The Efficacy of the Persian Version of the Mindfulness-Based Stress Management App (Aramgar) for College's Mindfulness Skills and Perceived Stress

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ARTICLE INFO	**ABSTRACT**
  	Functional mobile applications are regarded as one of the brand-new approaches to psychological interventions in different areas, including stress. The study aims to analyze a mobile application for Persian users on perceived stress and improve mindful skills. This study was a one-group pretest-posttest design with a quasi-experimental research design. Three instruments were used in this study: the Five Factor Mindfulness Questionnaire (FFMQ), the Perceived Stress Scale (PSS-10), and the Mobile App Rating Scale (MARS). Eighty-five students participated in an 8-week mindfulness mobile app (Aramgar) for at least 10 minutes per day intervention. They responded to validated outcome measures of stress and mindfulness at baseline after the 8-week continued access period. The mobile application, Aramgar, was designed based on Mindfulness-based stress reduction. Paired t-tests showed significant differences in general perceived stress (P = 0.03) and total score of mindfulness (P = 0.002) before and after Aramgar. The results of analyzing the quality of Aramgar in terms of engagement, functionality, aesthetics, and information quality showed that specialists assessed the quality of the application appropriately. Using functional mobile apps provides ease of use for mental health services. Therefore, to strengthen and develop the mentioned services, it is recommended that the necessary information technology infrastructures be provided and the existing limitations for designing and running mental health mobile apps be removed.

INTRODUCTION

Some research has discovered that higher stress levels are usually reported among college students compared to people in other age groups (Neely et al., 2009). In this regard, factors such as making career choices, increasing academic workload, and autonomy from families can be highlighted (Jayarajah et al., 2020). Nowadays, using programs related to stress reduction has been emphasized on college campuses. Recently, mindfulness-based interventions have become prioritized on college campuses, which can be considered an effective strategy for decreasing stress among college students (Bai et al., 2020).

Mindfulness refers to the attention and awareness of what occurs in the present moment without any judgment. Mindfulness-based cognitive therapy (MBCT) and mindfulness-based stress reduction (MBSR) are considered two of the most popular mindfulness-based interventions (Arlt Mutch et al., 2021). Based on the results of some studies, a significant decrease occurred in self-reported stress among college students (Sousa et al., 2021; Sturgill et al., 2021) and improved the well-being of undergraduate students (Chiodelli et al., 2022). Almost all college students use the Internet and smartphones (Huberty et al., 2019). Regarding the scope of mental health services, studies showed that college students seek help with online counseling (Lungu & Sun, 2016).

New trends like Mobile health, or M-health, provide a promising approach to supporting functional health behaviors. Since cellphone users are ubiquitous (Atienza & Patrick, 2011), certain cellphone applications can be used as platforms for behavioral interventions (Backinger & Augustson, 2011). Besides therapeutic benefits, M-health provides chances to overcome regular constraints regarding psychological and behavioral health treatment (Lindhiem et al., 2015).

Clinical information like texts, videos, audio files for skills, diaries, discussion boards, and pop-up reminders are some common features of health apps used for communication (Gustafson et al., 2014; Jones, 2018). By applying different app features in frequent order, clients encounter meaningful means of motivation to practice skills during treatment sessions. In addition, some apps send reminders and notifications to users (Lindhiem et al., 2015).

Some features of apps, like assessments and behavior diaries, can help clinicians identify their clients' typical behaviors (Pramana et al., 2014). Another feature is related to real-time management, which allows learning and applying coping strategies in ecologically valid contexts. Among mental health apps aiming to enhance the coping abilities of clients, a few can use the real-time capabilities of smartphones (Donker et al., 2013; Harrison et al., 2011).

Mental health apps are similar to internet interventions, which use different notifications, for instance, Short Message Service (SMS), as reminders through a certain time (Bleau et al., 2014). These prompts are successful in motivating initial enrollment for changes in health behavior (Bardus et al., 2014) and also induce repeated cases of interventions, specifically when these notifications carry

feedback, theoretically informed content, or behavior change techniques (De Leon et al., 2014; Morrison et al., 2012).

As mental health mobile apps have been developed greatly, they are known to be applicable for managing stress and anxiety (Preziosa et al., 2009; Villani et al., 2013). Cyber interventions based on Stress Inoculation Training methodologies (cyber-SIT), like Mindful Apps and Mind Apps (Plaza et al., 2013), enhance up-to-date technologies to educate individuals on how to cope with psychological stress effectively (Carissoli et al., 2015). There are different formats for delivering mindfulness courses, including self-directed digital (i.e., mobile, online) delivery (Dawson et al., 2020).

Mindfulness is a mind-training skill whose effectiveness requires regular practice and persistent efforts (Parsons et al., 2017), which is considered a challenge for both app-based and face-to-face mindfulness training (Borjalilu et al., 2019). Mindfulness apps can create 24/7 access to mindfulness-based practices like Mindfulness, Buddhify (Huberty et al., 2019), Headspace, and Smiling and Calm, which have high quality (Mani et al., 2015). Donovan and colleagues (Huberty et al., 2019) showed that users were highly satisfied with using a mobile app (BodiMojo) to train adolescents about self-compassion and mindfulness. An internet- and mobile-based intervention, StudiCare Mindfulness is a low-threshold, effective, and safe tool for enhancing students' psychological well-being. (Küchler et al., 2023). In another study, Emmerik et al. (2018) used a mindfulness-based mobile app (VGZ Mindfulness Coach) to increase the quality of life, general psychiatric symptoms, and mindfulness.

Plaza et al. (2013) suggested the need for developing apps in languages other than English; only 22%, or about 11/5 of the apps studied, allow other languages. Due to the rapid growth of stress among Iranian adults (Borjalilu et al., 2015; Hashemian et al., 2015; Hezomi & Nadrian, 2018), developing the Persian version of the functional mobile stress management app is necessary. The present study aims to evaluate the efficacy of the Persian Version of the Mindfulness-Based Stress Management Mobile Application (Aramgar) for Iranian college students to improve mindful skills and reduce perceived stress.

METHODS

Research Design

This study was a one-group pre-test and post-test design with a quasi-experimental research design. The mindfulness mobile app services (Aramgar) program was the independent variable. The dependent variables were mindfulness skills and perceived stress. Participants were medical students recruited from Tehran University. The study was promoted on the university's email distribution list and in leaflets distributed throughout campus. A total of 120 people volunteered for the study. Each volunteer was eligible if (1) they had a smartphone, (2) they were not practicing mindfulness regularly, (3) they

completed the pre-test and post-test, and (4) they were committed to 8 weeks of regular practice. Finally, 85 students were selected and enrolled in the study. Participants consented to participate in the survey by emailing a link to a pre-test. Participants also provided an email address where a link to the smartphone app could be sent. They were also asked about their age, gender, level and type of education, and current educational background (undergraduate or graduate). Then, they received an email providing a link to mindfulness mobile app services (Aramgar). Students received mindfulness mobile app services (Aramgar) according to their stress level for 8 weeks, daily. Aramgar is a mindfulness-based stress reduction app for stress management that elicits learning and intervention contents via non-intelligent notifications and evaluates the validity of the application. It was developed to run on Android phones.
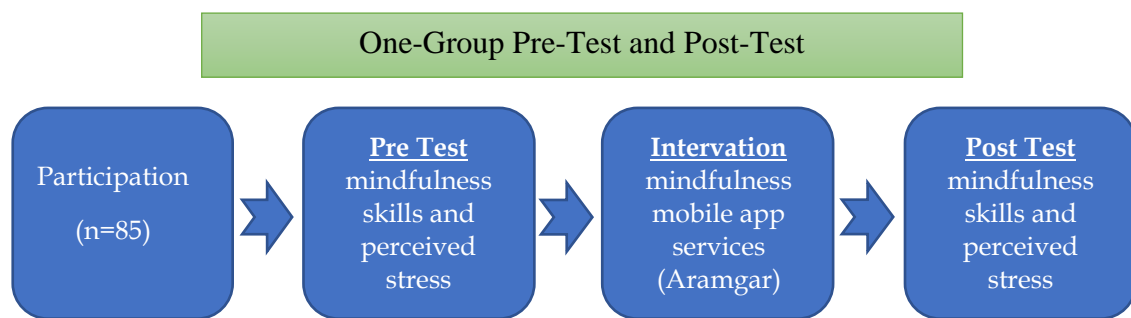

Figure 1. Process chart from the study

Before starting the study, the students had to download and install instructions for the Aramgar mobile app, which were emailed to the participants. After registration, a video would be displayed on Aramgar to reduce stress and explain how the application is accessed. Then, primary education was performed with written content to inform users about stress. In this section, users measured their stress using questionnaires and a perceived stress scale (PSS-14) based on self-assessment. Assessment feedback was provided for users.

In the second stage and the next application layer, Aramgar provided notifications based on mindfulness-based stress reduction (MBSR) and users' stress levels (severe, medium, and low). The mentioned notification would be delivered daily in audio, video, and text formats of approximately 40 characters for 20 days.

Finally, the timetable was delivered to the programmers and developers of the application so that they could regulate the sending of messages. In the end, the observation of the whole process of developing the application and testing the system's modules, as well as the final tests of the application and recognizing the potential gaps and bugs, were done. Figure 2 shows screenshots of various stress management app modules. All subjects completed the Mindfulness Inventory and Perceived Stress Scale at the beginning and end of the 8-week study. Also, subjects completed the Mobile App Rating Scale at the end to assess the app's quality.
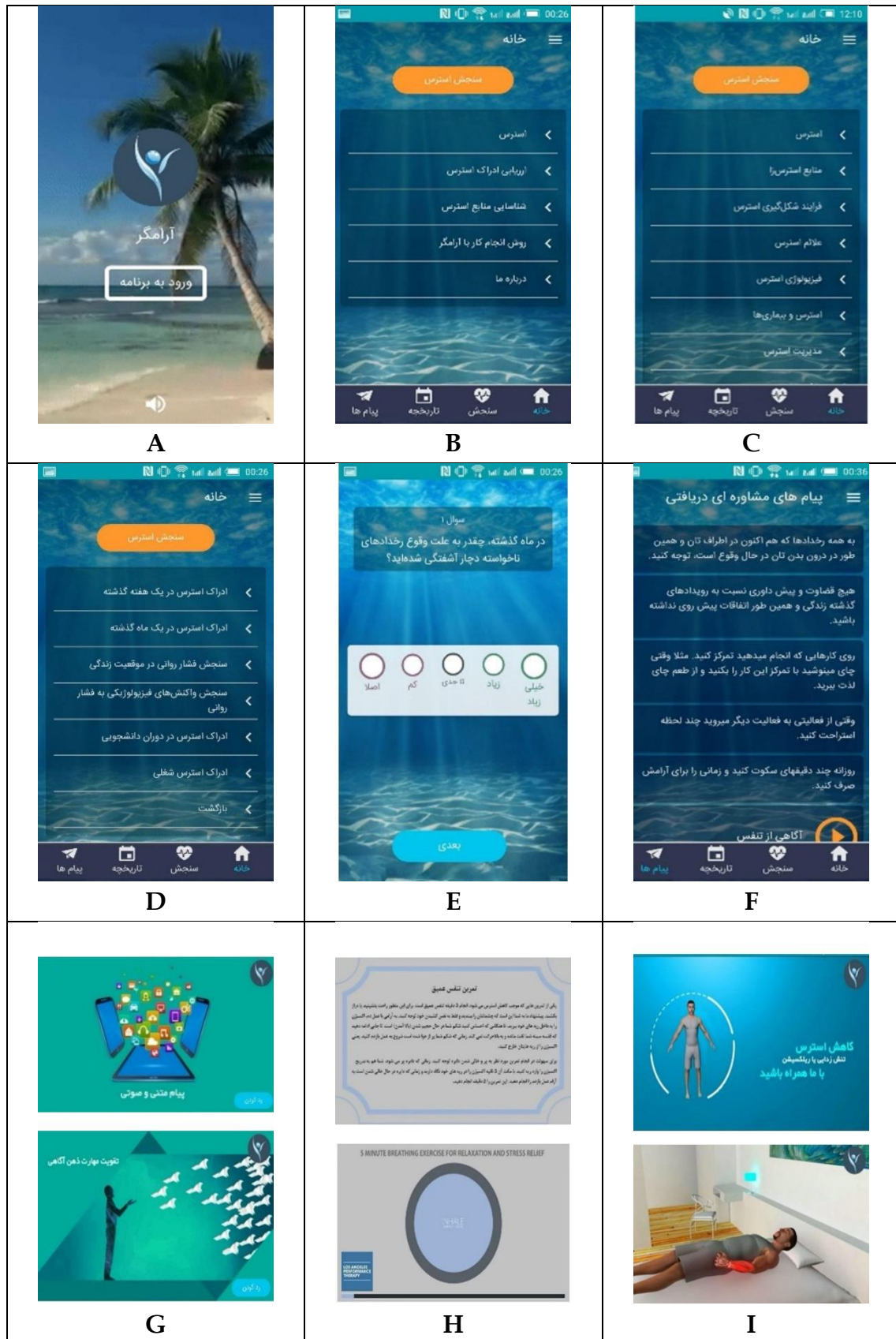
Figure 2. Stress Management App Screenshots

Note. Picture (A) shows a stress management splash screen, and (B, C) shows a sample of educational content apps. These contents include stress, the process of stress formation, the physiology of stress, stress management such as adaptation, controlling and stopping thoughts, time management, reading skills, and preparation for exams, as well as interpersonal relationships, nutrition, and sport. (D, E) illustrate a sample of self-assessment advice for stress. The perceived stress scale (PSS-14), the weekly stress inventory, the Holmes and Rahe Stress Scale, physiological measures of stress, and stress coping strategies questionnaires are included so that users measure themselves according to their needs for self-assessment and self-measurement. (F) Does the same for a sample of text message notifications about stress management. Notifications to deliver a short set of questions to users daily to assess their stress levels in real time so they could self-monitor their behaviors. (G) Depicts a detailed view of the video Mindfulness," self-management advice for stress. (H, I) shows a detailed view of the video "Muscle Relaxation and Deep Breathing," self-management advice for stress.

Research Subject

Subjects included college-age students. Eighty-five students with full-time undergraduate degrees in Tehran University medical science were recruited by email from January to April 2021.

Data Collection Method

Mindfulness: The Five Factor Mindfulness Questionnaire (FFMQ) consisted of a 39-item self-report scale from 1 to 5 utilized to evaluate multiple constructs related to mindfulness skills. Observing, non-judgment of inner experience, acting with awareness, and no reactivity to inner experience were considered subscales in this questionnaire. The reliability of FFMQ was high at baseline (r = 0.83-0.89).

The Perceived Stress Scale (PSS-10): The PSS-10 is a 10-item test that has five responses from "0 = never" to "4 = very often." The scores ranged from 0 to 40, and higher scores indicated higher perceived stress. The Cronbach's alpha was 0.9 in the present study sample.

Mobile App Rating Scale (MARS) to check out the qualifications of m-Health apps (Stoyanov et al., 2015). MARS has 23 items rated on a 5-point Likert scale. This scale had four objective quality subscales: engagement, functionality, aesthetics, and information, and a fifth subjective quality dimension. The Cronbach's alpha (α) coefficients ranged from 0.83 to 0.88.

Ethical Considerations

Shahid Beheshti University and the Iran National Science Foundation (INSF) approved this study. All participants provided written informed consent for participation.

Statistical Analysis

Paired t-tests were used to analyze whether the Aramgar apps were.

RESULT & DISCUSSION

Result

The mean age of the study participants who reported was 22.62 ± (SD) 1.37 years; 37% were male, 63% were female, 43% were single, and 31% of the students were employed. Significant demographic differences existed between groups.

Table 1. Mean differences between perceived stress, mindfulness

Variable	Baseline		Post-intervention		P value
	Mean	SD	Mean	SD	
PSS-10	33.31	(3.54)	29.15	(5.44)	.03
Observe	21.16	(4.48)	26.54	(4.65)	.01
Describe	22.42	(5.34)	27.23	(4.76)	.005
Act aware	23.35	(4.43)	25.35	(4.56)	.03
Non-judgment	19.72	(3.54)	22.43	(4.34)	.05
Non-reactivity	21.47	(3.79)	25.34	(4.22)	.001
FFMQ	108.12	(16.45)	128.89	(17.38)	.002

Table 1 contains the descriptive statistics of study outcomes. It was performed to assess whether statistically significant differences occurred based on their pre- and post-test scores on the PSS-10. The results were statistically significant ($t84 = 2.55$; P =.03; Cohen d = 0.52). The FFMQ was assessed further for statistically significant differences between the pre-test and post-test on subscales. Table 1 shows that the inventory values for observe ($t84 = 1.24$; P = .01; Cohen d = 0.46), describe ($t84 = 3.13$; P = .005; Cohen d = 0.44), act aware ($t84 = 2.65$; P = .03; Cohen d = 0.34), non-judgment ($t84 = 1.85$; P = .05; Cohen d = 0.63), non-reactivity ($t84 = 2.36$; P = .001; Cohen d = 0.38), and total score ($t84 = 2.56$; P = .002; Cohen d = 0.75) significantly improved from pre-test to post-test, also at follow-up.

Table 2 reports the analysis concerning the quality of Aramgar by the students. As shown, the overall mean score in scale engagement (M = 4.428, SD = 1.12), functionality (M = 4.575, SD = 1.1), aesthetics (M = 4.716, SD = 0.79), and information quality (M = 4.484, SD = 1.12) shows that specialists assessed the quality of the application as appropriate. As shown in the subjective quality subscale, the students with high mean scores (4.65± 1.23) were highly keen on recommending this application to others. In general, Aramgar was rated as one of the most suitable applications in the mental health area (M = 4.64, SD = 1.11).

Table 2. Assessing the Quality of Aramgar Mobile Apps
(Mean and Standard Deviation)

Subscale/item	M and SD
Engagement	
1. Entertainment	4.43± 1.2
2. Interest	4.63± 1.03
3. Customization	4.43± 1.16
4. Interactivity	4.64± 1.01
5. Target group	4.01± .81
Total mean score	4.428± 1.12
Functionality	
6. Performance	4.85±.82
7. Ease of use	4.01±1.12
8. Navigation	4.61± .95
9. Gestural designs	4.83±.71
Total mean score	4.575±1.1
Aesthetics	
10. Layout	4.84±.89
11. Graphics	4.4±.56
12. Visual appeals: How good does the app look?	4.91±.93
Total mean score	4.716±.79
Information	
13. Accuracy of app description	4.21± 1.2
14. Goals	4.56± 1.07
15. Quality of information	4.87± 1.02
16. Quantity of information	4.54± 1.23
17. Visual information	3.45± 1.65
18. Credibility	4.87± .67
19. Evidence base	4.89± .78
Total mean score	4.484± 1.12
Subjective quality	
20. Would you recommend this app?	4.65± 1.23
21. How many times do you think you would use this app?	4.56± 1.32
22. Would you pay for this app?	3.34±.65
23. What is your overall star rating for the app?	4.64± 1.11

Discussion

This study aims to determine the efficacy of the Persian Version of the Mindfulness-Based Stress Management Mobile Application (Aramgar) for Iranian college students to improve mindful skills and reduce perceived stress.

The applied cellphone application, Aramgar, regarding a psycho-educational approach, has been designed for users with stress perception who are exposed to

stress-making events. Regarding this, as has been mentioned, the application has been designed and developed in three stages: (a) training and informing, including the whiteness of stress, the process of causing stress, and managing it; (b) self-assessment and self-control, including using the daily stress test protocol for Aramgar; and (c) daily intervention via notifications-based mindfulness skills for each stress level. Hence, the main difference between Aramgar and the business version is that after assessing users' stress levels according to their stress perception, the necessary intervention will be done automatically.

Students who used Aramgar after 8 weeks showed decreased stress over time and increased mindfulness skills. Also, users engaged and interacted with the Aramgar app for longer. Champion et al. (2018) showed a significant improvement in stress, resilience, and satisfaction with life among adults after 10 days of using a mindfulness-based smartphone app. Also, Sturgill et al. (2021) showed that Ajivar is an app that utilizes artificial intelligence to deliver personalized mindfulness and emotional intelligence training that improves anxiety, depression, and EI in the college student population (Sturgill et al., 2021). Three mindfulness meditation apps, Headspace, Smiling Mind (Flett et al., 2019), and Wildflowers (Walsh et al., 2019), led to improvements in mental health.

One of the aims of Aramgar is to improve mental health literacy in stressful areas and increase mindfulness skills. Norman and Skinner defined e-Health literacy as applying electronic sources to seek, find, understand, and acknowledge health information and putting it into solving a health problem (Norman & Skinner, 2006). Based on the definition of e-Health Literacy, by having a better understanding of online health information, one is likely to be motivated to use health apps as electronic sources (Cho et al., 2014). Hence, through Aramgar, we are willing to increase Persian users' knowledge regarding stress and train them to manage it. It also promotes self-help among users to help them avoid and control stress.

Another large area in Aramgar is self-assessment. In this regard, there are two important objectives. The first is emotional self-awareness, considered one of the goals of mental health applications. Bakker et al. (2016) proved that mental health apps could lead to better emotional self-awareness and increase satisfactory means of encouragement for users to report their reflections, feelings, and behaviors. Furthermore, Runyan et al. (2013) discussed the existing evidence of using such apps to promote self-reflection through tracking, which can increase emotional self-awareness. In this domain, Aramgar helps users assess their daily perceived stress and also enables them to realize the sources of stress and recognize ways of coping with it through other surveys. Thus, it is believed that users reach an acceptable level of emotional self-awareness. So, it is necessary to deal with this in further studies.

On the one hand, Aramgar deals with the level of stress perceived by users by sending messages containing different questions at different intervals during the day and night. At last, it provides a level of stress perception for users. The

existing potentials in this application provide the chance for the researchers to realize the psychological conditions of clients in real-time and cause them to improve their ability to monitor and modulate emotional reactions, i.e., self-regulation, which impacts both mental and physical health (Fessl et al., 2012; Morris et al., 2010). So, the applied application, Aramgar, like the Mood Map app, which provides the same rooted feedback, deals with mood tracking (Morris et al., 2010).

Finally, Aramgar has been designed so meticulously that users receive notifications based on the level of stress perception and psychoeducational interventions. The following review indicates that 32 apps of this kind with satisfactory functionality are available in the iOS app store (Coulon et al., 2016). Besides patients, universities and institutions could take advantage of apps like DeStressify and mindfulness-based ones, as well as M-Health ones, especially for students who are fond of stress management (Choudhury et al., 2023; Dolbier et al., 2022; Lee & Jung, 2018; Plaza et al., 2017). Additionally, the intended interventions were based on non-intelligent notifications, and it is necessary to study the efficacy of the intended interventions in future studies.

CONCLUSION

Based on the results, Aramgar could play a role in decreasing stress and enhancing mindfulness skills among college students. In addition, high satisfaction was observed among the students after using Aramgar to decrease stress. The results could provide important information that can be implemented for other studies or the centers of mental health universities. Finally, Aramgar can be considered a user-friendly and convenient mobile phone for managing stress among Persian adolescents and developing mindfulness skills.

The present study has some limitations. First, the participants were not controlled beyond several post-intervention weeks. Thus, there was ambiguity about whether participants continually used the app or the long-term effects of the intervention. Another limitation of Aramgar was that notifications were sent to users to manage stress in this version. Yet, it was not analyzed whether users did practice managing stress, and this limitation also needs to be fixed in future versions. At last, Aramgar has been designed for Persian adults who must design and develop other functional applications with various features for teaching necessary skills to manage stress for Persian children and teenagers.

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