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Mobile-application intervention on physical activity of pregnant women in Iran during the COVID-19 epidemic in 2020

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Abstract:

BACKGROUND: Considering the low level of physical activity in pregnant women in the COVID-19 pandemic period, and on the other hand, the benefits of mobile application (mobile app) learning, we decided to conduct a study to determine the impact of educational intervention based on mobile app on physical activity in pregnant women.

MATERIALS AND METHODS: The present study was quasi-experimental and examined 93 pregnant women aged 16–20 weeks of gestation. Sampling was done on pregnant women participating in the childbirth preparation classes in Isfahan. We used the validated and reliable questionnaire including perceived benefits, perceived barriers, perceived enjoyment, perceived social support, and Pregnancy Physical Activity Questionnaire. The intervention was based on mobile app, and the content of the application contained 12 main domains such as description of physical activity and benefits and barriers of exercise in the pregnancy, different types of proper pregnancy exercise, planning for exercise, and different types of exercise. Finally, data were analyzed using SPSS20, and the Chi-square test, independent *t*-test Paired *t*-test were employed. The significance level was considered to be <0.05.

RESULTS: The results showed that, after the intervention based on mobile app, the mean score of perceived benefits and enjoyment were significantly higher than before the intervention in the intervention group. Finally, total mean score of physical activity significantly increased in the intervention group, while the change decreased in the control group.

CONCLUSION: The results indicated that the use of mobile app can be used to promote physical activity in pregnant women. Therefore, it is recommended that mobile app education should apply with face-to-face classes in health centers for physical activity in pregnant women in the pandemic situation.

Keywords:

Education, mobile application, physical activity, pregnancy

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Introduction

Pregnancy is an important-sensitive stage of a women's life, and regular physical activity improves the quality of life and physical conditions in pregnant women.[1] Studies on physical activity during pregnancy in the United States indicate that only 15.1% of pregnant women engage in physical activity at the recommended levels.[2] According to the report of the Deputy of Women's Sports in Iran, about 30% of women play sports, of which 5%–7% are during pregnancy.[3,4] Other studies on the lack of physical inactivity during pregnancy in Iran also indicated that 52% of pregnant women in the first half of pregnancy and 70.7% in the second half of pregnancy did not do any exercise.[5,6]

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Pregnant women have expressed various barriers in this regard, including the lack of a suitable place and time for exercise, lack of adequate equipment, and the lack of a suitable vehicle, and even a regular exercise program.[7,8] About cognitive factors, several studies have reported the lack of knowledge, lack of self-confidence, and positive attitudes toward physical activity during pregnancy, and even the lack of attention to psychosocial factors such as cultural norms and criteria as well as social support.[7,9,10] Due to the coronavirus (COVID-19) pandemic, these barriers have become more prominent, and even pregnant women have fewer out-of-home visits to the gym or walking. According to a study on the Spanish pregnant women with an aimed to analyze the impact of staying home due to COVID-19 on the pregnant women's lifestyles, there was a significant reduction in the level of physical activity in the pregnant women and even more than half of them could not participate in childbirth preparation sessions.[11] Even though several studies have recommended the health-care providers' roles in performing effective interventions to promote exercise in pregnant women,[12,13] inadequate education by health-care providers about the benefits of physical activity and safe activities during pregnancy are also other factors affecting the lack of physical activity.[3]

Given the determinants of the lack of physical activity behavior in pregnant women, as mentioned above, and the positive role of physical activity in the physical and mental health of pregnant mothers, we sought to use the education that somewhat reduced these barriers and used capabilities such as time-and-place-independent service,[14] high recovery and processing speed,[15] better efficiency and cost-effectiveness than printed media,[16] multimedia, and sending multiple messages.[17] Therefore, we chose mobile application (Mobile App) education as a modern method of health education that caused behavioral changes.[18] For instance, a review study by free on the use of mobile phones and communication technology in the field of health care indicated the effectiveness of mobile technology interventions to improve the results of health services worldwide.[19] Knight *et al*. studied Mobile Apps (apps) on physical activity in 2015 indicating the effectiveness of apps in this field.[20] However, there are few studies on the use of applications in the field of behavior changes in physical activity, but other studies have been conducted using the apps to change behavior, for instance, Amini *et al*. found that web-based educational interventions and e-learning could increase physical activity in female employees.[21] Pirzadeh *et al*. found that the web-based study was effective in increasing physical activity.[22]

Considering the low level of physical activity in pregnant women and its determinants as well as the impact of this behavior in the COVID-19 conditions, and on the other hand, the benefits of electronic and app-based learning, we decided to conduct a study to determine the impact of educational intervention based on mobile app on physical activity of pregnant women.

Materials and Methods

Study design and setting

The present study was quasi-experimental and examined 93 pregnant women aged 16–20 weeks of gestation. Sampling was done on pregnant women participating in the childbirth preparation classes in Isfahan (Falavarjan County) center of Iran country.

Study participants and sampling

Among the three centers of childbirth preparation classes, we accidentally considered a center as an intervention and another center as the control group. Inclusion criteria: willingness to participate, permission to participate in the childbirth preparation classes by a gynecologist, no disability and physical diseases (bone and joint problems), and no underlying diseases such as diabetes, hypertension, respiratory diseases, and no history of first abortion and pregnancy. Exclusion criteria: unwillingness to continue studying, migration or transfer from the county, not using the application during the intervention, obstruction of physical activity in terms of midwifery (cervical cerclage, placenta previa, rupture of membrane, preeclampsia, bleeding in the second and third trimesters of pregnancy, etc.).

Sampling was performed after explaining the research purpose to the head of the center according to the previous coordination with the researcher who attended the first session of childbirth preparation classes, and the pregnant women received training in both intervention and control groups in terms of the research purpose and the way of responding to the questionnaire. At the beginning of the study, we included 110 individuals in the study according to the inclusion criteria. Accidentally, 58 were put in the intervention group and 52 in the control group, nine person in the intervention group, and 8 in the control group were excluded from the study due to migration, cancellation of the study, earlier delivery, and the lack of use of the application during pregnancy (in the intervention group), and finally, the study continued with 49 individuals in the intervention group and 44 ones in the control group. All individuals in both groups completed the informed consent form. We did not mention the individuals' names in the questionnaire and the whole information was kept confidential.

Data collection tool and technique

In the study, we used the questionnaire to collect data before the intervention and 3 months after the intervention in both groups including the first part for

the demographic information including age, education level, and job.

The second part included the following constructs including the perceived benefits (13 questions), perceived barriers (14 questions), perceived enjoyment (6 questions), and perceived social support (14 questions) that were measured on a Likert scale (very agree with a score of 5, agree: 4, no idea: 3, disagree: 2, and strongly disagree: 1). Solhi *et al*. used the questionnaire and confirmed its validity and reliability.[23]

We used the standard Pregnancy Physical Activity Questionnaire to assess physical activity and Chasan-Taber *et al*. approved its validity,[24] and Abbasi *et al*. also evaluated and confirmed the validity of its Persian version and its reliability with a Cronbach's alpha of 0.81,[25] and Ahmadi evaluated and approved its validity using the opinions of some faculty members at Isfahan University of Medical Sciences and evaluated and confirmed its reliability with a Cronbach's alpha of 0.8.[26] In the present study, the reliability of the questionnaire was above 0.8. The questionnaire measured the levels of physical activity by questions about four different fields: 1 – household/caregiving (13 questions) among which we eliminated three questions about lawn mowing, care, and playing with pets for localization; 2 –transportation (3 questions); 3 – occupational activity (5 questions); and 4 – sports/exercise activity (8 questions), and we evaluated a total of 29 questions. Respondents were asked to report the duration of participation in each activity and select a category for each activity that best approximated the amount of time spent in the activity during a day of the current quarter of the year. We calculated the activity intensity based on MET as a unit for estimating metabolic expenditure in physical activity (a MET is equivalent to 3.5 ml of oxygen per kilogram of body weight). To calculate the intensity of activity, we multiplied the amount of MET of each activity by the time spent in a day. An activity with a MET of < 1.5 refers to sedentary activity, MET of 1.5–3 is light activity, MET of 3–6 is moderate activity, and MET of higher than 6 is intense activity.[24]

For designing the educational content, we first performed the need assessment on three groups of pregnant mothers, teachers of childbirth preparation classes, health education specialists, and experienced midwives and then prepared the appropriate educational content covering their needs under the supervision of health education specialists, a senior midwife, and a sports medicine specialist in text, photos, videos, and gifs from the ministry's reputable sources such as Pregnancy and Childbirth Preparation Books and other reliable sources, and then the content was reviewed by the research team. After confirming the content, an IT expert and we performed software programming and application development. In the content, we sought to focus on the perceived benefits and barriers, social support, and perceived enjoyment.

The content of the application contained 12 main domains: (1) description of physical activity, (2) Physical and mental benefits of exercise in the pregnancy, (3) different types of proper pregnancy exercise (walking, swimming, tennis, yoga, cycling, mountaineering, and water sports) (for the intervention of perceived benefits), (4) the way of doing daily activities (ways of correct stance, lifting objects, sleeping, and sitting properly, doing properly the rest of house affairs such as ironing, sweeping, and driving; and all of the educational principles were with a photo display), (5) planning for exercise, (6) time to stop exercising and cases of the absolute prohibition of exercise (to intervene on the perceived barriers), (7) Massage (including massage of the head, back, abdomen, shoulders, and perineum with photo display) (explaining the massage that could be done by spouse, colleague, parents, to intervention on the perceived social support), (8) stretching exercises (exercises in cross-legged sitting, in lying-down position, pelvic floor and groin exercises along with photo display), (9) relaxation, (10) reminding important points while doing exercises, (11) exercise demonstration movements (showing a few short sports movements), and (12) educational videos (eight videos including videos of standing exercise movements, stretching exercises, exercises for preventing constipation and strengthening the pelvis, and doing simple exercises for better delivery), and as a whole, playing music, proper training along with sports photos and gifs, colorful background and marginal content, and making the content attractive to intervene on the perceived enjoyment construct.

After creating the application and final checking, the app was given to the intervention group for use, and the account in the app was given to specialists to contact the pregnant mothers. In the intervention group, the necessary training was provided by the researcher about the way of using the application and everyone was encouraged to use the application during the week through the national messenger on cyberspace. It should be noted that the information was completed by the abovementioned questionnaire before and 3 months after the intervention in both groups, and the data were analyzed using SPSS 16 (SPSS Inc., Chicago, IL, USA). The descriptive statistics (frequency, percentage, mean, and standard deviation) and the Chi-square test were used for the qualitative variables. We also used the statistical analysis including *t*-test to compare the mean scores of physical activity and constructs before the intervention and 3 months after the intervention between

the intervention and control groups and compared the mean scores of physical activity and constructs before and after the intervention in both groups using the paired *t*-test. The significance level was considered to be <0.05.

Ethical consideration

After approving the proposal in the Isfahan University of Medical Sciences and receiving the ethical code (IR.MUI.RESEARCH.REC.1398.680), the researcher went to the centers and explains the goal of research for manager of health center and received consent form from participants.

Results

The mean age of women was 26.69 in the intervention group, and the mean age of women was 25.15 in the control group. The independent *t*-test ($P = 0.114$) indicated that the mean age did not differ significantly between the two groups [Table 1].

About the constructs of the model, the mean score of perceived benefits was 22.38 ± 6.75 in the intervention group before the intervention and 59.20 ± 5.57 3 months after the intervention. Even though there was an increase in the control group, the independent *t*-test indicated a significant difference between the intervention and control groups after the intervention ($P < 0.001$).

Before the intervention, the mean score of perceived barriers was 46.10 ± 9.02 in the intervention group, and 35.28 ± 7.12 after 3 months of the intervention; and the statistical test indicated the significant difference between the two groups after the intervention ($P < 0.001$).

The mean score of perceived enjoyment was 24.61 ± 2.89 in the intervention group before the intervention and 26.61 ± 2.81 3 months after the intervention. Even though a slight increase was seen in the control group, the difference was significant in the intervention group after training.

Table 1: Comparison of demographic information between intervention and control groups

Variable	Intervention groups, *n* (%)	Control groups, *n* (%)	*P**
Education level			
High school	16 (32.7)	5 (11.4)	0.526
Diploma	22 (44.9)	30 (68.2)	
Bachelor	10 (20.4)	9 (20.5)	
MA	1 (2)	0	
Job status			
Employee	1 (2)	0	0.655
housewife	46 (93.9)	43 (97.7)	
Home jobs	1 (2)	0	
Student	1 (2)	1 (2.3)	

*Chi-square test result was used

The mean score of social support was 51.67 ± 6.24 in the intervention group and 56.48 ± 5.81 3 months after the intervention, and 51.04 ± 6.38 in the control group, and 53.53 ± 6.53 3 months after the intervention, indicating a significant difference between the intervention and control groups after the intervention ($P = 0.045$).

As shown in Table 2, the mean scores of benefits, social support, and enjoyment in the intervention group were significantly higher before the intervention in comparison with after the intervention. Furthermore, the score of perceived barriers was significantly different in the intervention group before and after the intervention ($P < 0.001$) [Table 2].

In the control group, the mean scores of social support and benefits were significantly higher after the intervention in comparison with before the intervention, but there was no significant difference in mean scores of perceived barriers and enjoyment and their physical activity scores before and after the intervention. The independent *t*-test indicated that the mean scores of benefits, enjoyment, and social support in the intervention group were significantly higher than the control group, and the mean score of perceived barriers was lower than the control group.

Table 2 presents changes resulting from education in the intervention group so that the total mean score of physical activity significantly increased in the intervention group, while the change decreased in the control group, and the difference between mean scores was significant in the intervention and control groups after the intervention.

Discussion

The present study aimed to determine the effect of application-based educational intervention (Mobile App) on the physical activity of pregnant women. The results indicated that application-based education in childbirth preparation classes made changes in perceived benefits, barriers, enjoyment, and social support in the intervention group.

Given the constructs, there was no significant difference between mean scores of perceived benefits in the two groups before the intervention, but a significant difference was seen after the intervention, and it was consistent with a study by Mousavi *et al*. who aimed to determine the effect of educational interventions on awareness of benefits of physical activity in pregnant women in the Tehran health centers.[27] It was also consistent with a study by Solhi *et al*. who aimed to examine the effect of educational intervention on the adoption of appropriate physical activity in pregnant

Table 2: Mean scores of perceived benefits, perceived barriers, perceived social support, and perceived enjoyment in both groups in 2 times

Variable	Before the intervention	3 months after the intervention	Paired *t*-test result, *P*
Perceived benefit			
Intervention groups	22.38±6.75	59.20±5.57	≤0.001
Control groups	23.90±7.16	54.27±6.09	≤0.001
t-test	0.295	≤0.001	
Perceived barriers			
Intervention groups	46.10±9.02	35.28±7.12	≤0.001
Control groups	47.29±8.89	46.18±10.16	0.533
t-test	0.523	≤0.001	
Perceived enjoyment			
Intervention groups	24.61±2.89	26.61±2.81	≤0.001
Control groups	23.84±3.59	24.54±2.68	0.170
t-test	0.256	≤0.001	
Perceived social support			
Intervention groups	5167±6.24	56.48±5.81	≤0.001
Control groups	51.04±6.38	53.88±6.53	0.005
t-test	0.633	0.045	
Physical activity (Mets)			
Intervention groups	1570.00±754.11	1872.44±653.86	0.014
Control groups	1637.27±812.65	1413.29±758.74	0.084
t-test	0.680	0.002	

women.[23] Even though changes in perceived benefits in the control group existed after the intervention, changes in the intervention group were significant because there were perceived benefits in the app along with motivational content and images that emphasized both physical and psychological benefits.

The results of the present study indicated that the mean score of perceived barriers decreased significantly only in the intervention group after the intervention because the perceived barriers were identified after assessing the needs of pregnant women including lack of time, lack of access to reliable educational resources, and the impossibility of visiting the health centers that were solved by an application for doing the physical activity. Reducing barriers is an effective factor in changing behavior, especially physical activity and it has been proven in various studies.[23,28]

The present study indicated that the mean scores of social support significantly increased in both intervention and control groups after the intervention in comparison with before the intervention because there were different sections in the app for increasing the social support. In the control group, there was a significant increase after the intervention, but it was not as much as the intervention group, because the pregnancy preparation classes or the routine training provided training about the effect of social support on physical activity for the control group. The effect of social support on physical activity has been proven in various studies including Garshasbi *et al*.[29] and Keshavarz Mohammadian *et al*., and we should seek to emphasize the way of encouraging the pregnant women's husbands and their close acquaintances for physical activity in the application.[30]

The research results indicated that the mean score of perceived enjoyment increased in the intervention group after the intervention and there was no significant difference between the intervention and control groups before the intervention, but there was a significant difference after the intervention. The main reason for the continuity of physical activity is the enjoyment of understanding that behavior. In the study, uploading attractive images, fluent text with colored borders, relaxation, and massage with music in the content of the app increased the desire, motivation to do exercise, and understand its positive points, and increased enjoyment in the participants. The results of the present study were consistent with a study by Rezaei *et al*., who indicated the effect of lifestyle educational intervention on mean scores of perceived enjoyment in the intervention group.[31]

The present study indicated that the mean score of physical activity increased significantly in the intervention group after the intervention, and there was also a significant difference between the mean scores of physical activity in the control and intervention groups after the intervention probably due to the impact of the application on various constructs such as perceived barriers, perceived benefits, perceived social support, and perceived enjoyment. Other studies, which examined the abovementioned constructs, pointed out the effectiveness of investigating the physical activity in women such as studies by Solhi *et al*.[23] and Pirzadeh *et al*.[32] who found that the score of physical activity

improved significantly in the intervention group after the educational intervention. Cohen and Koski conducted a study inconsistent with the present study and in the absence of constructs affecting the behavioral change and noted that educational interventions about physical activity during pregnancy did not make any significant change in the physical activity of the intervention group.[33] Furthermore, a review study by Flannery *et al*. also indicated that education caused very little changes in levels of physical activity in pregnant women[34] probably because the educational intervention was as the face-to-face classes in most studies, but the content based on the audience's needs in the present study existed in the app so that most limitations and barriers to physical activity were solved. Furthermore, the whole educational content was prepared by an expert team with motivational multimedia with photos and videos as important motivating factors. On the other hand, pregnant women could use educational videos and content easily at any time and place without the need for a special device. The videos contained simple, safe, and doable movements for pregnant women that were included in various sections of the app along with relaxation programs such as massage, reducing fatigue, and exercise for pregnant women, and they could use the app easily in coronavirus epidemic when leaving home was forbidden.

Limitations and suggestion

A main limitation of the study was the exclusion of women from the study for various reasons such as migration or the existence of medical barriers to physical activity. Another limitation was the pregnant women's belief in the harmful effects of Wi-Fi waves on the fetus during pregnancy. Therefore, we made an attempt to design the app in a way that did not require an Internet connection. Lack of monitoring the women's behavior and self-reporting data collection were other barriers in the present study.

Conclusion

The research results indicated that the use of Mobile Apps increased scores of perceived benefits, barriers, social support, and enjoyment and improved the levels of physical activity in pregnant women, and the use of videos, photos, gifs, and music in the applications could help facilitate learning and acquisition of physical activity skills and motivation to do them.

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Conflicts of interest

There are no conflicts of interest.

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