J. Health Inform. *2023 Janeiro-Março; 15(1): 3-8*

Artigo Original

DOI: https://doi.org/10.59681/2175-4411.v15.i1.2023.966

Usability evaluation of a mHealth application for overweight and obesity

Avaliação da usabilidade de um aplicativo para sobrepeso e obesidade

Evaluación de la usabilidad de una aplicación para sobrepeso y la obesidade

Giselle Christina Felix da Silva Palma[1], Marcia Ito[2], Jean Jose Silva[4], Alexandra Monteiro[3]

Keywords: mHealth, Obesity, User-Centered Design

ABSTRACT

Objectives: This study aims to evaluate the usability and feasibility of the HealthFY mobile application among employees of a private company. The app focuses on the promotion of healthy habits and weight management through the use of gamification and social media features. **Methods:** Employees were invited to use the app during a 21-day program. A mixed-method approach was employed to evaluate usability. The messages sent to an online group chat were analyzed using thematic-category content analysis. Participants also answered a questionnaire based on the Mobile Application Rating Scale - user version (uMARS).Results: In total 26 adults completed the intervention. **Results:** Indicate that the use of mHealth within a corporate-delivered context is feasible. Quantitative and qualitative analysis indicated good usability. **Conclusion:** HealthFY appears to be a suitable and easy to use tool. Future studies should evaluate its efficacy as an intervention for overweight and obesity.

Descritores: Aplicativos Móveis, Obesidade, Design Centrado no Usuário

RESUMO

Objetivos: Este estudo tem como objetivo avaliar a usabilidade e viabilidade do aplicativo móvel HealthFY entre funcionários de uma empresa privada. O aplicativo foca na promoção de hábitos saudáveis e controle do peso por meio do uso de recursos de gamificação e uso de mídia social. **Métodos:** Os funcionários foram convidados a usar o aplicativo durante um programa de 21 dias. Uma abordagem de método misto foi empregada para avaliar a usabilidade. As mensagens enviadas para um chat em grupo online foram analisadas por meio da análise de conteúdo temática-categorial. Os participantes também responderam a um questionário baseado na Mobile Application Rating Scale - versão do usuário (uMARS). **Resultados:** No total, 26 adultos completaram a intervenção. Os resultados indicam que o uso de mHealth dentro de um contexto corporativo é viável. A análise quantitativa e qualitativa indicou boa usabilidade. **Conclusão:** O HealthFY parece ser uma ferramenta adequada e fácil de usar. Estudos futuros devem avaliar sua eficácia como intervenção para sobrepeso e obesidade.

Descriptores mSaúde, Obesidad, Diseño Centrado en el Usuario

RESUMEN

Objetivos: Este estudio tiene como objetivo evaluar la usabilidad y viabilidad de la aplicación móvil HealthFY entre los empleados de una empresa privada. La aplicación se centra en la promoción de hábitos saludables y el control del peso mediante el uso de funciones de gamificación y redes sociales. **Métodos:** Se invitó a los empleados a usar la aplicación durante un programa de 21 días. Se empleó un enfoque de método mixto para evaluar la usabilidad. Los mensajes enviados a un chat grupal en línea se analizaron mediante análisis de contenido de categorías temáticas. Los participantes también respondieron un cuestionario basado en la Escala de calificación de aplicaciones móviles - versión de usuario (uMARS**). Resultados:** En total 26 adultos completaron la intervención. Los resultados indican que el uso de mHealth dentro de un contexto corporativo es factible. El análisis cuantitativo y cualitativo indicó una buena usabilidad. **Conclusión:** HealthFY parece ser una herramienta adecuada y fácil de usar. Futuros estudios deberían evaluar su eficacia como intervención para el sobrepeso y la obesidad.

[1] Professional Master's in Telemedicine and Telehealth. State University of Rio de Janeiro – UERJ, Rio de Janeiro (RJ), Brazil.
[2] Professor Doctor of the Professional Master's Program in Production Systems. Paula Souza State Technological Education Center – CPS, São Paulo (SP), Brazil.
[3] Coordinating Professor of the Postgraduate Program in Telemedicine and Telehealth. State University of Rio de Janeiro – UERJ, Rio de Janeiro (RJ), Brazil.
[4] Professor Doctor of the Department of Physical Education, Faculty of Philosophy, Sciences and Letters of São José do Rio Pardo - FEUC, São José do Rio Pardo (SP), Brazil.

Autor Correspondente**: Giselle Christina Felix da Silva Palma**
e-mail: **gisellefelix.rj@gmail.com**

Artigo recebido: **30/05/2022**
Aprovado: **11/04/2023**
https://jhi.sbis.org.br/index.php/jhi-sbis

INTRODUCTION

Over the past half-century, the prevalence of obesity has increased across all ages and genders, regardless of geographic location, ethnicity, or socioeconomic status[1]. Presently, approximately 39% of the world's population is estimated to be either overweight or obese adults[2], and the COVID-19 pandemic's countermeasures may have further exacerbated this issue by limiting physical activity[3-4]. Moreover, conventional treatments for obesity have frequently proven ineffective in the long-term[1], highlighting the importance of innovations to tackle this growing problem. One such promising solution is the use of digital interventions for weight management[5].

Mobile applications (apps) are ubiquitous and ever-growing, becoming an integral part of people's lives. Health apps are currently used for wellness management, behavioral change, data collection, patient monitoring, rehabilitation, education, and medication adherence[5]. If well designed, these tools can engage patients in self-care and improve health-related behaviors, which can ultimately reduce healthcare costs[5]. There are several types of health apps available, ranging from those that promote physical activity, facilitate gym membership, or provide online corporate wellness programs, to those that focus on treatment engagement and adherence through gamification and social networking features[6]. Some of these apps also allow for synchronous communication between users and healthcare professionals. The HealthFY app (available at www.HealthFY.com.br), which was developed and registered at the end of 2020, is one example of a digital solution that combines the features of gamification and social networking, aiming to motivate and facilitate behavior change towards a healthy lifestyle.

The HealthFY app was developed based on the best practices for the behavioral treatment of overweight and obesity, with a focus on promoting adherence to weight loss therapies through social support, self-efficacy, and self-motivation. It features a personal and collective health gamification system designed to help users establish daily healthy habits and achieve their health goals. Among the actions promoted by HealthFY are balanced meals, exercise recommendations, and reminders to drink water, among others. Moreover, the app allows users to share their results and engage with friends and family through social networks, contributing to a culture of support and care for others.

Recent reviews suggests that mobile health interventions (mHealth) are effective in weight reduction[7], and might represent a more cost-effective solution than traditional intensive in-person programs[8]. However, the engagement of users with mobile interventions is usually low. For instance, a meta-analysis of the attrition rate in apps for chronic disease reveals that 43% of participants dropped out during the studies[9]. The lack of adherence to mHealth can be attributed to several factors, including usability problems. Usability is defined as the ease of use of a product, i.e., the extent to which any product can be easily understood, liked, and used under specified conditions and for specific users[10]. Consumers of apps for weight loss value features such as personalization, simplicity, and entertainment[11]. In addition, designing user-friendly and technically stable designs are factors associated with better adherence to health apps[9]. Therefore, the usability of an app may have a major impact on the uptake of that solution, ultimately influencing the adherence to the proposed intervention. Studies that evaluate the usability and acceptability of health apps are essential to define best practices in the development and implementation of digital solutions.

Considering that obesity and overweight remain major health challenges due to their high global prevalence and their association with risk of chronic diseases[1], it is crucial to explore innovative and easily accessible solutions to promote healthy lifestyle behaviors and weight management. Thus, the aim of this study is to evaluate the usability of the HealthFY mobile app among adults working from home for a private company.

METHOD

A prospective study was carried out between May and June 2021 in a private insurance and reinsurance company based in Brazil. All employees were invited through internal communication to download the HealthFY mobile application and participate in its 21-day program that stimulates healthy habits with a focus on weight loss. A representation of the app is available in Figure 1.

An online questionnaire was used to access previous experience with digital health solutions and sociodemographic data, such as age, education, and gender. In addition, self-reported weight and height were used to calculate the Body Mass Index (BMI). All participants provided written informed consent. The Research Ethics Committee approved the study under the number CAEE 46569521.0.0000.5282.

After the end of the program, participants answered a questionnaire to evaluate the usability of HealthFY. This instrument is based on the Mobile Application Rating Scale - user version (uMARS)[12], consisting of eleven questions about the app's engagement, functionality, aesthetics, and information quality. A

Figure 1. HealthFY app interface, with game track, daily mission and game-based activity for food education.

subset of 11 items of the original measure was chosen considering the research focus and the employees' time constraint. The instrument questions and response options are available in Table 1. One researcher familiar with usability instruments translated the items to Portuguese, and two independent reviewers evaluated the translation. The internal consistency of the instrument was ascertained through Cronbach's Alpha Coefficient[13]. Descriptive analyses are reported for sociodemographic and user usability evaluation. SPSS® version 20.0[14], Excel for Windows®, and R software were used for the analyses.

Furthermore, during the program participants had access to an online group chat where they could share spontaneous messages regarding the intervention. A qualitative analysis of this text content was conducted through thematic-category content analysis[15]. This analysis consists in a series of systematic and iterative steps with the goal of creating a group of categories, called thematic axes, to summarize the content of the data. Initially, all text messages were thoroughly examined to establish the thematic axes. Following this, we extracted concise and meaningful segments of text, known as record units, from the pool of messages. The record units were then linked to the thematic axes to determine the recurrence of each category. This process enables us to identify, and highlight, relevant patterns in the text messages.

RESULTS

A total of 26 adults completed the 21-day program, of which 73.08% (n= 19) were women. Ages ranged from 25 to 50 years, with a mean of 36.7 (SD = 6.6). All participants have completed tertiary education. BMI values ranged from 19.29 kg/m² to 30.69 kg/m², with a mean of 24.11 kg/m². As for anthropometric classification, only one individual had a BMI classified as grade I obesity, while 15 (53.84%) participants were classified as overweight and 11 (42.30%) were eutrophic.

The uMARS-based Questionnaire has good internal consistency[12] as evaluated through Cronbach's Alpha coefficient (α=0.77). Table 1 shows the response frequencies for each question.

In regard to the content analysis, the corpus consisted of 36 messages. Of all messages sent in the group, only those regarding the app and its program were considered for analysis. We extracted 53 items from the corpus and divided them in 6 thematic axes that are presented, alongside their recurrence and examples of items, in Table 2. The most frequent comments were about the planning and execution of activities proposed by the HealthFY application, followed by acknowledgement messages. The full list of items and its classification according to thematic axis is available under request.

DISCUSSION

This mixed-methods study evaluated the feasibility and usability of a mobile app for weight-management to be used by adults within private companies in Brazil The participants completed a 21-day program, after which they answered a questionnaire based on the uMARS[12]. Experience reports were also collected in a group chat and analyzed using thematic-category content analysis[15]. The results suggest that implementing an app-based intervention for the promotion of healthy habits and weight management is feasible and generally

Table 1 - uMARS-based questionnaire (n= 26)

Item	Responses	N	%
Is the application fun to use?	Super fun and playful, it would encourage continued use.	19	73.08
	Fairly fun, it would entertain the user for a short time (5-10 minutes in total).	7	26.92
This app made me more aware of the importance of dealing with health related behaviors	I totally agree	19	73.08
	I partially agree	6	23.08
	I neither agree nor disagree	1	3.85
	I partially disagree	0	0
	I totally disagree	0	0
This app changed my attitudes by improving this health related behavior.	I totally agree	12	46.15
	I partially agree	11	42.31
	I neither agree nor disagree	2	7.69
	I partially disagree	1	3.85
	I totally disagree	0	0
How accurately/fast do application features (functions) and components (buttons/menus) work?	Perfect/punctual response; no technical faults found or contain "charging time remaining" indicator (if relevant).	6	23.08
	Overall, it is functional with few or negligible issues.	10	38.46
	Application works in general. Some technical issues need tweaking, or it's slow at times.	10	38.46
	Some functions work but are slow or contain major technical issues.	0	0
	The application stops; no response or response is insufficient/inaccurate (e.g. stops working/fails/resources	0	0
How easy is it to learn how to use the app, and how clear are the menu labels, icons, and instructions?	You can use the application right away; intuitive and simple (no instructions required).	5	9.23
	Easy to learn (or has clear instructions)	17	65.38
	It takes a lot of time or effort.	1	3.85
	It has no instructions or the instructions are limited; menu IDs and icons are confusing, complicated.	3	15.54
Switching screens makes sense; the app has all the necessary links between screens?	Complete flow of screens perfectly logical, easy, clear and intuitive, and/or has shortcuts.	8	30.77
	Easy to understand and navigate.	14	53.85
	Understandable after some time/effort.	3	11.54
	Understandable after a lot of time/effort.	1	3.85
	There is no connection between the screens. Navigation is difficult.	0	0
App content has good information quality, is well written and relevant to the purpose of the app?	Highly relevant, appropriate, coherent and correct.	11	42.31
	Relevant, adequate, consistent and correct.	8	30.77
	Generally relevant, adequate, coherent and correct in appearance.	7	26.92
	Poor. Not relevant / adequate / consistent / may be incorrect.	0	0
	Irrelevant, inappropriate, inconsistent or incorrect.	0	0
Would you recommend this app to people who could benefit from using it?	I would definitely recommend this app to everyone.	9	34.61
	I would recommend this app to many people.	11	42.31
	Perhaps I would recommend this app to many people.	6	23.08
	Would recommend this app to a few people.	0	0
	No way. I would not recommend this app to anyone.	0	0
How many times do you think you would use this app in the next 12 months if it were relevant to you?	>50.	9	34.61
	10-50	15	57.69
	3-10.	2	7.69
	1-2.	0	0
	None.	0	0
Would you pay for this application?	I would definitely pay.	3	11.54
	Would pay if there was a discount.	3	11.54
	Probably not	20	76.92
	I would definitely not pay.	0	0
What is your overall rating of the app?	5 Stars: One of the best I've ever used.	16	61.53
	4 stars	5	19.23
	3 Stars: Average.	5	19.23
	2 Stars.	0	0
	1 Star: One of the worst I've ever used.	0	0

well-accepted by corporate employees. This aligns with evidence on web-based interventions for employees with obesity showing that the promotion of weight loss in this population using digital health is feasible and effective[16]. The authors also found that interventions incorporating elements such as goal-setting, self-

Table 2 - Content analysis of the online group chat messages regarding the HealthFY program

Thematic Axis	Recurrence	%	Examples
Thank you messages	9	17	Thank you so much guys.... I can't stop thanking the organizers... it was more than an experience because somehow it brought our routines closer even from distance…" "Thank you for everyone's dedication, motivation and partnership in this project! It was very enriching, and seeing every sharing and photo around here was really cool!"
Feelings about using the HealthFY app	4	8	"For more incredible experiences like this 💝🎸☺" "... it's good that it will be available for a few more days 💝"
Planning and Execution of activities proposed by the HealthFY application	24	45	"Inspired by you, I wrote down several recipes from here, many meals that inspired me to eat better, in addition to having healthy routines, you managed to influence my day to day, to change some thoughts." "Jeez, group that cheers us up 💪 After a two month break, 16 km 😍😍😍"
Interactions between participants in the forum for exchanging recipes	6	11	"I loved the recipes..!! I love stews, but the healthier I knew how to make was the green stew with cauliflower..." "Yummm seems delicious, what a nice tip, I will try as well"
Congratulation messages for performance with the HealthFY app	5	9	"Congratulations to all for the dedication!" "Congratulations to all of you!!!!
Testimonials of results achieved with HealthFY	5	9	"...it was an incredible experience and a true change of habits for life" "...it was an incredible experience, I even lost a few pounds with new eating habits and healthy habits"

monitoring, and social support were more effective than those without these components[16]. HealthFY uses these elements, in addition to gamification, to increase user engagement.

The quantitative results indicate that HealthFY usability is adequate, since there were no negative reviews. Most participants evaluated the app as fun to use (73%), with good overall functioning without major technical issues (100%), easy to navigate between screens (84%), with at least generally relevant and adequate content (100%). According to the definition of usability as the ease of use of a product under specified conditions and for specific users[10], it is possible to conclude that the usability of the application was evaluated as good. However, 4 people (19%) had difficulty in learning how to use the app, suggesting that this process can take a lot of time and effort or that the instructions are not sufficiently clear. This indicates that the learning process might be demanding for some of the participants, but afterwards it becomes easy to use. Notwithstanding, future versions of the app should improve the learning process through an user-centered approach.

Furthermore, the HealthFY app seems to have led to healthy habit changes, having an impact in people's lives. 73% of participants totally agreed that the app made them more aware of the importance of dealing with health related behaviors, and 88% totally or partially agreed that the app changed the attitudes related to weight-management behavior. The qualitative analysis further corroborates these results, showing that the participants were engaged in the intervention and related different behavioral modifications, such as healthy eating habits, more frequent exercise, and drinking water more often. Digital interventions may have an impact in the adoption of healthy behaviors, helping people to transition from attitude to action. This change might be due to the use and promotion of goal-setting, self-monitoring, feedback, the ability to motivate, educate, and remind, and social support, which were previously found in the literature as benefits of mHealth for weight loss[11,16].

The online discussion groups seem to have played an important role in the intervention, allowing for the sharing of messages, tips, and photos, engaging participants collectively. A review of social media interventions for weight reduction and physical activity yielded mixed results[17], however preliminary evidence suggest that well-designed interventions might promote behavior change and increase social support, which are important factors in maintaining long-term weight loss. In addition, the use of online groups within a larger program of behavioral change might be more effective than social media intervention alone. HealthFY also uses a gamification approach, which is indicated to improve short-term engagement[18], and could thereby increase user satisfaction and usability scores.

Despite the positive usability evaluation, participants showed low interest in acquiring the app. Only 11.5% said that would definitely pay for it. Considering that the implementation of the program within a private company was feasible, it might be of the interest of companies to implement mHealth interventions as part of a policy to promote employee well-being. A recent systematic review of mHealth to promote physical activity and reduce sedentary behavior in the workplace indicates that there is reasonable evidence demonstrating its feasibility and acceptability[19].

The study has limitations that need to be addressed. Firstly, employees' time constraints prevented the use of the full uMARS, which may result in loss of information. In addition, the over-representation of women in the sample could limit the generalizability of the findings to

the broader population. The qualitative analysis also has limitations as the data only consisted of spontaneous messages shared in an online group, which may have been biased towards more positive content. Future studies should consider evaluating the effects of HealthFY on the treatment of overweight and obesity, which was not a focus of this study. Additionally, researchers should consider adapting the uMARS to the Brazilian population to facilitate further research in the field of mHealth. The availability of instruments to evaluate usability might allow for a better comparison of scientific evidence to further improve the quality of health apps and enhance user experience.

CONCLUSION

This study aimed to evaluate the feasibility and usability of HealthFY, a mobile app designed for weight management and the promotion of healthy habits. The app's usability was rated as good. HealthFY appears to be a suitable tool for integrating health strategies within corporate-delivered programs, potentially preventing and intervening in cases of overweight and obesity.

REFERENCES

1. Blüher M. Obesity: global epidemiology and pathogenesis. *Nat Rev Endocrinol.* 2019;15(5):288-298. doi:10.1038/s41574-019-0176-8.
2. Chooi YC, Ding C, Magkos F. The epidemiology of obesity. *Metabolism.* 2019; 92:6-10. doi:10.1016/j.metabol.2018.09.005.
3. Popkin BM, Du S, Green WD, et al. Individuals with obesity and COVID-19: a global perspective on the epidemiology and biological relationships. *Obes Rev.* 2020;21(11):1-17. doi:10.1111/obr.13128.
4. Clemmensen C, Petersen MB, Sørensen TIA. Will the COVID-19 pandemic worsen the obesity epidemic?. *Nat Rev Endocrinol.* 2020 Nov;16(9):469-470. doi: 10.1038/s41574-020-00441-5.
5. Szinay D, Jones A, Chadborn T, Brown J, Naughton F. Influences on the uptake of and engagement with health and well-being smartphone apps: systematic review. *J Med Internet Res.* 2020;22(5):1-23. doi:10.2196/17572.
6. Greiwe J, Nyenhuis SM. Wearable technology and how this can be implemented into clinical practice. *Curr Allergy Asthma Rep.* 2020;20:1-10. doi: 10.1007/s11882-020-00915-w.
7. Wang Y, Min J, Khuri J, et al. Effectiveness of mobile health interventions on diabetes and obesity treatment and management: systematic review of systematic reviews. *JMIR Mhealth Uhealth.* 2020;8(4):1–12. doi:10.2196/15400.
8. Ufholz K, Werner J. The efficacy of mobile applications for weight loss. *Curr Cardiovasc Risk Rep.* 2023;17(4):83-90. doi:10.1007/s12170-023-00717-2.
9. Meyerowitz-Katz G, Ravi S, Arnolda L, Feng X, Maberly G, Astell-Burt T. Rates of attrition and dropout in app-based interventions for chronic disease: systematic review and meta-analysis. *J Med Internet Res.* 2020;22(9):1-10. doi:10.2196/20283.
10. Paz F, Pow-Sang JA. A systematic mapping review of usability evaluation methods for software development process. *Int J Softw Eng its Appl.* 2016;10(1):165-178. doi:10.1109/ASEA.2015.8
11. Lyzwinski LN, Caffery LJ, Bambling M, Edirippulige S. Consumer perspectives on mHealth for weight loss: a review of qualitative studies. *J Telemed Telecare.* 2018;24(4):290-302. doi:10.1177/135763 3X17692722.
12. Stoyanov SR, Hides L, Kavanagh DJ, Wilson H. Development and Validation of the User Version of the Mobile Application Rating Scale (uMARS). *JMIR MHealth UHealth.* 2016;4(2):1-5. doi: 10.2196/mhealth.5849.
13. Gliem JA, Gliem RR. Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales. Midwest research-to-Practice Conference in Adult, Continuing, and community education. 2003. Accessed May 11, 2022. https://scholarworks.iupui.edu/handle/1805/344
14. IBM Corp. IBM SPSS Statistics for Windows. IBM Corp; 2011.
15. Bardin L. *Análise de conteúdo.* Edições 70; 2016.
16. Lee Y, Lee NY, Lim HJ, Sung S. Weight Reduction Interventions Using Digital Health for Employees with Obesity: A Systematic Review. *Diabetes Metab Syndr Obes.* 2022;13(15):3121-3131. doi:10.2147/ DMSO.S384450.
17. Shiyab WE, Halcomb E, Rolls K, Ferguson C. The impact of social media interventions on weight reduction and physical activity improvement among healthy adults: systematic review. *J Med Internet Res.* 2023;25:1-16. doi:10.2196/38429
18. Sardi L, Idri A, Fernández-Alemán JL. A systematic review of gamification in e-Health. *J Biomed Inform.* 2017;71:31-48. doi:10.1016/j.jbi.2017.05.011.
19. Buckingham SA, Williams AJ, Morrissey K, Price L, Harrison J. Mobile health interventions to promote physical activity and reduce sedentary behaviour in the workplace: A systematic review. *Digit Health.* 2019;5:1-50. doi:10.1177/20552076198 39883.