IJHS

Original Article

# Effect of a WhatsApp walking trial on daily steps among female Saudi Arabian university students

**Juliann Saquib[1]*, Homaidan T. Alhomaidan[2], Abdulrahman Al-Mohaimeed[2], Lujain Aljaghwani[2], Raghad Al-Mohaimeed[2], Darren Alghadhiyah[2], Raghad Altwijri[2], Amal Lafi Alazmi[2], Fatmah Ali Al-Mohaimeed[2], Ghadah Saleh Alhamed[2], Asma Abdullah Alsowiyan[2], Ashwaq Mohammed Alharbi[2], Nazmus Saquib[1]**

[1]Department of Clinical Sciences, College of Medicine, Sulaiman Al Rajhi University, Al Bukayriah, Saudi Arabia, [2]Department of Family and Community Medicine, College of Medicine, Qassim University, Buraidah, Saudi Arabia

**Address for correspondence:**
Juliann Saquib, Ph.D., Assistant Professor, Department of Clinical Sciences, College of Medicine, Sulaiman Al Rajhi University, Saudi Arabia. Phone: 00966 50 713 6832.
E-mail: jsaquib11@gmail.com

**WEBSITE:** ijhs.org.sa
**ISSN:** 1658-3639
**PUBLISHER:** Qassim University

## ABSTRACT

**Objective:** Physical inactivity in Saudi women is high, even among young women (60% of university students are physically inactive). We aimed to investigate the effect of a physical activity intervention on daily walking among female students at a Saudi university.

**Methods:** Two hundred and seven female students (mean age: 22.6 ± 1.3; body mass index: 24.6 ± 5.9) participated in a parallel-group randomized trial. The intervention group wore pedometers and received health-promotion messages for 12 weeks through WhatsApp®; the control group received a similar number of messages unrelated to health. Average daily steps and self-reported activity were assessed at baseline and after 3 months. Analysis followed an intention-to-treat approach. Group differences in average daily steps were assessed using a two (group) by 2 (time) ANOVA. F-tests for main effects and the interaction were evaluated; $P < 0.05$ was considered significant.

**Results:** There was a significant group-by-time interaction, that is, the intervention group had a significantly higher change in daily steps compared to the control group (+576 vs. −525; F = 4.33, $P = 0.04$). Self-reported daily activity was not significantly different by group.

**Conclusions:** The intervention was effective at improving the number of daily steps in young women. Future studies could test this intervention among other student groups.

**Keywords:** Intervention, physical activity, university students, walking

## Introduction

Sedentary lifestyle is a major public health concern in Saudi Arabia.[1-3] A recent review estimated that between 35% and 65% of Saudi adults are physically active.[4] The most current estimates come from a national survey that reported that only 13% of adults meet the guidelines for recommended physical activity.[5] Studies have corroborated that there is a gender effect and that women are disproportionately less active.[6-8] Estimates for female university students have suggested that between 47% and 62% are considered active.[4,9,10]

Although social media's effect on health is not being tested in Saudi Arabia, elsewhere in the world, there is a growing body of literature examining the use of social media as the delivery method for health behavior interventions.[11,12] Interventions that are based on online networking platforms have significantly improved health behaviors such as smoking, diet, and physical activity; however, adherence to these interventions has been low, and the effect sizes have been small.[11] The trials that have used social media to encourage physical activity among college students have shown mixed results. A few showed modest but non-significant improvements in activity,[13] while others demonstrated significant changes in overall exercise level and daily steps in the intervention groups.[14,15]

The scientific literature in Saudi Arabia on physical activity has been mostly cross-sectional studies,[16] and the published trials have been either small or focused on other outcomes.[17,18] However, Saudi Arabia is an ideal setting for the development of social media interventions for physical activity promotion. The use of smartphones and social networking applications

among Saudi university students is widespread.[19] It is estimated that 82% have owned a smartphone for >3 years, and they spend on average 6.6 h/day reading news, social networks, and doing academic work on them.[19]

The tested intervention in the present study was based on the principles of social cognitive theory (SCT), which was developed by Albert Bandura.[20] The theoretical components included in the intervention design were the following: (a) having a goal, (b) monitoring one's own behavior, and (c) building self-efficacy through daily feedback. There is a rich literature on the use of SCT to promote physical activity,[21] which shows that interventions designed to promote self-efficacy consistently increase activity. The WhatsApp® application was chosen as the delivery system due to its popularity in Saudi Arabia. Several studies have reported that it is a main communication platform (>24 million users), and it has been used for various interventions in education.[22-24] The trial objectives were to

1. Compare the change in average daily steps between physical activity intervention participants and control participants among female university students. Intervention participants used pedometers and received two to three health-related messages weekly through WhatsApp. Control participants received two to three non-health-related messages weekly also through WhatsApp.
2. Compare the change in daily minutes of self-reported physical activity between intervention participants and control participants.

## Methods

### Design and eligibility

The study used a 2 × 2 randomized trial design, which included one intervention and one control arm and assessed the outcomes before and after a 3-month intervention period. Participants were recruited from a university in the central region of Saudi Arabia. Eligibility criteria included being a female student at the university, having a smartphone with access to WhatsApp, being physically active ≤150 min/week and being willing to complete all activities for the trial. Students were excluded if they did not have a smartphone, already exercised >150 min/week (self-reported), or had any disability that prevented them from exercising regularly. The study was approved by the regional research ethics committee, registered on clinicaltrials.gov, and was conducted in 2017.

### Study protocol

After screening for eligibility criteria, research assistants explained the purpose of the study and the requirements to the participants. The participants read and signed the informed consent. All participants were assessed at baseline and follow-up; the intervention period was 12 weeks. The assessment team was blinded from the participants' group assignment. Participants were randomized 1:1 to either the walking intervention group or the attention-control group. Randomization was applied using a pre-generated online randomization scheme [Figure 1]; this procedure was blinded from the recruitment and assessment teams.

#### *Intervention*

The intervention included four components: (a) brief information about healthy lifestyles, (b) pedometers for self-monitoring, (c) goal setting, and (d) optional social support. Intervention participants were given a brief (15 min) orientation, where they learned about the importance of exercise and the benefits of walking. The participants joined a WhatsApp group through their smartphones during the first orientation session with the research assistant. They received two to three health-related (walking and healthy lifestyle) promotional WhatsApp messages per week during the 12-week intervention period. The content of the messages was created in an earlier American study and translated into Arabic for this study (with the permission of the authors).[25,26] They were given a pedometer and told to wear it every day during the intervention period (12 weeks), during which time they should try to reach the daily step goal of 8000 steps. The

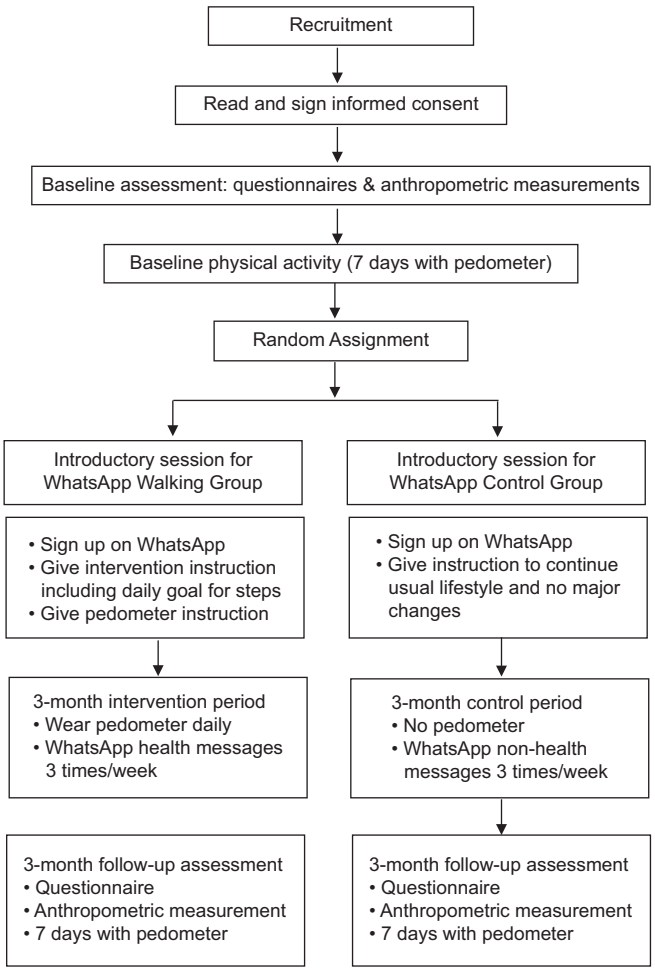


**Figure 1:** An overview of the study design and procedures for the WhatsApp® walking trial

research assistants encouraged them to meet or exceed this goal every day. This goal was set according to the lower threshold for active adults since most females in this population have not been physically active before.[27] Finally, in addition to receiving WhatsApp messages, they had the option to respond to the messages and/or interact with fellow participants in the group.

### *Control*

The control participants were enrolled into a different WhatsApp group during their first session with the research assistant. They received an equivalent number of messages (two to three non–health-related messages) per week through WhatsApp. They were not given a pedometer during the 12-week intervention period and were asked to maintain their normal lifestyle. Interaction within the WhatsApp group was optional.

## Assessments

### *Baseline*

The participants completed a standard questionnaire, which included questions on demography, lifestyle (e.g., screen time and sleep hours per night), diet (i.e., 24-h dietary recall), and physical activity (i.e., International Physical Activity Questionnaire [IPAQ]).[28-30] The participants were measured for height, weight, and waist circumference using standard protocols. All participants were given a pedometer and were asked to wear it continuously for 7 days and to maintain their usual activity during that week. The pedometers were checked by study staff for functionality before they were given to the participants. When participants returned the pedometers, the data were extracted. The group assignments were disclosed to them, and they were given an introductory session according to their assigned groups.

### *Follow-up*

After 12 weeks, each participant was contacted for the follow-up assessment. All participants were given a pedometer to wear for another 7-day assessment of steps. The assessment included the 7-day step average and a questionnaire (qualitative data on experience during the walking intervention and the IPAQ).

## Measures

The primary outcome was average daily steps assessed by pedometer. The Omron® HJ-320 Tri-axis accurately assesses step count using tri-axis accelerometer sensors that allow it to detect steps from any position. It also has a 7-day memory and automatically resets to zero at midnight. These advantages make it a common choice for research studies.[31] The data for 7 days were directly recorded from the pedometer and the average daily steps were calculated (i.e., sum of 7 days/seven). If a participant did not complete the full 7 days, the average was taken from the number of completed days as long as there were more than four complete days. For descriptive statistics, the cutoff of 8,000 steps/day was applied to determine the proportion of participants who met the step goal.

For the secondary outcome, the self-reported average number of minutes of activity per day was calculated from the IPAQ based on published methods.[7,28] Briefly, mild, moderate, and vigorous exercise sessions were recorded, and the number of days were multiplied by the minutes per session and then divided by seven.

## Data analysis

Baseline characteristics were compared between the study arms to see whether the groups were similar pre-intervention (comparisons were done using Chi-square or *t*-test). Analysis followed an intention-to-treat approach. Group differences in average daily steps (pedometer) and self-reported minutes of daily physical activity were assessed using two (group) by 2 (time) ANOVAs. *F*-tests for main effects and the interaction were evaluated and $P < 0.05$ was considered significant. Data were analyzed with SPSS® (version 21), and no *post hoc* or correction for multiple comparisons was required.

# Results

A total of 207 participants were enrolled in the study; 15 withdrew consent before completing the baseline assessment, and 11 withdrew during the intervention period, which resulted in 181 who completed the trial. The data analysis included all randomized participants; there were 103 participants in the intervention arm and 104 in the control arm ($n = 207$) [Figure 2]. There were no significant differences in demographic or anthropometric characteristics between those who completed the intervention period and those who withdrew from the study. Baseline characteristics were similar between the two groups [Table 1]. The majority of participants in both groups reported having normal weight (body mass index: I: 64.1%, C: 67.3%).

At baseline, both groups demonstrated relatively low daily step averages (I: 4813; C: 4392) with no significant difference between them. During the 12-week study period, intervention participants increased their average daily steps, while the control group decreased their steps (I: +576; C: -525). There was a significant main effect for group (ANOVA; $F$-test = 5.76, $P = 0.001$), and there was a significant group-by-time interaction (ANOVA; $F$-test = 4.33, $P = 0.038$), indicating that the intervention group had a higher change in their average daily step count between baseline and follow-up compared to the control group [Table 2]. At follow-up, the proportion of intervention participants who met the step goal (>8,000 step/day) was higher than the proportion of control participants who met the goal (12.6% vs. 6.7%). There were no significant differences between groups for self-reported minutes of physical activity (ANOVA; $F$-test = 0.10, $P = 0.76$).

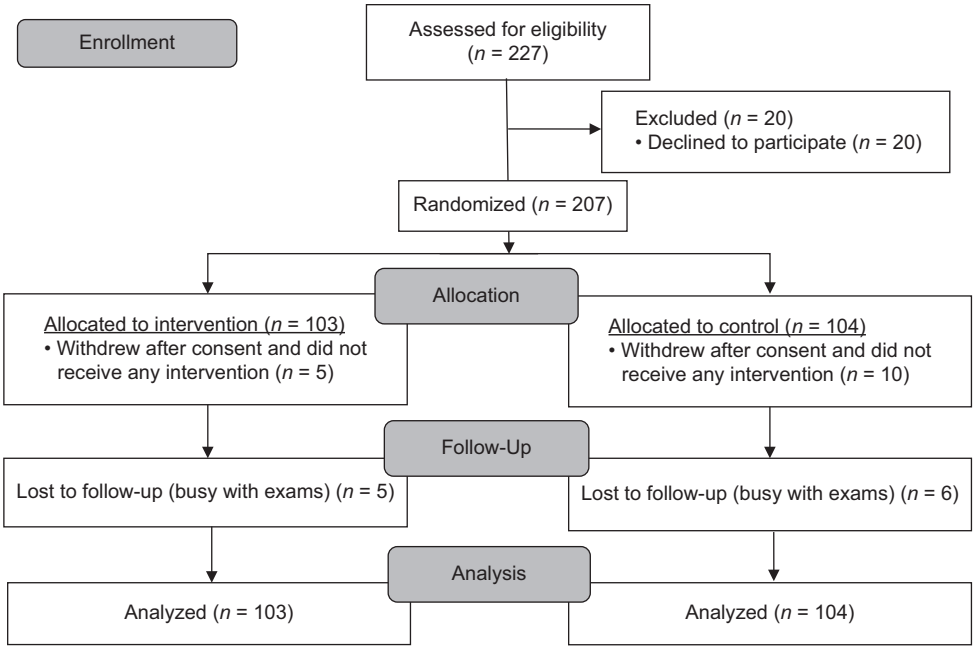


**Figure 2:** Consort diagram from the WhatsApp® walking trial

**Table 1:** Demographic, anthropometric, and lifestyle characteristics among female university students enrolled in the WhatsApp® walking trial (*n*=207)

| Description | Walking intervention *n*=103 % or mean (SD) | Attention control *n*=104 % or mean (SD) | *P* value |
|---|---|---|---|
| Age (years) | 22.6 (1.35) | 22.6 (1.32) | 0.97 |
| Education | | | 0.52 |
| Preparatory through 2nd year | 44.7 | 49.0 | |
| 3rd through 5th year | 55.3 | 51.0 | |
| Weight (kg) | 63.1 (17.61) | 60.6 (14.05) | 0.25 |
| Body mass index (BMI) (kg/m$^2$) | 24.8 (6.39) | 24.4 (5.40) | 0.60 |
| Obesity status (BMI categories) | | | 0.74 |
| Normal <25 | 64.1 | 67.3 | |
| Overweight 25–29.9 | 17.5 | 18.3 | |
| Obesity ≥30 | 18.4 | 14.4 | |
| Waist circumference (cm) | 78.2 (13.36) | 77.0 (13.63) | 0.50 |
| Central obesity status (cut-off=90 cm) | | | 0.24 |
| Normal | 81.6 | 87.5 | |
| Obese | 18.4 | 12.5 | |
| Average daily steps (pedometer) | 4813 (2430) | 4392 (2000) | 0.17 |
| % >8,000 steps/day | 8.7 | 3.8 | 0.15 |
| Self-reported daily walking (min) | 25.1 (25.35) | 24.8 (29.82) | 0.93 |

BMI: Body mass index

## Discussion

The study tested the effect a walking intervention that employed pedometers and messages through WhatsApp had on physical activity. The results showed a significant group-by-time interaction for pedometer-recorded daily steps, which meant that the change in average daily steps was different between the intervention and the control group. Specifically, average daily steps increased among intervention participants, while it decreased among control participants. The study groups were not significantly different for self-reported physical activity.

The study findings are similar to those of other trials that have tested physical activity interventions delivered through social media applications. Some studies have shown improvements in physical activity, including increased average daily

**Table 2:** Physical activity among female university students enrolled in the WhatsApp® walking trial (*n*=207)

| Variable | Baseline | Follow-up | Change | *F*-test* | *P* value | Effect size |
|---|---|---|---|---|---|---|
| Average daily steps (pedometer) | Mean (SD) | | | 4.33 | 0.038 | 0.01 |
| Intervention | 4813 (2430) | 5445 (3931) | 576 (4014) | | | |
| Control | 4392 (2000) | 3867 (2589) | -525 (3035) | | | |
| Self-reported daily walking (min) | | | | 0.10 | 0.76 | 0.001 |
| Intervention | 25.1 (25.3) | 56.0 (37.8) | 17.2 (35.5) | | | |
| Control | 24.7 (29.8) | 57.8 (40.1) | 19.6 (42.2) | | | |

*The *F*-test reported is from the group-by-time interaction term in a 2 × 2 ANOVA

steps. Overall, the effects of these interventions have been statistically significant but has had a modest effect size.[13,32] For example, one study that was conducted in southern California was quite similar to the present study in terms of size, scope, and participants, and those results showed improvements that were significant by time but not by group for physical activity.[13] Another trial among female undergraduates showed that women in a Facebook social support group intervention increased daily steps significantly more than women in a standard walking intervention.[15] One aspect of these trials that could be further examined is the extent to which the participants need to interact with the intervention. In our study, the participants were part of a WhatsApp group that allowed them to post (i.e., send messages to the group), but they did not use this option; they only received two to three prompts per week. However, in the Facebook social support intervention, which had a larger effect, the participants were much more engaged; they were asked to post their steps per day and provide feedback to one another. This level of engagement may mimic accountability and may be critical to behavior change.

### Strengths and limitations

The strengths of the study include the use of a randomized trial design and objective assessment of the outcomes (pedometer). Furthermore, the study had a sufficient sample size and statistical power to examine the primary outcome. The intervention was simple and utilized a common phone application, which increases the generalizability and potential distribution of the intervention. The intervention can be implemented on a larger scale with minimal cost.

A major study limitation is that we did not include any process evaluation during the intervention; therefore, we cannot determine the exact level of adherence to the intervention in between the assessment periods. The only assessment of adherence is the proportion of intervention participants who met the walking goal at follow-up. Another limitation was the significant amount of time and effort that was required of the research team to follow-up with the participants. Saudi female university students have had little exposure to research participation, and many did not fully understand the type of commitment required when they initially agreed. In addition, follow-up was affected by university examination schedules for some (but not all) of the participants whose 12-week period ended near the end of the academic year. The intervention only focused on the goal to increase daily steps and did not address any other targets such as weight loss.

## Conclusions

Delivering a physical activity intervention to university students through WhatsApp is feasible and potentially effective to increase daily steps. Using smartphone applications and available technology is both appealing to young adults and cost effective. The intervention could be disseminated to other groups of students to increase daily walking, such as boys and girls as well as younger students. Future interventions should test other applications as potential delivery methods as well as increasing social accountability online.

## Authors Declaration

### Ethics approval and consent to participate

The study was approved by the regional research ethics committee, registered on clinicaltrials.gov (NCT03143309).

### Availability of data and material

The data that support the findings of this study are available from the corresponding author on reasonable request.

### Competing interests

The authors declare that they have no conflicts of interest.

### Funding statement

This work was supported by Qassim University's Deanship of Scientific Research.

### Authors' contributions

NS and JS designed the study and wrote the protocol. JS analyzed the data. All authors contributed to the various aspects of the fieldwork, including recruitment, pre- and post-testing, and intervention management. All authors contributed to writing and editing the manuscript, and all approved the final version.

## Acknowledgments

The authors thank Ms. Erin Strotheide for her editorial contributions to this article.

## References

1. Memish ZA, El Bcheraoui C, Tuffaha M, Robinson M, Daoud F, Jaber S, *et al*. Obesity and associated factors--Kingdom of Saudi Arabia, 2013. Prev Chronic Dis 2014;11:E174.
2. Al-Othaimeen AI, Al-Nozha M, Osman AK. Obesity: An emerging problem in Saudi Arabia. Analysis of data from the National Nutrition Survey. East Mediterr Health J 2007;13:441-8.
3. Al-Hazzaa HM, AlMarzooqi MA. Descriptive analysis of physical activity initiatives for health promotion in Saudi Arabia. Front Public Health 2018;6:329.
4. Alahmed Z, Lobelo F. Physical activity promotion in Saudi Arabia: A critical role for clinicians and the health care system. J Epidemiol Glob Health 2018;7 Suppl 1:S7-15.
5. El Bcheraoui C, Tuffaha M, Daoud F, Kravitz H, Al Mazroa MA, Al Saeedi M, *et al*. On your mark, get set, go: Levels of physical activity in the Kingdom of Saudi Arabia, 2013. J Phys Act Health 2016;13:231-8.
6. Al-Hazzaa HM. Physical inactivity in Saudi Arabia revisited: A systematic review of inactivity prevalence and perceived barriers to active living. Int J Health Sci (Qassim) 2018;12:50-64.
7. Al-Hazzaa HM. Health-enhancing physical activity among Saudi adults using the International Physical Activity Questionnaire (IPAQ). Public Health Nutr 2007;10:59-64.
8. Al-Nozha MM, Al-Hazzaa HM, Arafah MR, Al-Khadra A, Al-Mazrou YY, Al-Maatouq MA, *et al*. Prevalence of physical activity and inactivity among Saudis aged 30-70 years. A population-based cross-sectional study. Saudi Med J 2007;28:559-68.
9. Khalaf A, Ekblom Ö, Kowalski J, Berggren V, Westergren A, Al-Hazzaa H. Female university students' physical activity levels and associated factors--a cross-sectional study in southwestern Saudi Arabia. Int J Environ Res Public Health 2013;10:3502-17.
10. Alzamil HA, Alhakbany MA, Alfadda NA, Almusallam SM, Al-Hazzaa HM. A profile of physical activity, sedentary behaviors, sleep, and dietary habits of Saudi college female students. J Family Community Med 2019;26:1-8.
11. Maher CA, Lewis LK, Ferrar K, Marshall S, De Bourdeaudhuij I, Vandelanotte C. Are health behavior change interventions that use online social networks effective? A systematic review. J Med Internet Res 2014;16:e40.
12. Latkin CA, Knowlton AR. Social network assessments and interventions for health behavior change: A critical review. Behav Med 2015;41:90-7.
13. Cavallo DN, Tate DF, Ries AV, Brown JD, DeVellis RF, Ammerman AS. A social media-based physical activity intervention: A randomized controlled trial. Am J Prev Med 2012;43:527-32.
14. Zhang J, Brackbill D, Yang S, Centola D. Efficacy and causal mechanism of an online social media intervention to increase physical activity: Results of a randomized controlled trial. Prev Med Rep 2015;2:651-7.
15. Rote AE, Klos LA, Brondino MJ, Harley AE, Swartz AM. The efficacy of a walking intervention using social media to increase physical activity: A randomized trial. J Phys Act Health 2015;12 Suppl 1:S18-25.
16. Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Alsulaiman NA, Musaiger AO. Prevalence of overweight, obesity, and abdominal obesity among urban Saudi adolescents: Gender and regional variations. J Health Popul Nutr 2014;32:634-45.
17. Al-Eisa E, Al-Rushud A, Alghadir A, Anwer S, Al-Harbi B, Al-Sughaier N, *et al*. Effect of motivation by "Instagram" on adherence to physical activity among female college students. Biomed Res Int 2016;2016:1546013.
18. Midhet FM, Sharaf FK. Impact of health education on lifestyles in central Saudi Arabia. Saudi Med J 2011;32:71-6.
19. Alosaimi FD, Alyahya H, Alshahwan H, Al Mahyijari N, Shaik SA. Smartphone addiction among university students in Riyadh, Saudi Arabia. Saudi Med J 2016;37:675-83.
20. Bandura A. Social cognitive theory for personal and social change by enabling media. In: Singhal A, Cody MJ, Rogers EM, Sabido M, editors. Entertainment-education and Social Change: History, Research, and Practice. United States: Lawrence Erlbaum Associates Publishers; 2004. p. 75-96.
21. Keller C, Fleury J, Gregor-Holt N, Thompson T. Predictive ability of social cognitive theory in exercise research: An integrated literature review. Online J Knowl Synth Nurs 1999;6:2.
22. Global Media Insight. Saudi Arabia Social Media Statistics 2019; 2019. Available from: https://www.globalmediainsight.com/blog/saudi-arabia-social-media-statistics [Last Accessed on 2020 Jul 01].
23. Alabasi KM, Alghamdi FM. Students' opinions on the functions and usefulness of communication on WhatsApp in the EFL higher education context. Arab World Engl J 2019:129-44. DOI: https://dx.doi.org/10.24093/awej/elt1.10
24. Alqahtani MS, Bhaskar CV, Elumalai KV, Abumelha M. WhatsApp: An online platform for university-level English language education. Arab World Engl J 2018;9:108-21.
25. Adams MA, Hurley JC, Todd M, Bhuiyan N, Jarrett CL, Tucker WJ, *et al*. Adaptive goal setting and financial incentives: A 2 × 2 factorial randomized controlled trial to increase adults' physical activity. BMC Public Health 2017;17:286.
26. Hurley JC, Hollingshead KE, Todd M, Jarrett CL, Tucker WJ, Angadi SS, *et al*. The walking interventions through texting (WalkIT) trial: Rationale, design, and protocol for a factorial randomized controlled trial of adaptive interventions for overweight and obese, inactive adults. JMIR Res Protoc 2015;4:e108.
27. Tudor-Locke C, Craig CL, Brown WJ, Clemes SA, De Cocker K, Giles-Corti B, *et al*. How many steps/day are enough? For adults. Int J Behav Nutr Phys Act 2011;8:79.
28. Helou K, El Helou N, Mahfouz M, Mahfouz Y, Salameh P, Harmouche-Karaki M. Validity and reliability of an adapted arabic version of the long international physical activity questionnaire. BMC Public Health 2017;18:49.
29. Biddle SJ, Bengoechea EG, Pedisic Z, Bennie J, Vergeer I, Wiesner G. Screen time, other sedentary behaviours, and obesity risk in adults: A review of reviews. Curr Obes Rep 2017;6:134-47.
30. Luyster FS, Strollo PJ Jr., Zee PC, Walsh JK, Mullignton JM, Drummond SP, *et al*. Sleep: A health imperative. Sleep 2012;35:727-34.
31. Tudor-Locke CE, Myers AM. Methodological considerations for researchers and practitioners using pedometers to measure physical (ambulatory) activity. Res Q Exerc Sport 2001;72:1-12.
32. Direito A, Jiang Y, Whittaker R, Maddison R. Apps for IMproving FITness and increasing physical activity among young people: The AIMFIT pragmatic randomized controlled trial. J Med Internet Res 2015;17:e210.