functioning (MD = 1.71, $p = 0.002$, d = 0.58) also showed significant improvements. For well-being and function, sleep quality improved (MD = 1.91, $p < 0.001$, d = 0.66), along with

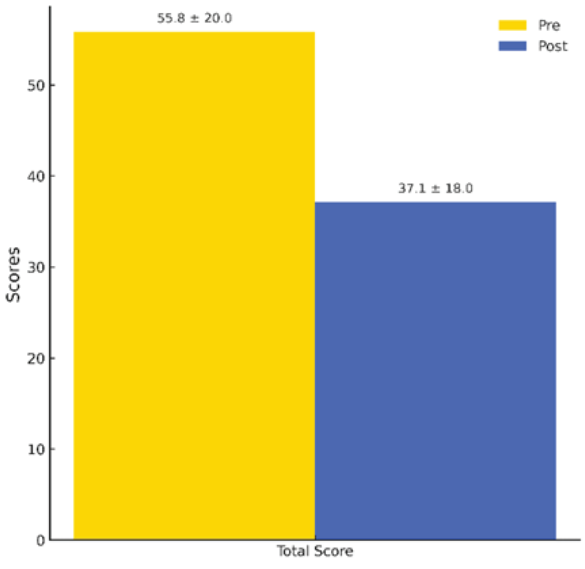

***Figure 1.** Changes in primary outcome before and after intervention*

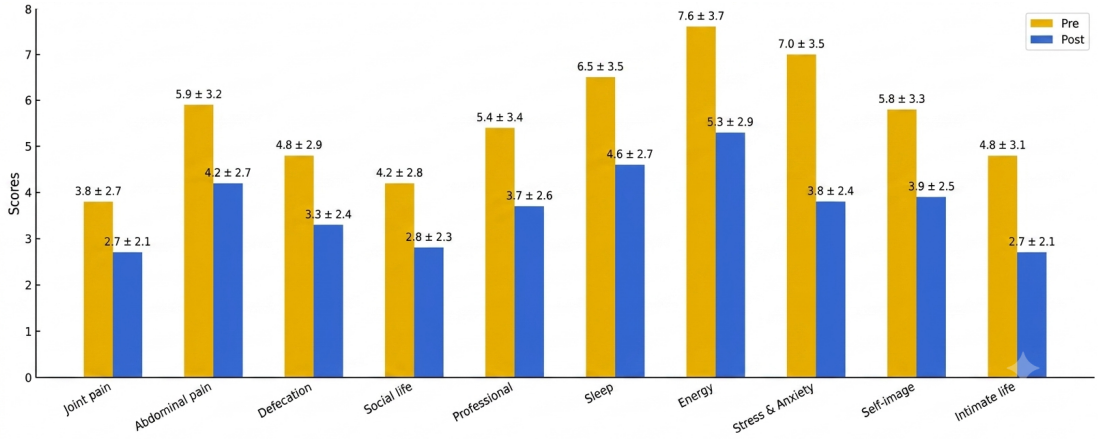

Figure 2. *Changes in symptoms and functional domains before and after the intervention, as measured by the IBD-Disk*

energy levels (MD = 2.32, p < 0.001, d = 0.91). Stress and anxiety decreased markedly (MD = 3.24, p < 0.001, d = 1.31). Self-image (MD = 1.82, p < 0.001, d = 0.71) and intimate life (MD = 2.03, p < 0.001, d = 0.73) both demonstrated significant improvements. Details are described in Supplementary Table 1.

After adjusting for age, gender, and BMI, the program was associated with statistically significant improvements across most symptoms and function domains. The largest effect was observed in the Total Score (regression coefficient: b = -18.74, p < 0.001), indicating a substantial overall reduction in symptom burden (Supplementary Table 2).

As described in Supplementary Table 3, 73.5% of participants had impaired QoL (IBD disk score > 40) while 26.5% had satisfactory QoL (IBD disk score ≤ 40) before the program. After the program, the proportion was 50% for impaired and satisfactory QoL, respectively. It means that the proportion of satisfactory QoL is higher after the program. This difference is significant with p=0.021 by MaNemar's test. In addition, logistic regression also revealed that after the program, participants are 2.89 times more likely to have satisfactory QoL (95% CI: 1.21-6.89).

Changes in Perceived Stress Scale (PSS-10) Scores Pre- and Post-Program

There was a slight reduction in mean PSS-10 scores following the program (Pre: 21.12 ± 3.27; Post: 20.59 ± 5.46), with a mean difference of 0.53 points (95% CI: –1.64 to 2.70; p = 0.623). This difference was not statistically significant, and the effect size was small (Cohen's d = 0.12), indicating a negligible practical effect. The mixed-effects regression, adjusted for age, gender, and BMI, also showed no significant association in PSS-10 scores after the program (b = –0.53, 95% CI: –2.59 to 1.53; p = 0.615) as shown in Supplementary Table 4.

As shown in Supplementary Figure 1, the distribution of stress symptom frequency shifted following the program. Reports of "never" experiencing stress increased from 51 to 78, while "almost never" changed minimally (16 to 18). Moderate-level reports ("sometimes") declined from 77 to 53, and "fairly often" decreased from 149 to 124. In contrast, "very often" remained stable (146 vs. 150), indicating persistent high-intensity stress in a subset of participants.

Changes in Good Eating Habit Scores Pre- and Post-Program

As shown in Supplementary Table 5, the mean good eating habit score increased from 5.32 ± 1.89 to 6.29 ± 1.45 (p = 0.010; mean difference = –0.97, 95% CI: –1.78 to –0.16; Cohen's d = 0.58), indicating a moderate-to-large improvement. Regression analysis confirmed this effect (β = 0.97, 95% CI: 0.47–1.47, p < 0.001). The median also rose (5.5 to 6.5), and the range narrowed (2–9 to 4–9), reflecting more consistent healthy eating practices. Details of changes in eating habits from pre- to post-program are described in Supplementary Table 6.

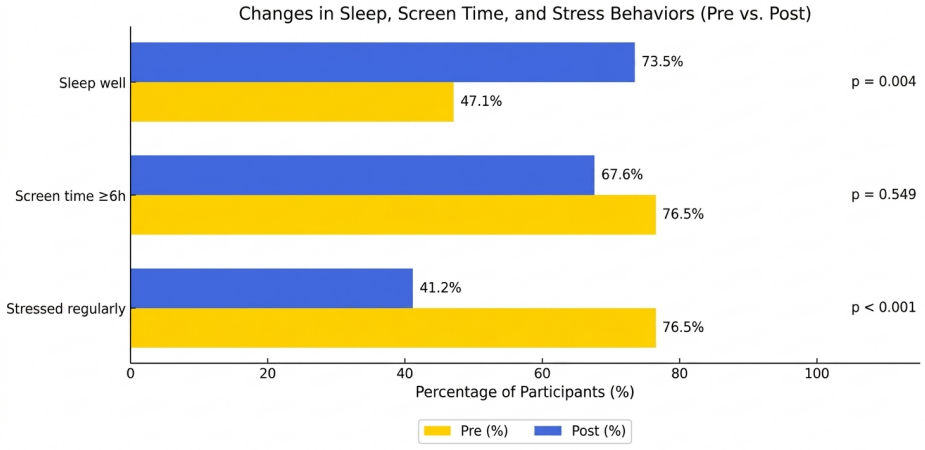

Figure 3. *Changes in Sleep, Screen Time, and Stress Behaviors Following Intervention*

Changes in Sleep, Screen Time, and Stress Behaviors Before and After the Program

Following the program, adequate sleep increased from 47.1% to 73.5% (p = 0.004; OR = 3.64, 95% CI: 1.68–7.92), while no significant change was seen in ≥6 hours of daily screen time (76.5% to 67.6%; p = 0.549). Regular stress decreased markedly from 76.5% to 41.2% (p < 0.001; OR = 0.20, 95% CI: 0.09–0.46) (Figure 3). Details are described in Supplementary Table 7.

Changes in Behavioral Outcomes

Supplementary Table 8 and Supplementary Figure 2 & 3 presents changes in behavioral outcomes across several items. Following the program, physical activity increased from 55.9% to 79.4% (p = 0.021; OR = 3.37, 95% CI: 1.23–9.25), indicating participants were over three times more likely to be physically active post-program. Contact with nature rose from 58.8% to 76.5% (p = 0.014; OR = 2.34, 95% CI: 1.22–4.48), reflecting more than twice the odds of nature exposure after the program.

Physical Activity Frequency, Duration, and Effort Level

Table 2 details exercise patterns among participants who engaged in physical activity before and after the program. The proportion exercising >3 times per week decreased from 42.1% to 29.6%, while weekly exercise (1–3 times) increased. Session duration shifted upward, with more participants exercising >60 minutes (3.7% vs. 26.3%). Perceived effort rose slightly (mean 2.84 to 2.96; median 3). Overall, these findings indicate moderate diversification and slight intensification of physical activity among active participants.

Table 2. *Exercise patterns among participants who engaged in physical activity before and after the program*

Physical Activities	Pre (n = 19)	Post (n = 27)
Frequency of Physical Activity		
1–2 times/month	1 (5.3%)	1 (3.7%)
Once a week	1 (5.3%)	5 (18.5%)
Twice a week	7 (36.8%)	6 (22.2%)
Three times a week	2 (10.5%)	7 (25.9%)
More than 3 times/week	8 (42.1%)	8 (29.6%)
Exercise Duration		
16–30 min	3 (15.8%)	5 (18.5%)
31–45 min	4 (21.1%)	5 (18.5%)
46–60 min	7 (36.8%)	9 (33.3%)
More than 60 min	5 (26.3%)	8 (29.6%)
Effort Level (1–5)		
1	2 (10.5%)	1 (3.7%)
2	3 (15.8%)	6 (22.2%)
3	10 (52.6%)	14 (51.9%)
4	4 (21.1%)	5 (18.5%)
5	–	1 (3.7%)
Effort Level (Summary)		
Mean ± Standard deviation	2.84 ± 0.90	2.96 ± 0.85
Median (Interquartile Range)	3 (2–3)	3 (2–3)
Min – Max	1 – 4	1 – 5
RICCI AND GAGNON score		
Low physical activity	18 (52.9%)	12 (35.3%)
Moderate physical activity	7 (20.6%)	11 (32.4%)
High physical activity	9 (26.5%)	11 (32.3%)
- Mean ± SD	8.76 ± 7.19	12.15 ± 6.10
- Median (Q1 – Q3)	11.5 (1 – 16)	15 (11 – 16)
- Min – max	1 – 18	1 – 18

From pre- to post-program, the proportion of participants with low physical activity decreased by 33.3%, indicating a positive shift. Meanwhile, moderate physical activity increased by 57.2%, and high physical activity rose by 22.2%, suggesting overall improvement in physical activity levels among participants.

Changes in Sedentary Behavior Categories Pre- and Post-Program

As shown in Supplementary Table 9 and Figures 4 and 5, 26.5% of participants reduced their work-related sedentary category, 8.8% reduced their personal sedentary category, and 14.7% reduced their overall sedentary category after the program. The proportion of participants in the low sedentary category increased from 29.4% to 38.2% at work, from 55.9% to 52.9% in personal life, and from 14.7% to 23.5% overall. Most participants, however, remained in the moderate sedentary category across all domains before and after the program.

Changes in Happiness and Sound Environment Perception

Supplementary Table 10 shows psychological outcomes pre- and post-program. Happiness scores increased significantly (mean difference = –1.09, 95% CI: –1.59 to –0.58, p < 0.001; Cohen's d = 0.71). Mixed-effects regression confirmed the effect (β = 1.09, 95% CI: 0.61–1.57, p < 0.001). In contrast, perceptions of the sound environment did not change (p = 0.769), indicating the program primarily enhanced emotional well-being.

Post-Test Feedback

Post-test feedback from 34 participants indicated high satisfaction and perceived effectiveness (Figure 4). Most (91.2%) reported moderate to high satisfaction, and 64.7% achieved personal goals. Behavioral outcomes were encouraging, with 41.2% initiating new exercise habits. Satisfaction with program structure was high (73.5%), and content quality was rated very satisfactory by 76.5%. All participants (100%) found coaching helpful and support appropriate, underscoring the value of personalized guidance.

Discussion

Despite therapeutic advances, many patients with IBD have suboptimal disease control and impaired quality of life, highlighting the need for digital applications that address lifestyle, behavioral, and psychosocial factors alongside medical therapy. The results from this study support the effectiveness of a holistic program in improving quality of life and reducing disease burden in IBD. The study demonstrates significant improvements in overall IBD-Disk scores, particularly in stress and anxiety, sleep, energy, and body image. These findings align with the recommendations of Sudhaka et al, who emphasized the value of patient-centered holistic approaches in IBD care [13].

Most studies examining environmental and behavioral impacts in IBD have evaluated nutrition, physical activity, or psychological factors in isolation. The originality of this prospective study lies in assessing the impact of a holistic program targeting the "fundamentals of life," using a hybrid model combining a digital application (DOCLIVI) and personalized coaching, on quality of life and health behaviors.

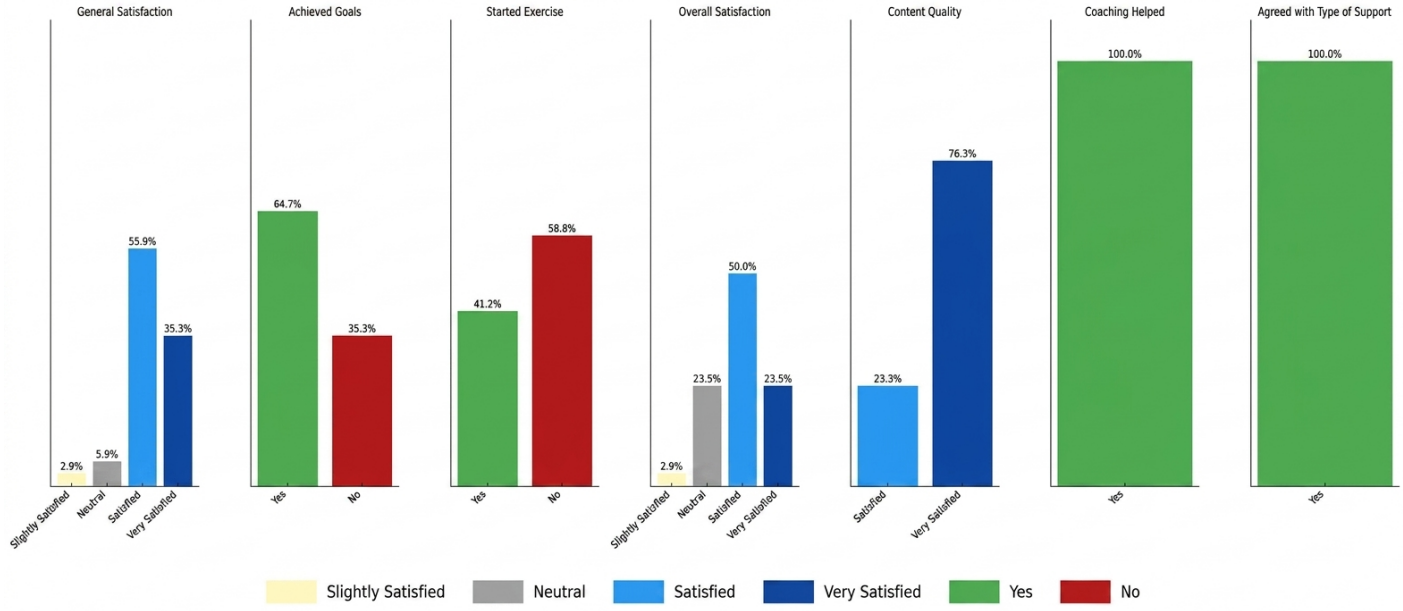

Figure 4. *Participants' Feedback post-program among 34 participants*

In relation to digital tools within the care pathway, this study provides evidence for the independent effectiveness of a digital holistic health program on quality of life in IBD. This contrasts with prior platforms such as My IBD Coach and TELE-IBD [14] where improvements in quality of life may have been attributable to a combination of educational support and remote monitoring. Notably, remote monitoring alone, even without educational support, has also been shown to improve quality of life [15].

The positive impact on professional and intimate life observed in this study is notable, as these dimensions are often overlooked in routine clinical evaluations. The Doclivi program primarily targets three key pillars of life: nutrition, physical activity, and stress/emotion regulation. The observed positive effects on energy, sleep quality, as well as professional and intimate life, illustrate the existence of "diffuse" or indirect effects. Some modules, such as those addressing stress regulation, incorporate themes like contact with nature and optimization of circadian rhythm, which can contribute to improving sleep and reducing fatigue. However, no specific intervention targets professional or intimate life. This suggests that improvements in fundamental physiological and psychological functions can have positive spillover effects beyond initial objectives, indirectly influencing social, professional, and intimate spheres. Such phenomena are rarely documented in clinical IBD studies, which tend to prioritize biological or symptom-based endpoints over broader psychosocial dimensions. Highlighting these "off-target" effects opens interesting perspectives for integrative approaches and underscores the importance of multidimensional evaluation in future research.

From a behavioral standpoint, the increase in physical activity (from 55.9% to 79.4%, $p = 0.021$) and contact with nature (from 58.8% to 76.5%, $p = 0.014$) reflects a positive behavioral shift, consistent with current integrative health recommendations [16]. The significant improvement in the overall dietary habits score ($p = 0.010$) indicates a trend toward a more plant-rich, less processed diet, in line with the benefits of the Mediterranean diet in IBD [17].

The absence of significant change in the PSS-10, despite improvements in IBD Disk stress dimensions, may reflect differences in tool sensitivity or a more marked effect on specific stress components rather than on global perception. The PSS-10 particularly explores perceived loss of control and associated anxiety. In IBD patients, this loss of control is often experienced concretely in direct relation to the unpredictable and constraining occurrence of symptoms. This context fosters the development of a quasi-adaptive anticipatory anxiety, aimed at maintaining constant vigilance against the risk of relapse or exacerbation. Under these conditions, it is understandable that, even if certain stress dimensions improve (sleep quality, emotional tension, anxiety), the global perception measured by the PSS-10 may remain stable, reflecting a state of vigilance inherent to the disease.

We demonstrate that this digital tool, combined with coaching, can modify environmental and behavioral factors: nutrition, physical activity, exposure to nature and circadian rhythm, stress regulation. Since these environmental and habits factors are known to be responsible for the onset and activity of IBD, we suggest that it may be possible to act beyond quality of life and functional disability on the prevention of chronic inflammatory bowel diseases and their activity.

The results, combined with the structured content of the Doclivi tool, suggest strong motivational potential, reinforced by personalization and interactive follow-up. However, experience shows that without regular practice of the proposed activities and without close follow-up by a physician or therapist, this initial momentum tends to fade quickly. In most cases, intrinsic motivation declines in the absence of external reinforcement. These observations confirm that active cooperation between the patient and the healthcare professional is a key success factor. Physicians should therefore take into account patients' motivations, priorities, and pace of change when discussing lifestyle modifications, to promote sustainable adoption of beneficial behaviors.

This study demonstrates the value of combining a structured digital platform with limited personalized coaching, an approach that improves adherence compared with digital tools alone [18] and has shown benefits for fatigue in IBD [19]. By integrating key lifestyle domains (nutrition, physical activity, emotional regulation) into a single system with only three

targeted coaching sessions, the program optimizes human and technical resources, offering a scalable and cost-effective model. High adherence and satisfaction rates (>90%) further support its feasibility and acceptability. Limitations include the absence of a control group, the short duration (6 months), a predominantly female population, and reliance on self-reported data. While improvements were observed across several behaviors, most participants did not reach international lifestyle targets, underscoring the challenge of achieving sustained multidimensional change. Longer-term strategies with gradual, personalized reinforcement may be required to optimize outcomes.

This program could represent a relevant complement to conventional treatments, particularly to improve quality of life and support self-management. Randomized controlled trials with extended follow-up and integration of objective criteria (biomarkers, endoscopy) are needed to confirm these results and assess effects on endoscopic remission.

Conclusion

This study confirms that integrative holistic care significantly improves both quality of life and functional disability in patients with IBD, which was the primary objective of this work. Beyond this, the holistic framework of integrative medicine — grounded in the interconnectedness of the "tripod of life" (nutrition, stress regulation, and physical activity) — also contributed to improvements in fatigue, work productivity, sleep, sexuality, and self-confidence.

Importantly, these results were achieved through the use of a holistic digital application, DOCLIVI, based on scientifically validated data and focused on the tripod of life, when combined with structured physical coaching. This underscores the critical role of integrating digital tools with human support in chronic disease management.

Furthermore, our findings suggest that this hybrid model not only improves patient-reported outcomes but may also positively influence key environmental and behavioral factors — including nutrition, physical activity, exposure to nature and circadian rhythm, and stress regulation. Since these factors are closely linked to both the onset and the activity of IBD, such interventions may ultimately contribute to disease prevention and modulation of disease activity. This hypothesis, however, warrants confirmation in larger, long-term randomized controlled trials designed to better identify responder profiles and optimize the integration of digital and human support.

Conflict of Interest

Guillaume Bonnaud is co-founder of LIVODOC Sarl which developed the Doclivi digital platform used in this study. He did not receive any direct financial compensation for this research. All other authors declare no conflicts of interest related to this work.

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Supplementary Data

***Supplementary Table 1**. Changes in Symptom and Function Scores Before and After the Program*

Outcome	Pre (n=34)	Post (n=34)	Pre minus post	95% CI of Mean Difference	p-value (paired t-test)	Effect size (Cohen's d)
	Mean ± SD	Mean ± SD	Mean Difference			
Joint pain	3.76 ± 3.25	2.74 ± 3.13	1.03	-0.18 – 2.24	0.046	0.32
Abdominal pain*	5.88 ± 3.07	4.21 ± 2.87	1.68	0.68 – 2.67	<0.001	0.57
Defecation*	4.82 ± 3.50	3.26 ± 2.72	1.56	0.51 – 2.60	0.002	0.50
Social life	4.24 ± 3.09	2.79 ± 2.29	1.44	0.19 – 2.69	0.013	0.53
Professional	5.44 ± 2.97	3.74 ± 2.88	1.71	0.57 – 2.84	0.002	0.58
Sleep	6.50 ± 2.87	4.59 ± 2.88	1.91	0.82 – 3.00	<0.001	0.66
Energy	7.62 ± 2.17	5.29 ± 2.86	2.32	1.33 – 3.32	<0.001	0.91
Stress and Anxiety*	7.03 ± 2.39	3.79 ± 2.57	3.24	2.20 – 4.27	<0.001	1.31
Self-image	5.76 ± 2.72	3.94 ± 2.40	1.82	1.08 – 2.56	<0.001	0.71
Intimate life	4.76 ± 2.83	2.74 ± 2.70	2.03	1.11 – 2.95	<0.001	0.73
Total Score*	55.82 ± 19.49	37.09 ± 17.49	18.74	11.62 – 25.85	<0.001	1.01
* p-values from sign-rank test – Abdominal pain: <0.001, Defecation: 0.028, Stress and Anxiety: <0.001, Total: <0.001.						

***Supplementary Table 2**. Effects of the Program on Symptom and Function Scores (n = 34)*

Outcome	Coefficient (b)	95% CI of b	p-value
Total Score	-18.74	-25.49 to -11.98	<0.001
Joint Pain	-1.03	-2.18 to 0.12	0.079
Abdominal Pain	-1.68	-2.62 to -0.73	<0.001
Defecation	-1.56	-2.55 to -0.57	0.002
Social Life	-1.44	-2.63 to -0.25	0.017
Professional	-1.71	-2.78 to -0.63	0.002
Sleep	-1.91	-2.94 to -0.88	<0.001
Energy	-2.32	-3.27 to -1.38	<0.001
Stress & Anxiety	-3.24	-4.21 to -2.26	<0.001
Self-image	-1.82	-2.53 to -1.12	<0.001
Intimate Life	-2.03	-2.91 to -1.15	<0.001
Note: Mixed-Effects Regression Adjusted for Age, Gender, and BMI.			

***Supplementary Table 3.** Changes in Quality of life Before and After the Program Based on McNemar's Test and Logistic Regression*

IBD related QoL	Pre n =34	Post n = 34	McNemar's Test p-value	Logistic Regression* Odds Ratio (OR)	95% CI of OR
Quality of life			0.021		
- Impaired (score ≤ 40)	25 (73.5%)	17 (50.0%)		1 (ref.)	
- Satisfactory (score > 40)	9 (26.5%)	17 (50.0%)		2.89	1.21 – 6.89
*Panel logistic regression with covariate adjustment and robust standard errors clustered at the individual level while adjusting for covariates: gender, age, BMI.					

Supplementary Table 4. *Changes in Perceived Stress Scale (PSS-10) Scores Pre- and Post-Program*

Outcome	Pre (n=34)	Post (n=34)	Pre minus post	p-value	95% CI of Mean Difference	Effect size (Cohen's d)	Regression's b (95% CI)	p-value (Regression)
	Mean ± SD	Mean ± SD	Mean Difference					
PSS-10	21.12 ± 3.27	20.59 ± 5.46	0.53	0.623	-1.64 – 2.70	0.12	-0.53 (–2.59 to 1.53)	0.615

-Pre PSS-10 score (median = 21.5, Q3 – Q1 = 23 – 19, min – max = 13 – 27)
-Post PSS-10 scores (median = 21, Q3 – Q1 = 24 – 17, min – max = 9 – 30)

Supplementary Table 5. *Changes in Eating habit Scores Pre- and Post-Program*

	Pre (n=34)	Post (n=34)	Pre minus post	p-value	95% CI of Mean Difference	Effect size (Cohen's d)	Regression's b (95% CI)	p-value (Regression)
Good eating habit score	Mean ± SD	Mean ± SD	Mean Difference					
	5.32 ± 1.89	6.29 ± 1.45	–0.97	0.010	–1.78 to –0.16	0.58	0.97 (0.47 to 1.47)	<0.001

-Pre-Program score (median = 5.5, Q3 – Q1 = 6 – 4, min – max = 2 – 9)
-Post-Program score (median = 6.5, Q3 – Q1 = 7 – 5, min – max = 4 – 9)

Supplementary Table 6. *Changes in Eating Habits from Pre- to Post-Program Assessed by McNemar's Test and Panel Logistic Regression*

Eating habits	Pre n =34	Post n = 34	McNemar's Test p-value	Logistic Regression* Odds Ratio (OR)	95% CI of OR
Sugary drinks					
- No or <3 times/week	31 (91.2%)	33 (97.1%)		1 (ref.)	0.06 – 1.67
- >3 times/week	3 (8.8%)	1 (2.9%)		0.31	
Vegetables					
- Daily	14 (41.2%)	20 (58.8%)	0.109	2.16	0.98 to 4.76
- Less than daily	20 (58.8%)	14 (41.2%)		1 (ref.)	
Whole grains					
- ≥3 times/week	12 (35.3%)	18 (52.9%)	0.18	2.11	0.85 to 5.21
- <3 times/week	22 (64.7%)	16 (47.1%)		1 (ref.)	
Legumes					
- ≥3 times/week	6 (17.6%)	8 (23.5%)	0.727	1.47	0.50 to 4.35
- <3 times/week	28 (82.4%)	26 (76.5%)		1 (ref.)	
Good Oil					
- ≥1 tbsp/day	17 (50.0%)	21 (61.8%)	0.289	1.7	0.82 to 3.53
- <1 tbsp/day	17 (50.0%)	13 (38.2%)		1 (ref.)	
Alcohol drinking					
No/ <10 drinks/ week	31 (91.2%)	32 (94.1%)	0.317	0.61	0.26 – 1.45
> 10 drinks/ week	3 (8.8%)	2 (5.9%)		1 (ref.)	
Industrial foods					
Never/once/twice a week	30 (88.2%)	31 (91.2%)	0.564	0.72	0.23 – 2.27
Everyday or several times a week	4 (11.8%)	3 (8.8%)		1 (ref.)	
Sugary foods					
- 3+ times/week or Daily	18 (52.9%)	13 (38.2%)	0.18	0.53	0.25 - 1.11
- Never or 1–2 times/week	16 (47.1%)	21 (61.8%)		1 (ref.)	
Meat (red and transformed)					
- ≥3 times/week	13 (38.2%)	10 (29.4%)	0.375	0.65	0.35 - 1.22
- <3 times/week	21 (61.8%)	24 (70.6%)		1 (ref.)	
Fish					
- ≥2 times/week	3 (8.8%)	6 (17.6%)	0.453	2.22	0.54 – 9.12
- < times/week	31 (91.2%)	28 (82.4%)		1 (ref.)	

*Panel logistic regression with covariate adjustment and robust standard errors clustered at the individual level while adjusting for covariates: gender, age, BMI.

Supplementary Table 7. *Changes in Sleep, Screen Time, and Stress Behaviors Before and After the Program Based on McNemar's Test and Logistic Regression*

Behaviors	Pre (n=34)	Post (n=34)	McNemar's Test (p-value)	Odds Ratio (OR)*	95% CI of OR
Sleep well					
Yes	16 (47.1%)	25 (73.5%)	0.004	3.64	1.68 – 7.92
No	18 (52.9%)	9 (26.5%)		1 (ref.)	
Screen time					
≥6 hours	26 (76.5%)	23 (67.6%)	0.549	0.63	0.23 – 1.72
< 6 hours	8 (23.5%)	11 (32.4%)		1 (ref.)	
Stressed regularly					
Yes	26 (76.5%)	14 (41.2%)	<0.001	0.20	0.09 – 0.46
No	8 (23.5%)	20 (58.8%)		1 (ref.)	
*Panel logistic regression with covariate adjustment and robust standard errors clustered at the individual level while adjusting for covariates: gender, age, BMI.					

Supplementary Table 8*. Pre–Post Comparison of Behavioral Outcomes with McNemar's Test and Logistic Regression (n = 34)*

Behaviors	Pre (n=34)	Post (n=34)	McNemar's Test (p-value)	Odds Ratio (OR)*	95% CI of OR
Living alone					
- Yes	10 (29.4%)	13 (38.2%)	0.454	1.55	0.73 – 3.32
- No	24 (70.6%)	21 (61.8%)		1 (ref.)	
Social interaction					
- >3 times/week	20 (58.8%)	24 (70.6%)	0.424	1.73	0.62 – 4.81
- ≤2 times/week	14 (41.2%)	10 (29.4%)		1 (ref.)	
Physical Activity					
- Yes	19 (55.9%)	27 (79.4%)	0.021	3.37	1.23 – 9.25
- No	15 (44.1%)	7 (20.6%)		1 (ref.)	
Psycho-corporal Activity					
- Yes					
- No	13 (38.2%)	16 (47.1%)	0.366	1.48	0.63 – 3.49
	21 (61.8%)	18 (52.9%)		1 (ref.)	
Contact with Nature					
- Yes	20 (58.8%)	26 (76.5%)	0.014	2.34	1.22 – 4.48
- No	14 (41.2%)	8 (23.5%)		1 (ref.)	
Hours in Nature					
- More than 2 hours	13 (38.2%)	11 (32.4%)	-	0.75	0.43 – 1.31
- Less than 2 hours	21 (61.8%)	23 (67.6%)		1 (ref.)	
Circadian Rhythm Improved					
- Yes		28 (82.4%)			
- No		6 (17.6%)			

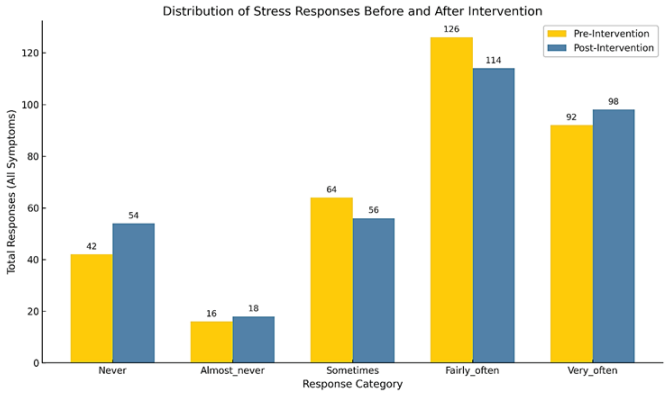
*Panel logistic regression with covariate adjustment and robust standard errors clustered at the individual level while adjusting for covariates: gender, age, BMI.

Supplementary Table 9. *Distribution of Sedentary Behavior Categories and Proportion of Participants with Reduced Sedentary Time (n = 34)*

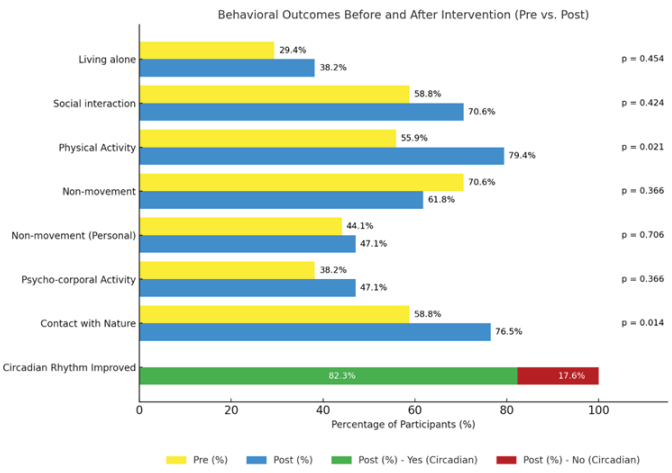
Domain	Sedentary Category	Pre-Program (n, %)	Post- Program (n, %)	Reduced Sedentary Time (n, %)
Work	Low	10 (29.4%)	13 (38.2%)	9 (26.5%)
	Moderate	18 (52.9%)	16 (47.1%)	
	High	6 (17.6%)	5 (14.7%)	
Personal Life	Low	19 (55.9%)	18 (52.9%)	3 (8.8%)
	Moderate	14 (41.2%)	14 (41.2%)	
	High	1 (2.9%)	2 (5.9%)	
Overall	Low	5 (14.7%)	8 (23.5%)	5 (14.7%)
	Moderate	27 (79.4%)	24 (70.6%)	
	High	2 (5.9%)	2 (5.9%)	

Supplementary Table 10. *Changes in Happiness and Perceived Sound Environment: Paired T-test and Mixed-Effects Regression Results (n = 34)*

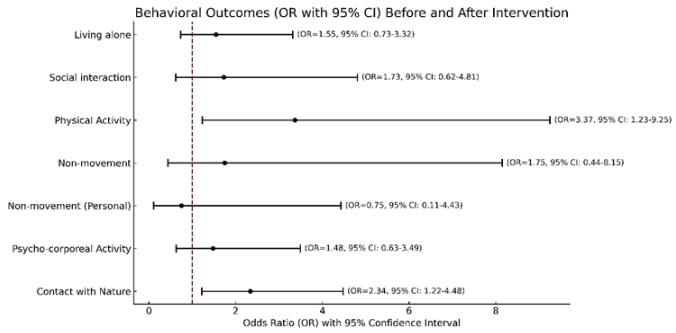
Outcome	Pre (n=34)	Post (n=34)	Pre minus post	95% CI of Mean Difference	p-value	Effect size	Mixed-effects Regression*	
	Mean ± SD	Mean ± SD	Mean Difference		(paired t-test)	(Cohen's d)	b (95% CI)	p-value
Happiness	6.21 ± 1.74	7.29 ± 1.57	–1.09	–1.59 to –0.58	<0.001	0.71	1.09 (0.61 to 1.57)	<0.001
Sound environment	5.12 ± 2.23	5.24 ± 2.12	–0.12	–0.93 to 0.69	0.769	0.05	0.12 (–0.65 to 0.89)	0.764
* Adjusted for age, gender, and BMI.								



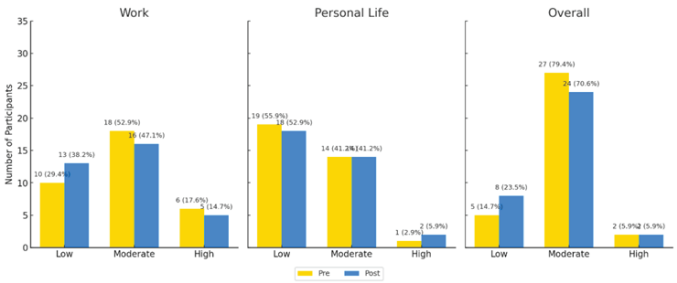
Supplementary Figure 1. *Distribution of stress responses before and after the program*
(Notes: Frequencies for each response category ("Never," "Almost never," "Sometimes," "Fairly often," "Very often") represent the sum of participant responses across all ten stress-related symptom items. For each category, responses were aggregated separately for pre- and post-program time points. For example, the total frequency for "Never (pre)" includes all instances where participants selected "Never" for any of the ten symptom items before the program. This approach provides a cumulative overview of response patterns and facilitates comparison of overall perceived stress levels across time points.)



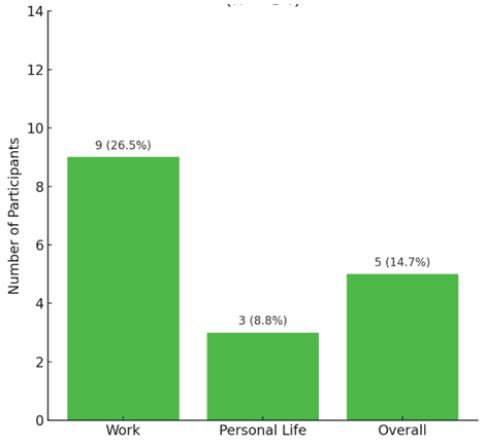
Supplementary Figure 2. *Changes in behavioral outcomes before and after program*



Supplementary Figure 3. *Changes in behavioral outcomes before and after program by logistic regression*



Supplementary Figure 4. *Distribution of Sedentary Behavior Categories before and after the program*



Supplementary Figure 5. *Percentage of Reduction in Sedentary time after the program*

Supplementary Annexe 1 *: Ricci and Gagnon Questionnaire*

	1	2	3	4	5
Do you regularly engage in one or more physical activities?	No				Yes
How often do you practice these activities overall?	1 to 2 times/month	Once/week	Twice/week	3 times/week	4 times/week
On average, how many minutes do you spend on each session of physical activity?	Less than 15 min	16 to 30 min	31 to 45 min	46 to 60 min	More than 60 min
How do you usually perceive your effort? (1 = very easy, 5 = very hard)	1	2	3	4	5