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Research Article

Reducing Smartphone Addiction and Improving Fibromyalgia Outcomes: A Randomized Controlled Trial

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Abstract

Aim: Smartphone overuse may worsen pain and disability in fibromyalgia. Health education about potential negative effects of smartphone addiction on fibromyalgia may help decrease this overuse. The aim of this study is to examine the relationship between smartphone addiction (SA), and total fibromyalgia impact (TFI) in patients with fibromyalgia, and to assess the effects of health education on decreasing pain and disability.

Material and Methods: Study was designed as a randomized controlled trial, and was conducted in the physiatry clinic of a state hospital. Patients were randomized into intervention and control groups and followed for 21 days. 83 patients (42 intervention group mean age 40.36 ± 6.54 years; 41 control group mean age 40.90 ± 9.42 years) were included. The intervention group received one-time health education session on negative effects of SA, alongside self-monitoring with an exercise diary. The control group engaged in self-monitoring only, using the same diary. The study compared education plus self-monitoring versus self-monitoring alone. Primary outcomes included SA (measured by the Smartphone Addiction Scale-Short Version, SAS-SV) and TFI (measured by the revised Fibromyalgia Impact Questionnaire, FIQR) at baseline and on day 21. Secondary outcomes included daily smartphone screen time (DSST) and daily exercise time (DET) tracked during the 20-day period.

Results: Young and single fibromyalgia patients exhibited higher SA levels. Both groups showed improvements in DSST, DET, SA, and TFI after 21 day period. Improvements were greater in the intervention group, however between-group differences were not statistically significant. Reductions in SA scores correlated positively with reductions in TFI scores. Self-monitoring with or without patient education, improved SA and TFI.

Conclusion: Self-monitoring with physician follow-up was sufficient to promote behavior change. Decreased SA was linked to reduced symptom burden in patients. Findings suggest that self-monitoring may be an underused yet effective behavioral strategy in fibromyalgia care. This study was retrospectively registered at ClinicalTrials.gov (NCT06239779) on 26 January 2024.

Keywords: Behavioral medicine, fibromyalgia, health education, pain management, self monitoring, technology addiction

INTRODUCTION

Fibromyalgia, a prevalent syndrome marked by widespread musculoskeletal pain, is often accompanied by fatigue, sleep disturbances, and anxiety. It is the third most common musculoskeletal disorder worldwide (1). Estimated rates vary, affecting 0.2% to 6.6% of the general population and 2.4% to 6.8% of women (2). It's most common in those aged 30-40, with a female-to-male ratio of 6:1 to 8:1 (2-5). The pathophysiology of fibromyalgia involves central sensitization with altered neurotransmitter release, peripheral sensitization affecting nociceptor signaling. Genetic, endocrine, psychological, and sleep disturbances also contribute (1). Key triggers include environmental, mechanical, and psychological stressors which disrupt the body's stress and pain systems (6,7). Treatment involves

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pharmacological and non-pharmacological strategies. Patient education is the first step, followed by exercise, cognitive-behavioral therapy, and medication (1,7,8).

Smartphones, offering the capabilities of a full computer in a compact design, have integrated deeply into our daily lives. A meta-analysis across 24 countries found that smartphone ownership among individuals aged 15 to 35 is nearly universal especially in high-income countries (9). Global number of smartphone users is projected to reach approximately 7.52 billion by the year 2026 (10). Excessive attention and uncontrolled dedication to one's cell phone is called 'addiction' (11). Smartphone addiction (SA) is associated with poor sleep quality, headaches, decreased academic performance, mental health and happiness (12,13).

Musculoskeletal system is one of the systems affected by SA. Problems reported among mobile phone users include myofascial pain syndrome, fibromyalgia, thoracic outlet syndrome, tendinitis, De Quervain's syndrome, hand and neck pain (14-16). SA can lead to reduced trunk position sense, postural changes and muscle trigger points (17,18). The negative effects of SA on mental and physical health, combined with its potential to disrupt sleep, increase stress, and contribute to poor posture, may exacerbate the pain in fibromyalgia. The initial hypothesis of this study proposed that fibromyalgia patients with higher levels of SA would exhibit greater disease impact, as measured by the revised Fibromyalgia Impact Questionnaire (FIQR). The null hypothesis posited that no significant relationship would exist between SA and total fibromyalgia impact (TFI). Building upon this, a second hypothesis was formulated for the interventional phase: that a physician-led educational session addressing the negative effects of excessive smartphone use and its potential risks for fibromyalgia, would lead to reductions in daily smartphone screen time (DSST), Smartphone Addiction Scale–Short Version (SAS-SV) scores, FIQR scores and increases in daily exercise time (DET). The null hypothesis for the interventional phase stated that the education would not produce these changes.

Besides DSST we included the SAS-SV, a validated tool specifically designed to assess problematic smartphone use (PSU). This dual approach, combining DSST and SAS-SV, provides a more comprehensive understanding of both the quantity and the psychological impact of smartphone use, and their potential contribution to symptom burden in fibromyalgia. The behavioral strategies used in this study, education and self-monitoring, were grounded in evidence-based behavior change models, including the Behaviour Change Wheel and self-regulation theory (19-22). Reducing smartphone addiction may positively influence sleep quality, stress levels, and postural strain, thereby potentially contributing to symptom improvement. This study aimed to shed light on the potential negative effects of SA on fibromyalgia and to explore the role of patient education and self-monitoring in alleviating its symptoms.

MATERİAL AND METHODS

Design

This study was designed as a parallel-group randomized controlled trial. Participants were monitored for 20 days through daily diary recordings. The 21-day follow-up period was selected as a practical and exploratory timeframe to evaluate the short-term impact of the intervention. The study followed CONSORT guidelines, and written informed consent was obtained from all participants. The trial was registered at ClinicalTrials.gov (Identifier: NCT06239779) prior to data analysis.

Randomization and blinding

Patients were randomized into two groups using stratified randomization by age (20–35, 35–50 years) and sex, ensuring balanced allocation across demographic subgroups. Group assignments were determined at the time of enrollment by an assistant using a computer-generated sequence. Blinding was maintained throughout the study: participants were unaware of the existence of another group. Following data collection, the assistant anonymized group identities as A and B. Group labels were masked, and statistical analysis was carried out in a blinded fashion.

Recruitment and participants

We recruited 90 fibromyalgia patients aged 20 to 50 from the outpatient unit of Physical Medicine and Rehabilitation Department of a state hospital. Patients with missing questionnaires or incomplete diaries and one patient in remission (FIQR<23), were excluded (23). After a 7.8% dropout rate, the final sample consisted of 83 participants (Fig. 1).

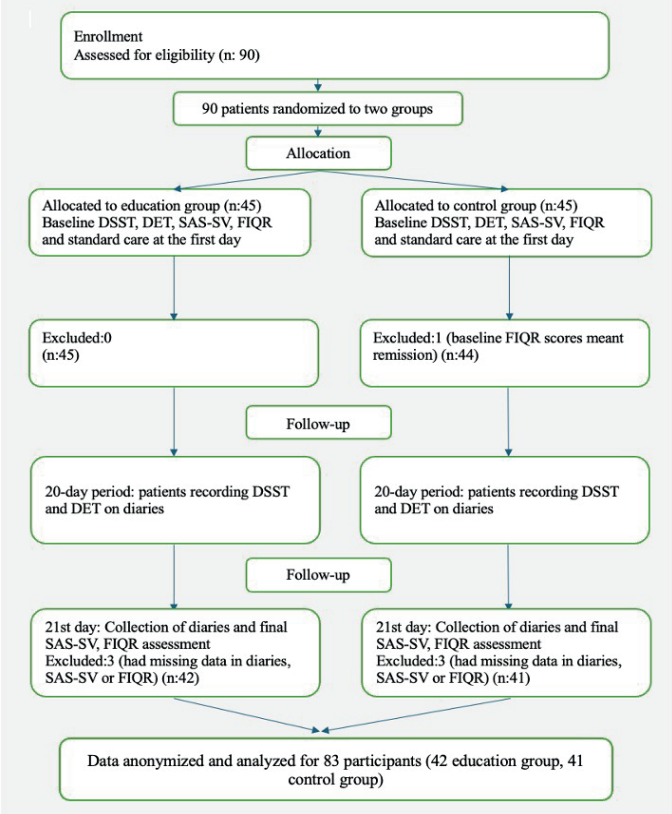

Figure 1. Consort diagram of the study

DSST: daily smartphone screen time, DET: daily exercise time, SAS-SV: smartphone addiction scale- short version, FIQR: fibro-

myalgia impact questionnaire-revised.

Participants were required to have a confirmed fibromyalgia diagnosis by a specialist (recently diagnosed, ≤6 months), using the 2016 revision of the 2010/2011 American College of Rheumatology criteria (24,25). Eligible participants had not taken or declined medication. Additionally, participants needed to own a smartphone, commit to engaging in the research process. Exclusion criteria included cognitive impairments, severe neurological or psychiatric disorders, serious health conditions (e.g., cancer, chronic heart disease), addictions (alcohol, substance abuse), and participants who had undergone major surgery or experienced recent trauma.

Data collection

On the first day, participants reported their average DSST, obtained from the 'Settings' section of their mobile devices, as well as their self-reported DET. Exercise was defined as intentional physical activities beyond routine daily tasks, such as walking for fitness, swimming, or other forms of moderate-to-vigorous physical activity. Participants also completed the FIQR and the SAS-SV. Then they were given lifestyle diaries to track their DSST and DET over the following 20 days. On the 21st day, participants visited the clinic again, completed the same scales, and their diaries were collected for analysis. Although relatively short, this timeframe was intended to determine whether an acute reduction in DSST could yield measurable improvements in fibromyalgia-related outcomes.

Assessments

Assessments included lifestyle metrics (DSST and DET) and health metrics (FIQR and SAS-SV). The FIQR is a self-reported questionnaire assessing the TFI across three domains: functionality, overall impact, and symptom severity. Scores range between 0 to 100, with higher scores indicating a greater disease burden (26). Disease severity was classified according to scores as follows: remission (FIQR≤23), mild (23<FIQR≤40), moderate (40<FIQR≤ 63), severe (63<FIQR≤82), and very severe (FIQR>82) (23). The SAS-SV, a self-reported scale assessing SA, consists of 10 questions rated on a six-point Likert scale from 1 (strongly disagree) to 6 (strongly agree). Scores range between 10 to 60, with higher scores indicating a greater risk of addiction (27). Both tools were validated for regional language (28,29).

Intervention and control

The intervention group received a standardized, physician-delivered educational session on fibromyalgia and the potential negative impacts of PSU on fibromyalgia (e.g., poor sleep and cognitive difficulties), digital hygiene strategies (e.g., limiting notifications and setting screen time boundaries), and fibromyalgia management (e.g., exercise, stress reduction, and lifestyle modifications). The educational session was prepared by the authors based on reputable sources and delivered via a PowerPoint presentation (30–32). It was delivered face-to-face by a physician in a single individual appointment and lasted approximately 20 minutes. Participants viewed the slide deck on a clinic computer screen and received verbal key messages. The session included time for questions and confirmation of understanding using brief teach-back. Following the session, participants engaged in 20 days of self-monitoring using a structured lifestyle diary, which was submitted to the physician at a scheduled follow-up on day 21.

The control group did not receive the educational session but similarly completed 20 days of self-monitoring using the same diary, which was also submitted at the day 21 follow-up visit. Thus, the study compared education plus self-monitoring versus self-monitoring alone, with both groups undergoing equal levels of physician contact and diary-based tracking.

The diary was incorporated into the study design with the dual purpose of facilitating self-monitoring and enabling behavioral observation, with an anticipated potential to increase participants' awareness and promote behavioral insight. Therefore, the control group served as an active control. The educational session was grounded in cognitive-behavioral and self-regulation principles, aiming to enhance participants' awareness, promote self-regulation, and facilitate positive behavior change. The combination of education and self-monitoring corresponds to persuasion functions within the Behaviour Change Wheel framework (22). No changes were made to the trial methods or outcomes after initiation. Stopping guidelines and interim analyses were not required.

Outcome Measures

Primary outcomes were FIQR and SAS-SV scores at baseline and day 21. Secondary outcomes were DSST and DET, recorded at baseline and tracked daily via diaries for 20 days.

Power and sample size

An a priori power analysis using G*Power indicated a required sample of 70 participants (35 per group) to detect a large effect size ($d = 0.8$) with $\alpha = 0.05$ and 95% power. To enhance robustness, 90 eligible patients were recruited. A post-hoc power analysis confirmed 97.5% power for the final sample ($n = 42$ and 41 per group).

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics (version 29.0.2.0), with $p < 0.05$ considered significant. Continuous variables were summarized as mean ± SD, and categorical variables as frequencies and percentages. Data normality was assessed using the Shapiro-Wilk test. Paired t-tests or Wilcoxon tests were used for within-group comparisons; inde-

pendent t-tests or Mann–Whitney U tests for between-group comparisons; and Pearson or Spearman correlations for associations, based on data distribution. Marital status, though binary, was coded numerically (1=married, 2=single) for correlation analyses. Effect sizes were reported as Cohen's d (t-tests), r (Mann–Whitney U), and ρ or r (correlations). Sex was excluded from analyses due to sample imbalance and the study's design not targeting sex-based comparisons.

RESULTS

Descriptive results

The mean age of the 83 participants was 40.36 years (SD = 8.05, range = 22–50). The average DSST was 2.95 hours (SD = 1.73, range = 0.14–7.00), and the average DET was 0.16 hours (SD = 0.31, range = 0–1.00). The sample had a notable female predominance (female-to-male ratio = 9.38:1). Most participants were married, and university graduates constituted the largest educational subgroup. Based on p-values above 0.05, the intervention and control groups were comparable across age, FIQR and SAS-SV scores. Table 1 presents the baseline demographic and clinical characteristics stratified by study group.

A positive correlation was found between DSST and SAS-SV (ρ = 0.43, p < 0.001), which was expected since both reflect smartphone use, one self-reported and the other from phone settings. SAS-SV scores showed a weak negative correlation with age (ρ = -0.22, p = 0.045), meaning younger individuals had higher addiction scores. There was also a positive correlation between marital status and DSST (ρ = 0.34, p = 0.002) and SAS-SV (ρ = 0.26, p = 0.017), with single individuals scoring higher smartphone screen times and addiction scores than married ones. Other pairwise correlations are shown in Table 2.

Results of intervention

Within group analysis showed that in both groups DSST, SAS-SV scores and FIQR scores decreased and DET increased (p < 0.001). Although changes were numerically more favorable in the intervention group (except for DET) none reached statistical significance; between-group analysis revealed no significant differences (Table 3). Diary adherence was 100% (20/20 days completed) among participants included in the final analysis.

Although between-group differences were not statistically significant, changes were directionally consistent with greater improvement in the education arm. Because the control arm included daily tracking and planned physician review, it constituted an active comparator. There were no harms or unintended effects in study groups.Table 3. Changes in lifestyle metrics (initial self-reports vs. 20-day diary averages) and health outcomes (pre–post observation comparisons)

Correlation analysis for changes

Spearman's rank-order correlation analysis, conducted on all 83 participants from both groups, revealed several significant associations. A positive correlation was found between education level and reductions in SAS-SV scores (ρ = 0.23, p = 0.035) and FIQR scores (ρ = 0.26, p = 0.016), indicating that a higher level of education was associated with greater reductions in SA and fibromyalgia impact. Additionally, a positive correlation was observed between reductions in SAS-SV and FIQR scores (ρ = 0.32, p = 0.003), suggesting that improvements in SA were associated with improvements in fibromyalgia symptoms (Fig. 2). All other pairwise correlations did not

Table 1. Baseline characteristics of the participants

Category	Intervention group (N=42)	Control group (N=41)	p-value
Age	40.36 (SD: 6.54)	40.90 (SD: 9.42)	0.471
FIQR score	58.84 (SD: 19.18)	61.65 (SD: 21.40)	0.530
SAS-SV score	28.26 (SD: 9.88)	27.27 (SD: 10.68)	0.415
DSST (hr)	2.91 (SD: 1.67)	3.00 (SD: 1.82)	
DET (hr)	0.19 (SD: 0.34)	0.13 (SD: 0.28)	
Female	38 (90.5%)	37 (90.2%)	
Male	4 (9.5%)	4 (9.8%)	
Married	34 (81%)	31 (75.6%)	
Single	8 (19.0%)	10 (24.4%)	
PG	13 (31.0%)	11 (26.8%)	
SG	5 (11.9%)	5 (12.2%)	
HG	9 (21.4%)	12 (29.3%)	
UG	15 (35.7%)	13 (31.7%)	
Mild disease	7 (16.7%)	6 (14.6%)	
Moderate disease	18 (42.9%)	16 (39.0%)	
Severe disease	12 (28.6%)	10 (24.4%)	
Very severe disease	5 (11.9%)	9 (22%)	

PG: primary-school graduate, SG: secondary-school graduate: HG, high-school graduate; UG: university graduate. Mann-Whitney U test was used to compare age and initial SAS-SV scores, independent samples t-test was used to compare initial FIQR scores between groups.

Table 2. Pairwise cCorrelations among lifestyle and health metrics of fibromyalgia patients

Variable 1	Variable 2	Effect size (Spearman's ρ/ Pearson's r)	95% Confidence Interval	p-value
DSST	DET	0.03	-0.195 to 0.248	0.802
DSST	FIQR	-0.15	-0.355 to 0.080	0.192
DSST	SAS-SV	0.43	0.229 to 0.595	<0.001*
DET	FIQR	-0.15	-0.362 to 0.072	0.168
DET	SAS-SV	0.04	-0.185 to 0.258	0.727
FIQR	SAS-SV	0.11	-0.105 to 0.321	0.308
DSST	Age	-0.11	-0.322 to 0.117	0.332
DET	Age	-0.06	-0.276 to 0.167	0.608
SAS-SV	Age	-0.22	-0.422 to 0.001	0.045*
FIQR	Age	0.01	-0.211 to 0.233	0.918
DSST	Education	0.20	-0.024 to 0.403	0.071
DET	Education	0.01	-0.235 to 0.209	0.901
SAS-SV	Education	0.10	-0.127 to 0.312	0.381
FIQR	Education	-0.19	-0.393 to 0.036	0.089
DSST	Marital status	0.34	0.020 to 0.426	0.002*
DET	Marital statuıs	0.15	-0.070 to 0.364	0.164
SAS-SV	Marital status	0.26	0.049 to 0.452	0.017*
FIQR	Marital status	-0.19	-0.386 to 0.031	0.093

SAS-SV and FIQR values represent raw questionnaire scores, while DSST and DET are expressed in hours. * indicates statistical significance. Pearson's correlation was used to assess associations between SAS-SV and FIQR scores and between these scores and marital status (point-biserial for binary variables). Spearman's rank-order correlation was used for all other non-parametric associations.

Table 3. Changes in lifestyle metrics (initial self-reports vs. 20-day diary averages) and health outcomes (pre–post observation comparisons)

Outcome measure	Group	Pre-observation mean ±SD (SEM)	Post-observation mean ±SD (SEM)	Within group p-value	Change ±SD (SEM)	Test statistics	Effect size (r/ Cohen's d)	Between-group p-value
DSST	Intervention	2.91 ±1.67 (0.26)	2.10 ±1.37 (0.21)	<0.001	-0.80 ±1.52 (0.23)	Z:-1.658	-0.18	0.097
	Control	3.00 ±1.82 (0.28)	1.63 ±1.32 (0.21)	<0.001	-1.37 ±1.71 (0.27)	-	-	-
DET	Intervention	0.19 ±0.34 (0.05)	0.50 ±0.31 (0.05)	<0.001	0.31 ±0.42 (0.06)	Z:-1.220	-0.13	0.222
	Control	0.13 ±0.28 (0.04)	0.59 ±0.36 0.06)	<0.001	0.45 ±0.41 (0.06)	-	-	-
SAS-SV	Intervention	28.26 ±9.88 (1.52)	23.07 ±9.11 (1.41)	<0.001	-5.19 ±7.45 (1.15)	Z:-0.391	-0.04	0.696
	Control	27.27 ±10.68 (1.67)	23.34 ±10.77 (1.68)	<0.001	-3.93 ±4.39 (0.69)	-	-	-
FIQR	Intervention	58.84 ±19.18 (2.96)	39.16 ±22.84 (3.52)	<0.001	-19.68 ±21.74 (3.36)	t:0.59 (df:81)	0.13	0.276
	Control	61.65 ±21.40 (3.34)	44.76 ±23.50 (3.67)	<0.001	-16.90 ±20.76 (3.24)	-	-	-

SD: standard deviation; SEM: standard error of the mean; r: effect size for Mann–Whitney U test; Cohen's d: effect size for independent samples t-test; Z: test statistic for Mann–Whitney U; t: test statistic for independent samples t-test; df: degrees of freedom. SAS-SV and FIQR are presented as raw questionnaire scores; DSST and DET are expressed in hours. Paired samples t-test or Wilcoxon signed-rank test was used for within-group comparisons, and independent samples t-test or Mann–Whitney U test for between-group comparisons, depending on data normality. All within-group p-values were statistically significant.

Table 4. Pairwise cCorrelation of changes in lifestyle and health metrics after the observation period

Variable 1	Variable 2	Effect size (ρ)	95% Confidence Interval	p-value
Change in DSST	Age	-0.21	-0.412 to 0.014	0.058
Change in DET	Age	0.18	-0.049 to 0.382	0.114
Change in SAS-SV	Age	-0.10	-0.314 to 0.126	0.374
Change in FIQR	Age	-0.17	-0.374 to 0.058	0.134
Change in DSST	Marital status	0.03	-0.194 to 0.250	0.793
Change in DET	Marital status	-0.17	-0.382 to 0.049	0.113
Change in SAS-SV	Marital status	0.04	-0.185 to 0.258	0.732
Change in FIQR	Marital status	0.12	-0.103 to 0.335	0.272
Change in DSST	Education level	0.20	-0.026 to 0.401	0.075
Change in DET	Education level	0.13	-0.094 to 0.343	0.238
Change in SAS-SV	Education level	0.23	0.011 to 0.432	0.035*
Change in FIQR	Education level	0.26	0.044 to 0.458	0.016*
Change in DSST	Change in FIQR	0.21	-0.010 to 0.415	0.054
Change in DET	Change in FIQR	-0.20	-0.402 to 0.025	0.073
Change in SAS-SV	Change in FIQR	0.32	0.108 to 0.508	0.003*

Changes in SAS-SV and FIQR are expressed as raw scores, while changes in DSST and DET are reported in hours. Spearman's rank-order correlation was used for all associations. Spearman's rho (ρ) represents both the correlation coefficient and effect size. * indicates statistical significance.

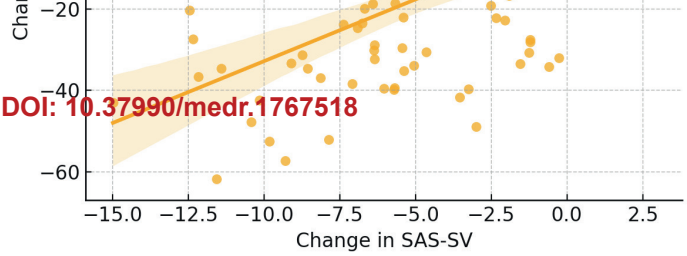

Figure 2. Correlation between changes in smartphone addiction and fibromyalgia impact. Scatterplot illustrates the associations between changes in SAS-SV and FIQR scores. Each dot represents an individual participant. Spearman's ρ = 0.32, p = 0.003. Shaded area represents the 95% confidence interval of the regression line.

Finally, disease severity percentages were calculated for day 1 and day 21. A shift toward milder categories and remission was observed in both groups (Fig. 3).

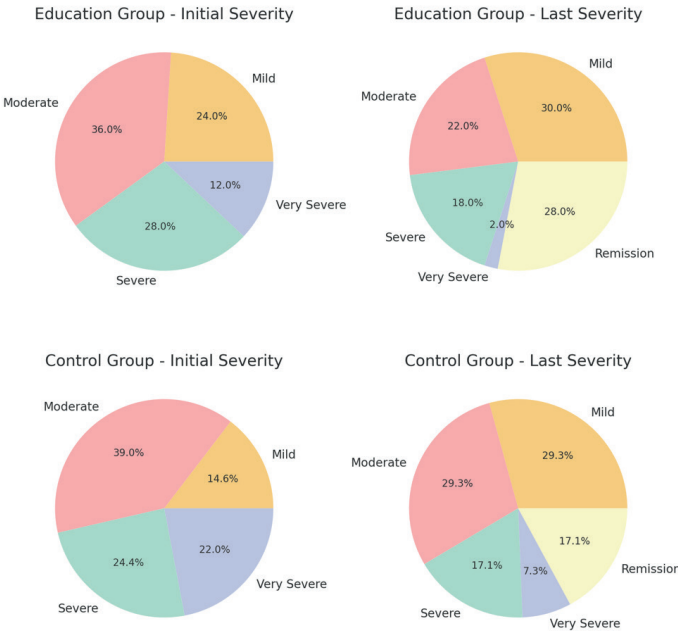

Figure 3. Distribution of disease severity categories before and after the observation period

DISCUSSION

This study examined the relationship between SA and patient characteristics in individuals with fibromyalgia. It also evaluated whether adding patient education to self-monitoring would lead to greater improvements in SA and fibromyalgia impact compared to self-monitoring alone.

Baseline characteristics

The demographics of the 83 fibromyalgia patients (mean age: 40.6 years; female-to-male ratio: 9.4:1) aligned with previous studies (2-5). Patients' average daily smartphone use (2.95 hours) exceeded the limit when the recommendations for 17-year-olds (<2 hours/day) were referenced as adult screen time guidelines are lacking (33) . Their average daily exercise (0.16 hours) was far below the WHO's recommended 21–43 min/day, indicating a predominantly sedentary lifestyle (34).

The study hypothesized that higher SA levels would be associated with greater fibromyalgia impact. However, no significant correlation was found between baseline SA and fibromyalgia scores. Instead, SA was linked to demographics: younger and single individuals in our sample showed higher SA scores. While the association with younger age aligns with most prior research, findings on marital status have been mixed; some studies report greater smartphone use among married individuals (11,35). No association was found with education level in our study, which contrasts with previous studies linking lower education to higher SA (27,35,36).

Patient education as an adjunct to self-monitoring

The second hypothesis assumed that patient education would lead to greater improvements in lifestyle and health outcomes. However, while the education group showed slightly better results, both groups improved significantly, and the between-group differences were not statistically significant. Despite the lack of statistical significance, the education arm showed consistently larger numerical gains across most outcomes, which may still be clinically meaningful. This lack of significance may be due to the brief, single-session dose of education, an active control condition (daily self-monitoring with anticipated physician review), a relatively homogeneous sample. Additionally the trial was powered for a large between-group effect (d = 0.8); thus, smaller incremental benefits of a single-session education may have been underdetected.

Educational interventions are widely recommended in fibromyalgia management, with some studies reporting lasting benefits and improved self-efficacy even after short programs and brief education interventions (19-21). However, consistent with García-Ríos et al., our study found no significant added benefit of education session beyond self-monitoring, suggesting limited incremental effect of education alone (37). Interestingly, the control group may have experienced meaningful behavioral change through diary-based self-monitoring. The fact that physician would evaluate the lifestyle diary may have added to the patient's self-monitoring process, increasing self-awareness and supporting the development of healthier lifestyle habits. These effects likely contributed to improvements in both groups, potentially masking any added benefit of education. The lack of statistically significant between-group differences does not invalidate the potential of the intervention. The intervention group's favorable numerical trends may still suggest clinical relevance, warranting further investigation. These findings, however, primarily underscore the potential contribution of self-monitoring alone, which appeared to act as an effective behavior change strategy in both groups. Daily tracking likely acted as a self-regulation tool in this study by increasing the salience of screen time and exercise, providing ongoing feedback, and creating accountability through planned physician review at follow-up. This interpretation is consistent with

self-regulation/control theory models and withbehavior change models, where self-monitoring is recognized as a powerful tool. Filling out a daily diary is a recognized technique within the 'Behaviour Change Wheel' framework. It is used in many interventions to promote behavioral improvements such as diet, physical activity, and overall health management (22). For example, consistent use of food and exercise diaries has been associated with greater weight loss, enhanced diet and exercise behaviors, and increased awareness of healthy living strategies (38-41). In addition, one study showed that exercise diaries used during home-based pulmonary rehabilitation were positively correlated with clinical outcomes (42).

A broader review underscores the central role of self-monitoring in chronic disease management. Whether tracking pain, fatigue, sleep, or medication use, self-monitoring empowers individuals to better manage their health, communicate effectively with healthcare providers, and seek timely interventions (43). Similarly, personal tracking including screen time enhances productivity, promote discipline, reduce overuse, foster greater awareness of daily routines and support improvements in overall well-being (44-45). Notably, a fibromyalgia-specific study showed that diary-based self-monitoring of behaviors (sleep, activity, stress, screen time) and symptoms (pain, fatigue, mood) improved memory, digestion, fatigue, mood, and sleep complaints (46).

Associations between changes in SA and fibromyalgia outcomes

Another key finding in this study was that patients with higher education levels demonstrated greater reductions in both SA and TFI scores. This suggests that more educated individuals may derive greater benefit from diary-based behavioral strategies and possibly from the educational component as well, likely due to increased health literacy and better engagement with the intervention content. These results highlight the importance of tailoring behavioral and educational strategies according to patients' educational backgrounds in order to optimize effectiveness.

In addition, a significant correlation was found between reductions in SA scores and decreases in TFI scores. Although SA may not directly cause fibromyalgia, its effective management appears to contribute positively to clinical outcomes, possibly through reducing stress and sleep disturbances, common consequences of excessive smartphone use (11,47). These findings highlight the potential of reducing smartphone use as a supportive lifestyle strategy for alleviating fibromyalgia symptoms, warranting further investigation.

Although the education and observation period in this study was brief, prior research supports the effectiveness of short-term interventions in chronic pain populations. Even single sessions of exercise have shown immediate benefits for anxiety and depression, while 3- to 4-week programs have improved autonomic balance in conditions like fibromyalgia (48,49). Similarly, psychological benefits have been observed after just 20 minutes of physical activity, and a three-week sleep intervention reduced insomnia and depressive symptoms in adolescents with sleep restriction (50,51). These findings support the rationale that the 21-day observation period used in this study was sufficient to promote measurable biopsychosocial improvements.

Clinical implications

Clinicians should consider assessing smartphone overuse in fibromyalgia patients, as it may contribute to symptom burden. A simple behavioral strategy such as self-monitoring of screen time may support patient self-management and encourage healthier routines. This approach could be particularly effective in patients with higher educational backgrounds. Given the sample's alignment with typical fibromyalgia populations, these findings may be generalizable.

Study limitations

This study had several limitations. First, DET was self-reported, which may introduce bias. In contrast, daily DSST was objectively obtained from phone settings. However, DSST does not distinguish between functional (e.g., work-related) and problematic use, nor does it capture behavioral aspects of smartphone addiction such as compulsive checking, withdrawal, or loss of control. To address this, we also included the SAS-SV, a validated tool for assessing PSU. This dual approach aimed to provide a more complete understanding of both usage quantity and its psychological impact. Second, the sample was predominantly female, limiting sex-based comparisons; however, this reflects the typical sex distribution seen in fibromyalgia populations. Third, the educational component consisted of a single session. This was a deliberate choice to mimic the constraints of a typical outpatient consultation between physician and patient. Fourth, the study did not assess the long-term sustainability of the observed health improvements. The reductions in SAS-SV and FIQR scores at the 21st day reflect short-term benefits rather than durable behavioral change. Future research should provide repeated educational sessions, extend follow-up durations, and utilize standardized assessments of additional lifestyle factors such as sleep quality and social interactions while also including larger and more diverse samples to improve generalizability.

CONCLUSION

Younger and single patients with fibromyalgia demonstrated higher levels of SA. The improvements observed in both study groups were likely driven by the self-monitoring tool, which appeared to facilitate behavior change and positively affect addiction and disease outcomes. Notably, the reduction in SA scores was significantly correlated with the disease burden. Furthermore, patients with higher education levels experienced greater benefits over the follow-up period.

These findings suggest that assessing SA may be a valuable addition to clinical evaluation in fibromyalgia. Promoting healthier smartphone use and encouraging self-monitoring strategies, an often underutilized behavioral tool, may serve as valuable components of comprehensive fibromyalgia management.

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Conflict of interest
The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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Author contributions
N.O. and S.Y.M. contributed to conception, design, supervision, fundings, materials, analysis and/or interpretation, literature review, writing, critical review, N.O.contributed to data collection and/or processing.

Data availability statement
The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Patient consent for publication
Not applicable, as no identifying images or clinical details of participants are included in this manuscript.

Ethical approval
The study received ethical approval (28.12.2023, decision no. 18/29) from regional hospital ethical committee. Informed consent was obtained from all participants in accordance with the Declaration of Helsinki and good clinical practice guidelines.

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