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

Somaieh Borjalilu

Shahid Behshti University, Iran

Corresponding email: sborjalilu@gmail.com

ARTICLE INFO	ABSTRACT
  	Functional mobile applications are 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 is a one-group pretest-posttest design with a quasi-experimental research design. Three instruments were used in this study, including 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. Aramgar is 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 analysis of Aramgar's quality regarding engagement, functionality, aesthetics, and information quality showed that specialists assessed the quality appropriately. Using functional mobile apps provides simplicity for mental health services. Therefore, to strengthen and develop the mentioned services, it is recommended that the necessary information technology infrastructures be provided and limitations for designing and running mental health mobile apps be removed.

Citation:

Borjalilu, S. (2023). The efficacy of the persian version of mindfulness-based stress management app (aramgar) for college's mindfulness skills and perceived stress. *International Journal of Islamic Educational Psychology*, *4*(1), 1-16. https://doi.org/10.18196/ijiep.v4i1.16513

INTRODUCTION

Some research has discovered that higher stress levels are likelier found among college students than 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, some universities have prioritized mindfulness-based interventions, 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). Some studies reported a significant decrease in self-reported stress among college students (Sousa et al., 2021; Sturgill et al., 2021) and an improvement in undergraduate students' well-being (Chiodelli et al., 2022). Almost all college students use the Internet and smartphones (Huberty et al., 2019). Regarding 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 apps can work 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).

Well-developed mental health mobile apps 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 (in 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 App (Aramgar) for Iranian college students to improve mindful skills and reduce perceived stress.

METHODS

Research Design

This study is a one-group pre-test and post-test design with a quasi-experimental research design. The mindfulness mobile app services (Aramgar) program is the independent variable. The dependent variables are 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 daily mindfulness mobile app services (Aramgar) according to their stress levels for eight weeks. 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. Aramgar was developed to run on Android phones.
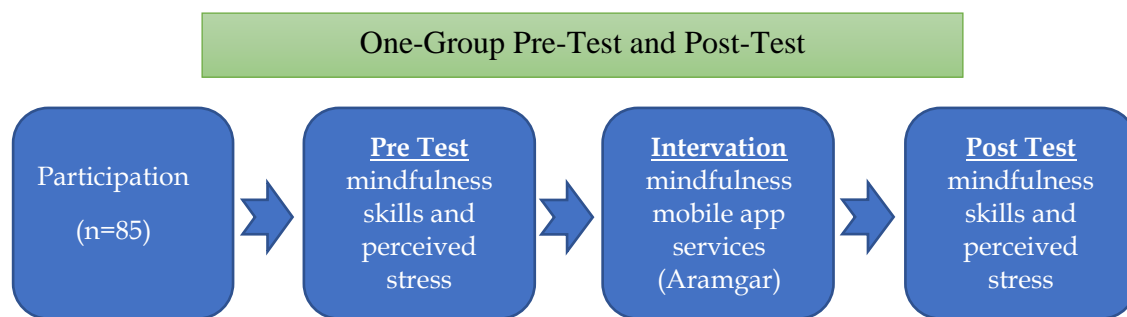

Figure 1. Process chart from the study

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.
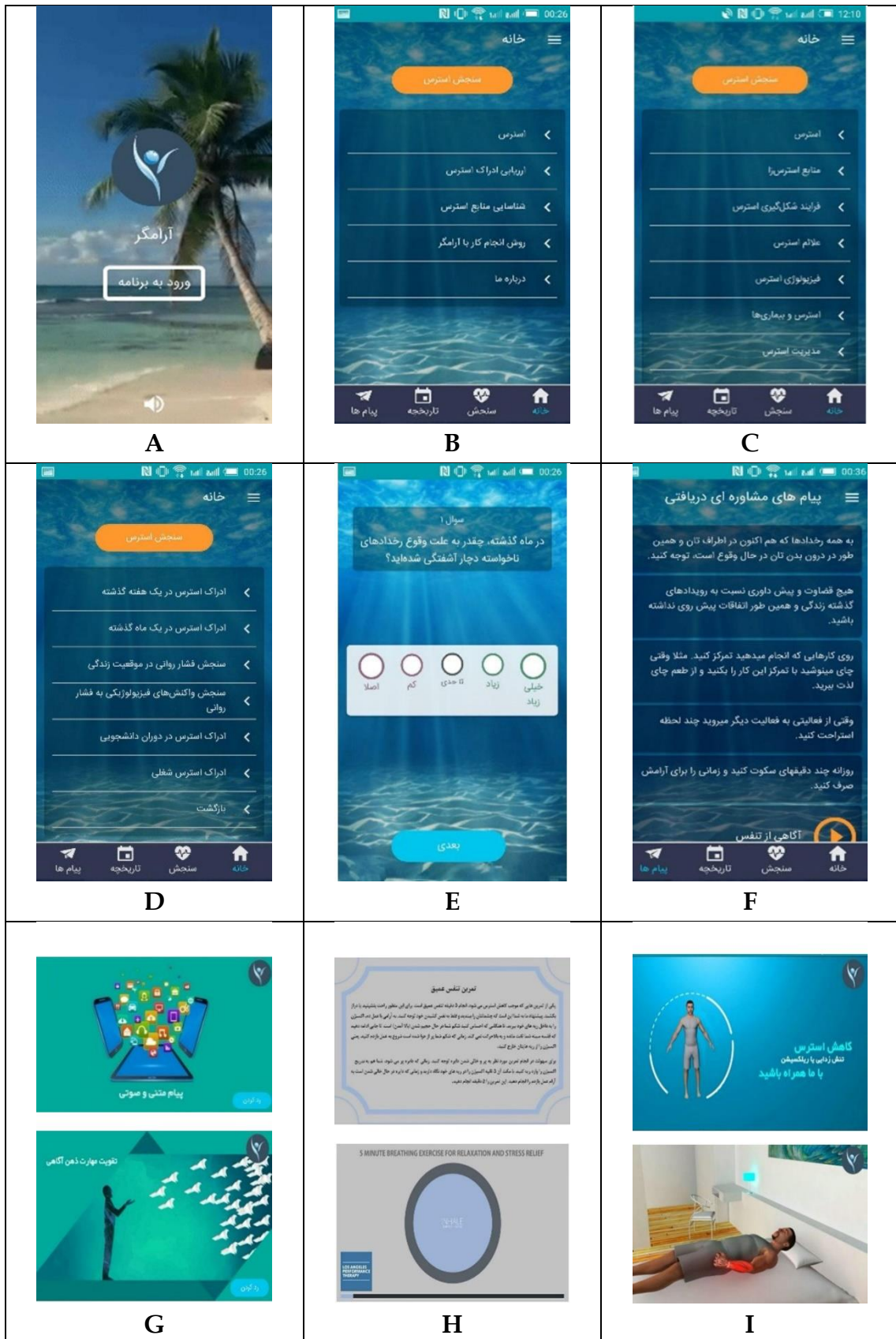
Figure 2. Stress Management App Screenshots

Picture (A) shows a stress management splash screen, and Pictures B and C show 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 sports. Pictures D and 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. Picture F shows a sample of text message notifications about stress management. Notifications deliver a short set of questions to users daily to assess their stress levels in real time so they can self-monitor their behaviors. Picture G depicts a detailed view of the video Mindfulness," self-management advice for stress. Pictures H and I show 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) consists of a 39-item self-report scale from 1 to 5 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 with 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 the Aramgar app.

RESULT & DISCUSSION

Result

The mean age of the study participants who reported was 22.62 ± (SD) 1.37; 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 and 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 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 app 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

Aramgar, regarding a psychoeducational approach, has been designed for users with stress perception who are exposed to stress-making events. This app has also 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 eight 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 ten 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.

Aramgar aims to improve mental health literacy and increase mindfulness skills in stressful areas. 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 that using such apps to promote self-reflection through tracking 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, users are believed to 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 stress level perceived by users by sending messages containing different questions at different intervals during the day and night. Lastly, Aramgar provides a level of stress perception for users. The existing potentials in this appl 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, another app, like the Mood Map app, provides the same rooted feedback and 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 similar apps 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 help reduce stress and enhance 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 for other studies or the centers of mental health universities. Finally, Aramgar is 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. Finally, 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.

REFERENCES

Arlt Mutch, V. K., Evans, S., & Wyka, K. J. J. o. C. P. (2021). The role of acceptance in mood improvement during Mindfulness-Based Stress Reduction. *Journal of Clinical Psychology*, *77*(1), 7-19. https://doi.org/10.1002/jclp.23017

Atienza, A. A., & Patrick, K. (2011). Mobile health: the killer app for cyberinfrastructure and consumer health. *American Journal of preventive medicine, 40*(5), S151-S153. https://doi.org/10.1016/j.amepre.2011.01.008

Backinger, C. L., & Augustson, E. M. (2011). Where there's an app, there's a way?. *American Journal of preventive medicine, 40*(3), 390-391. https://doi.org/10.1016%2Fj.amepre.2010.11.014

Bai, S., Elavsky, S., Kishida, M., Dvořáková, K., & Greenberg, M. T. J. M. (2020). Effects of mindfulness training on daily stress response in college students: ecological momentary assessment of a randomized controlled trial. *Mindfulness*, *11*, 1433-1445. https://doi.org/10.1007/s12671-020-01358-x

Bakker, D., Kazantzis, N., Rickwood, D., & Rickard, N. (2016). Mental health smartphone apps: review and evidence-based recommendations for future developments. *JMIR mental health,* *3*(1), e4984. https://doi.org/10.2196/mental.4984

Bardus, M., Blake, H., Lloyd, S., & Suzanne Suggs, L. (2014). Reasons for participating and not participating in an e-health workplace physical activity intervention: A qualitative analysis. *International Journal of Workplace Health Management, 7*(4), 229-246. https://doi.org/10.1108/IJWHM-11-2013-0040

Bleau, D. N., Vaughan, G. B., & Davey, J. T. (2014). Message push notification client improvements for multi-user devices. *U.S. Patent No. 8,924,489.* Washington, DC: U.S. Patent and Trademark Office.

Borjalilu, S., Mazaheri, M. A., Talebpour, A. J. I. J. o. P., & Sciences, B. (2019). Effectiveness of mindfulness-based stress management in the mental health of Iranian university students: a comparison of blended therapy, face-to-face sessions, and mHealth app (Aramgar). *Iranian Journal of Psychiatry and Behavioral Sciences*, *13*(2). https://doi.org/10.5812/ijpbs.84726

Borjalilu, S., Mohammadi, A., & Mojtahedzadeh, R. (2015). Sources and severity of perceived stress among Iranian medical students. *Iranian Red Crescent Medical Journal, 17*(10). https://doi.org/10.5812%2Fircmj.17767

Carissoli, C., Villani, D., & Riva, G. (2015). Does a meditation protocol supported by a mobile application help people reduce stress? Suggestions from a controlled pragmatic trial. *Cyberpsychology, Behavior, and Social Networking, 18*(1), 46-53. https://doi.org/10.1089/cyber.2014.0062

Champion, L., Economides, M., & Chandler, C. J. P. O. (2018). The efficacy of a brief app-based mindfulness intervention on psychosocial outcomes in healthy adults: A pilot randomised controlled trial. *PloS one*, *13*(12), e0209482. https://doi.org/10.1371/journal.pone.0209482

Chiodelli, R., Mello, L. T. N. d., Jesus, S. N. d., Beneton, E. R., Russel, T., & Andretta, I. (2022). Mindfulness-based interventions in undergraduate students: A systematic review. *Journal of American College Health, 70*(3), 791-800. https://doi.org/10.1080/07448481.2020.1767109

Cho, J., Park, D., & Lee, H. E. (2014). Cognitive factors of using health apps: systematic analysis of relationships among health consciousness, health

information orientation, eHealth literacy, and health app use efficacy. *Journal of Medical Internet Research, 16*(5). https://doi.org/10.2196/jmir.3283

Choudhury, A., Kuehn, A., Shamszare, H., & Shahsavar, Y. (2023). Analysis of Mobile App-Based Mental Health Solutions for College Students: A Rapid Review. *Healthcare, 11*(2), 272. https://doi.org/10.3390/healthcare11020272

Coulon, S. M., Monroe, C. M., & West, D. S. (2016). A systematic, multi-domain review of mobile smartphone apps for evidence-based stress management. *American Journal of Preventive Medicine, 51*(1), 95-105. https://doi.org/10.1016/j.amepre.2016.01.026

Dawson, A. F., Brown, W. W., Anderson, J., Datta, B., Donald, J. N., Hong, K., Allan, S., Mole, T. B., Jones, P. B., & Galante, J. (2020). Mindfulness-based interventions for university students: A systematic review and meta-analysis of randomised controlled trials. *Applied Psychology: Health and Well-Being, 12*(2), 384-410. https://doi.org/10.1111/aphw.12188

De Leon, E., Fuentes, L. W., & Cohen, J. E. (2014). Characterizing periodic messaging interventions across health behaviors and media: Systematic review. *Journal of Medical Internet Research, 16*(3), e2837. https://doi.org/10.2196/jmir.2837

Dolbier, C., Conder, L., Guiler, W., & Haley, E. (2022). A mindfulness-based intervention for university students: A feasibility study. *Building Healthy Academic Communities Journal, 6*(1), 47-62. https://doi.org/10.18061/bhac.v6i1.8980

Donker, T., Petrie, K., Proudfoot, J., Clarke, J., Birch, M.-R., & Christensen, H. (2013). Smartphones for smarter delivery of mental health programs: a systematic review. *Journal of Medical Internet Research, 15*(11), e247. https://doi.org/10.2196/jmir.2791

Fessl, A., Rivera-Pelayo, V., Pammer, V., & Braun, S. (2012). Mood tracking in virtual meetings. In *21st Century Learning for 21st Century Skills: 7th European Conference of Technology Enhanced Learning, EC-TEL 2012, Saarbrücken, Germany, September 18-21, 2012. Proceedings 7* (pp. 377-382). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-33263-0_30

Flett, J. A., Hayne, H., Riordan, B. C., Thompson, L. M., & Conner, T. S. J. M. (2019). Mobile mindfulness meditation: a randomised controlled trial of the effect of two popular apps on mental health. *Mindfulness, 10*, 863-876. https://doi.org/10.1007/s12671-018-1050-9

García, I. P., Sánchez, C. M., Espílez, Á. S., García-Magariño, I., Guillén, G. A., & García-Campayo, J. (2017). Development and initial evaluation of a mobile

application to help with mindfulness training and practice. *International journal of medical informatics*, *105*, 59-67. https://doi.org/10.1016/j.ijmedinf.2017.05.018

Gustafson, D. H., McTavish, F. M., Chih, M.-Y., Atwood, A. K., Johnson, R. A., Boyle, M. G., Levy, M. S., Driscoll, H., Chisholm, S. M., & Dillenburg, L. (2014). A smartphone application to support recovery from alcoholism: a randomized clinical trial. *JAMA psychiatry, 71*(5), 566-572. https://doi.org/10.1001/jamapsychiatry.2013.4642

Harrison, V., Proudfoot, J., Wee, P. P., Parker, G., Pavlovic, D. H., & Manicavasagar, V. (2011). Mobile mental health: Review of the emerging field and proof of concept study. *Journal of mental health, 20*(6), 509-524. https://doi.org/10.3109/09638237.2011.608746

Hashemian, S. M. R., Farzanegan, B., Fathi, M., Ardehali, S. H., Vahedian-Azimi, A., Asghari-Jafarabadi, M., & Hajiesmaeili, M. (2015). Stress among Iranian nurses in critical wards. *Iranian Red Crescent Medical Journal*, *17*(6). https://doi.org/10.5812%2Fircmj.22612v2

Hezomi, H., & Nadrian, H. (2018). What determines psychological well-being among Iranian female adolescents? Perceived stress may overshadow all determinants. *Health Promotion Perspectives, 8*(1), 79. https://doi.org/10.15171%2Fhpp.2018.10

Huberty, J., Green, J., Glissmann, C., Larkey, L., Puzia, M., Lee, C. J. J. M., & uHealth. (2019). Efficacy of the mindfulness meditation mobile app "calm" to reduce stress among college students: Randomized controlled trial. *JMIR mHealth and uHealth*, *7*(6), e14273. https://doi.org/10.2196/14273

Jayarajah, U., Lakmal, K., Athapathu, A., Jayawardena, A. J., & de Silva, V. J. J. o. T. U. M. S. (2020). Validating the medical students' stressor questionnaire (MSSQ) from a Sri Lankan medical faculty. *Journal of Taibah University Medical Sciences*, *15*(5), 344-350. https://doi.org/10.1016/j.jtumed.2020.08.003

Jones, D. J. (2018). Future directions in the design, development, and investigation of technology as a service delivery vehicle. In *Future Work in Clinical Child and Adolescent Psychology* (pp. 51-65). Routledge. https://doi.org/10.4324/9781315187914

Küchler, A.-M., Schultchen, D., Dretzler, T., Moshagen, M., Ebert, D. D., & Baumeister, H. (2023). A three-armed randomized controlled trial to evaluate the effectiveness, acceptance, and negative effects of studicare mindfulness, an internet-and mobile-based intervention for college students with no and "on demand" guidance. *International Journal of Environmental Research and*

Public Health, 20(4), 3208. https://doi.org/10.3390/ijerph20043208

Lee, R. A., & Jung, M. E. (2018). Evaluation of an mhealth app (destressify) on university students' mental health: pilot trial. *JMIR mental health*, 5(1), e8324. https://doi.org/10.2196/mental.8324

Lindhiem, O., Bennett, C. B., Rosen, D., & Silk, J. (2015). Mobile technology boosts the effectiveness of psychotherapy and behavioral interventions: a meta-analysis. *Behavior modification*, 39(6), 785-804. https://doi.org/10.1177/0145445515595198

Lungu, A., & Sun, M. J. T., (2016). Time for a change: college students' preference for technology-mediated versus face-to-face help for emotional distress. 22(12), *Telemedicine and e-Health*, 22(12), 991-1000. https://doi.org/10.1089/tmj.2015.0214

Mani, M., Kavanagh, D. J., Hides, L., & Stoyanov, S. R. (2015). Review and evaluation of mindfulness-based iPhone apps. *JMIR mHealth and uHealth*, 3(3), e4328. https://doi.org/10.2196/mhealth.4328

Morris, M. E., Kathawala, Q., Leen, T. K., Gorenstein, E. E., Guilak, F., DeLeeuw, W., & Labhard, M. (2010). Mobile therapy: case study evaluations of a cell phone application for emotional self-awareness. *Journal of medical Internet research*, 12(2), e1371. https://doi.org/10.2196/jmir.1371

Morrison, L. G., Yardley, L., Powell, J., & Michie, S. (2012). What design features are used in effective e-health interventions? A review using techniques from critical interpretive synthesis. *Telemedicine and e-Health*, 18(2), 137-144. https://doi.org/10.1089/tmj.2011.0062

Neely, M. E., Schallert, D. L., Mohammed, S. S., Roberts, R. M., & Chen, Y. J. (2009). Self-kindness when facing stress: The role of self-compassion, goal regulation, and support in college students' well-being. *Motivation and Emotion*, 33, 88-97. https://doi.org/10.1007/s11031-008-9119-8

Norman, C. D., & Skinner, H. A. (2006). eHealth literacy: essential skills for consumer health in a networked world. *Journal of medical Internet research*, 8(2), e506. https://doi.org/10.2196/jmir.8.2.e9

Parsons, C. E., Crane, C., Parsons, L. J., Fjorback, L. O., & Kuyken, W. (2017). Home practice in mindfulness-based cognitive therapy and mindfulness-based stress reduction: a systematic review and meta-analysis of participants' mindfulness practice and its association with outcomes. *Behaviour research and therapy*, 95, 29-41. https://doi.org/10.1016/j.brat.2017.05.004

Plaza, I., Demarzo, M. M. P., Herrera-Mercadal, P., & García-Campayo, J. (2013). Mindfulness-based mobile applications: literature review and analysis of current features. *JMIR mHealth and uHealth*, *1*(2), e2733. https://doi.org/10.2196/mhealth.2733

Pramana, G., Parmanto, B., Kendall, P. C., & Silk, J. S. (2014). The SmartCAT: an m-health platform for ecological momentary intervention in child anxiety treatment. *Telemedicine and e-Health*, *20*(5), 419-427. https://doi.org/10.1089/tmj.2013.0214

Preziosa, A., Grassi, A., Gaggioli, A., & Riva, G. (2009). Therapeutic applications of the mobile phone. *British Journal of Guidance & Counselling*, *37*(3), 313-325. https://doi.org/10.1080/03069880902957031

Runyan, J. D., Steenbergh, T. A., Bainbridge, C., Daugherty, D. A., Oke, L., & Fry, B. N. (2013). A smartphone ecological momentary assessment/intervention "app" for collecting real-time data and promoting self-awareness. *PloS one*, *8*(8), e71325. https://doi.org/10.1371/journal.pone.0071325

Sousa, G. M. D., Lima-Araújo, G. L. D., Araújo, D. B. D., & Sousa, M. B. C. D. (2021). Brief mindfulness-based training and mindfulness trait attenuate psychological stress in university students: a randomized controlled trial. *BMC psychology*, *9*, 1-14. https://doi.org/10.1186/s40359-021-00520-x

Stoyanov, S. R., Hides, L., Kavanagh, D. J., Zelenko, O., Tjondronegoro, D., & Mani, M. (2015). Mobile app rating scale: a new tool for assessing the quality of health mobile apps. *JMIR mHealth and uHealth*, *3*(1), e3422. https://doi.org/10.2196/mhealth.3422

Sturgill, R., Martinasek, M., Schmidt, T., & Goyal, R. (2021). A novel artificial intelligence-powered emotional intelligence and mindfulness App (Ajivar) for the college student population during the COVID-19 pandemic: quantitative questionnaire study. *JMIR Formative Research*, *5*(1), e25372. https://doi.org/10.2196/25372

van Emmerik, A. A., Berings, F., & Lancee, J. (2018). Efficacy of a mindfulness-based mobile application: a randomized waiting-list controlled trial. *Mindfulness*, *9*(1), 187-198. https://doi.org/10.1007/s12671-017-0761-7

Villani, D., Grassi, A., Cognetta, C., Toniolo, D., Cipresso, P., & Riva, G. (2013). Self-help stress management training through mobile phones: an experience with oncology nurses. *Psychological services*, *10*(3), 315. https://psycnet.apa.org/doi/10.1037/a0026459

Walsh, K. M., Saab, B. J., & Farb, N. A. (2019). Effects of a mindfulness meditation app on subjective well-being: active randomized controlled trial and

experience sampling study. *JMIR mental health*, *6*(1), e10844. https://doi.org/10.2196/10844