The Effect of Pender's Health Promotion Model-based Education on the Physical Activity among Pregnant Women

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Abstract

Background and Purpose: The positive effects of physical activity during pregnancy have been completely recognized. However, given the lack of required knowledge and information, most of the pregnant women are inactive, and providing an educational program is thus of high significance for pregnant mothers. Given the multifactorial nature of physical activity, being affected by personal, interpersonal, environmental, and social factors, Pender's health promotion model has been applied for designing the required intervention. The present study was thus designed and conducted to investigate the effect of an educational intervention based on Pender's health promotion model on the physical activity of pregnant women.

Method: The present study is a quasi-experimental one with a control group conducted at four Comprehensive Health Service Centers (both urban and suburban) in Sanandaj in 2020. Applying a random-stratified sampling method, two centers were dedicated to the control group and two centers were dedicated for the intervention group. With a continuous sampling plan, based on the inclusion exclusion criteria, as many as 88 pregnant women referring to the health service centers were selected and entered into the present study in two groups of intervention and control (each group consists of 44 participants). The control group received the regular care and training and the intervention group was provided with an education program based on Pender's Health Promotion Model in five sixty-to-ninety-minute sessions with different methods and materials includingbrainstorming, lectures, group discussions, questions and answers, showing movies, and providing educational booklets and brochures distributed among women.

The data collection tools include demographic questionnaires and the Pregnancy Physical Activity Questionnair by Chasan-*Taber* et al. For investigating the effect of the intervention, the questionnaires were completed 6 weeks after the end of the intervention for both intervention and control groups. The data were analyzed by using SPSS-25 as well as Chi-squared test, Fisher's Exact Test, independent T-test, and paired t-test.

Findings: Before initiating the educational intervention, there was no significant difference between the groups in terms of demographic and physical activity scores.But after the educational intervention, there was a statistically significant difference in the mean of total physical activity between the intervention and control groups($P<0.001$).

Conclusion: The present study confirms the effectiveness of an educational intervention based on Pender's Health Promotion Model on promoting the pregnant women's physical activity. Given the findings of the present study, it is thus recommended to apply Pender's Health Promotion Model as a framework for designing the educational intervention to promote the physical activity among women.

Keywords: *pregnancy, physical activity, education, Pender's Health Promotion Model*

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Introduction

Pregnancy is a life-changing experience that is likely to bring about changes in the physical activities of an individual; it can make the physical activities a challenge for pregnant women [1].In spite of the valid evidence existing on the advantages and benefits of physical activities for pregnant women, various studies have indicated that a large number of pregnant women do not participate in regular physical activities; they are willing to adopt an inactive sedentary life during pregnancy [2]. The existing data indicate that 3-35% of pregnant women have energy-taking physical activities following the recommendation made by ACOG (American College of Obstetricians and Gynecologists)[3]. According to one study conducted in America, as many as 31% of pregnant women have been reported to conduct minor physical activities, 38% conduct moderate physical activities, and 32% conduct severe physical activities [4]. In Canada, 23% of pregnant women's population participate in sporting activities [5].It has been also reported that in the Western China, as many as 92% of pregnant women do not follow the guidelines for physical activities as provided by ACOG [6].In Poland, 50% of pregnant women's population are involved in some kind of sporting activities the most common type of which is walking [7].Analyzing the physical activities among pregnant women in different parts of Iran indicate their inactivity. In Isfahan, for instance, as many as 98.7% of pregnant women conduct minor physical activities, and 1.3% of them conduct moderate physical activities [8]. In Ilam, as many as 19.5% of women conduct moderate physical activities and 80.5% of them conduct minor physical activities [9].In recent years, the researches related to sporting activities have remarkably increased, and there is a lot of evidence on the positive effects of moderate physical activities during pregnancy on women who used to be highly inactive [10]. The American College of Obstetricians and Gynecologists (ACOG) has reported that the healthadvantages of physical activities for pregnant women outweigh their possible unfavorable results. ACOG has also recommended moderate physical activities for 150 minutes a week or moderate physical activities for 30 minutes on most weekdays for all women lacking midwifery or medical problems and complications[11]. There is remarkable evidence confirming that conducting physical activity during pregnancy is associated with reduced diabetes [12], reducedpretermdelivery [13], preserving and improving the cardiovascular activities, fitness, physical vigor, and reduced back pain and sciatica [14], reduced risk of suffering from preeclampsia [15], improved sleep during pregnancy [1], reduced depression during pregnancy and later [16], reduced urinary problems[17], and improved quality of life [18].In addition to the aforementioned benefits, various studies have indicated that fetal heart rate as well as fetal birth weight are not influenced by harmful effects in healthy mothers who conduct moderate physical activities [19]; during and after the physical activities, the fetal heart rate increases by 10 to 30 rate in comparison to the basic heart rate [20]. The maternal physical activity level is inversely related to the fetal weight; in pregnancies associated with moderate physical activities, the fetus enjoys a normal weight. However, intense physical activities ae associated with reduced fetal weight [21].

Domenjoz et al, indicated that physical activities during pregnancy especially during the second and third trimester would result in reduced caesarean birth; it is thus essential that pregnant women increase their physical activities during pregnancy [22]. Despite the advantages and benefits mentioned earlier, the findings of various studies conducted on physical activities in our country indicate that the level of physical activities conducted by Iranian women are a lot less than the recommended level; the most important factor behind this is the lack of proper training provided by the health service personnel on the benefits and advantages of physical activities during pregnancy [23].It is evident that health training and education is one of the fundamental strategies for promoting physical activities [24].It seems that for training pregnant women and achieving an effective intervention, it is highly essential to recognize the effective factors affecting their health behaviors so that their behaviors will change[25]. Thus, it is required to conduct programs that are based upon effective models and theories; applying model-based training courses as well as behavior change theories can identify the individual and environmental features affecting the behaviors [26]. Numerous studies have been conducted on the positive effects of educational models on

pregnant women's physical activities. In most of these studies, intrapersonal factors (both physical and mental) have been highlighted for promoting the pregnant women's physical activities, but the significance of other effective factors including interpersonal (social) and environmental factors have been ignored. Designing interventions that take the abovementioned factors into account have been highly recommended [27]. Since physical activity is a multifactorial behavior affected by personal, interpersonal, environmental, and social factors [28], applying the behavior change theories and models analyzing the aforementioned factors can be greatly helpful.One of the comprehensive predictive model is Pender's Health Promotion Model. Pender's Model is one of the descriptive models of health education that is widely applied for changing unhealthy behaviors and promoting the user's health. Pender is attempting to describe and analyze the multidimensional nature of personal behaviors by applying a combination of both personal and physical environment factors. The constructs of Pender's Health Promotion Model include three main categories. The first group includes individual characteristics and experiences consisting of two constructs i.e. one's past behaviors and personal characteristics. The second category is behavior-specific cognitions and affect that include variables such as perceptual cognitive factors of the observed benefits, observed barriers, observed self-efficacy,and behavior-related emotions directly affect the health promotion behaviors. Moreover, modulatory factors, as interacting factors (affecting interpersonal, environmental, and behavioral factors) play a pivotal roleon the perceptual cognitive process, and they are likely to affect health promotion behaviors in an indirect way. This category of constructs in Pender's Health Promotion Model indicate the most important and fundamental behavioral motivations that account for the main core of the interventions. The third category is behavioral outcome being the outcome of decision making and commitment to action that is the ultimate goal of the health promotion model [29]. Given the significance of physical activities during pregnancy, the key role of midwives in providing pregnancy cares, and the training and recommendation that can motivate women for conducting physical activities, researchers have been encouraged to conduct and analyze further studies in this regard. By searching the authentic scientific databases on the effect of educational programs and interventions (based on Pender's Health Promotion Model) on pregnant women's physical activity, the researchers did not find any studies in this regard. Thus, the present study was designed and conducted to investigate the effect of Pender's Health Promotion Model-based education on the physical activity among pregnant women.

Methods

The present study is a quasi-experimental one with a control group. It was conducted on pregnant women referring to urban and suburban health centers affiliated with Kurdistan University of Medical Sciences in 2020. The a random-stratified sampling method was adopted. As many as 8 health centers (4 urban centers and 4 suburban ones) from the 34 urban and suburban health centers of Sanandaj (18 urban centers and 16 suburban centers). Then, two urban and suburban centers were randomly dedicated to the intervention group, and two urban and suburban centers were defined as the control group. These centers had an acceptable geographical distance; the participants could not be in touch with one another. Through adopting a continuous sampling method at the selected health centers, as many as 88 pregnant women were selected based on the inclusion/exclusion criteria: 44 participants for the intervention group and 44 participants for the control group. The inclusion criteria for entering into the present study include: willingness to participate in the study, being able to read and write, being 18-45 years old, the gestational age of 16-20 weeks,lacking underlying diseases (diabetes, prior high blood pressure, autoimmune disease, cardiovascular diseases, and kidney diseases), lacking complication in their previous pregnancies (abortion, placenta Previa, extra uterine pregnancy, and preterm delivery), no history of infertility and Cerclage, lack of suffering from any mental diseases in their current pregnancy, no history of hospitalization, lacking any motor limitations and defects, not attending at any delivery-preparation classes, and having regular prenatal cares. The exclusion criteria include death oran incurable disease of one of the family members, failing to attend the training classesfor more than 2 sessions, having warning symptoms preventing physical activities such

as vaginal bleeding, vertigo, premature contraction, reduced fetal movements, amniotic fluid leakage, muscular weakness, chest pain, and having complications during pregnancy such as abortion threat, gestational diabetes, preeclampsia, and abortion.The data collection tools of the present study include questionnaires on demographic information and fertility characteristics and Pregnancy Physical Activity Questionnaire (PPAQ). The demographic and midwifery information questionnaire include 12 questions (5 questions on the personal information such as employment status, educational level, husband's employment status, economic status, and age, and 7 questions were related to fertility characteristics including gestational age, number of pregnancies, number of deliveries, number of living children, pre-pregnancy weight or the weight at the beginning of the pregnancy, height, and willingness and habit to conduct physical activities before pregnancy. The Pregnancy Physical Activity Questionnaire includes two sections: the first section includes information on individual characteristics, and the second section includes 32 questions in 4 domains of household/ caregiving activities (16 questions), transportation activities (3 questions), occupational activities (5 questions), and sports/exercise activities (8 questions). The intensity of the activity is measured based on Metabolic Equivalent of Task (MET) which is a scale for estimating the metabolic equivalents in physical activities (one MET is equal to *3.5* ml O2 per kg body weight). For measuring the total MET of an activity, the MET value related to the intensity of an activity is multiplied by the minutes spent on the activity during one day; based on the MET measured for an activity and its mean for the MET of other activities in one day, the level of daily physical activity is determined.Conducting physical activities with a MET of less than 1.5 is considered as inactivity. In addition, conducting physical activities with a MET of 1.5-3 is defined as a light physical activity. Finally, conducting physical activities with a MET of 3-6 and more than 6 are respectively considered as moderate and severe physical activities [30].The validity of Pregnancy Physical Activity Questionnaire (PPAQ) has been confirmed Chasan-Taberet al,in Massachusetts; the questionnaire validity has been reported to be 78%[31]. Moreover, the validity of its Persian version has been investigated and confirmed in a study conducted by Abbasi et al at Ferdowsi University of Mashhad. By conducting an initial study on 20 qualified pregnant women, the reliability of the questionnaire was determined to be 81% [30].The required permit from the Ethics Committee (IR.IUMS. REC.1398.126) was acquired. Moreover,a permit was obtained from the Research Council of Iran University of Medical Sciences.The permits for conducting the research as well as the introduction letter of the university were offered to the health centers of Sanandaj. The required coordination was then made with the selected health center officials and personnel. After selecting the participants, the researchers arranged to hold a session with the participants of both intervention and control groups on predetermined days to encourage their participation in the study (the participants of different centers were uninformed about each other). In the briefing session, the researcher introduced himself. Then, the participants introduced themselves as well. The researcher explained the purpose for conducting the study, and the participants were ascertained about the confidentiality of the information by the researcher. The participants willing to participate in the study were entered into the study based on inclusion/exclusion criteria and completing the written letter of consent. Before the intervention, the questionnaires were completed on the first visit. The questionnaires were completed by research participants in the presence of the researcher in case of any ambiguity on the questions. The control group received the regular pregnancy cares. At the end of the intervention, the educational package of the intervention group was also provided for the control group. The educational intervention was conducted in fivesixty-to-ninety-minutesession for the intervention group in four 11-participant groups through adopting different approaches and methods including speeches, question and answer, group discussion, brainstorming. Moreover, the researchers also appliedlearning assistant tools, slide, pamphlet, educational videos, and the protocol provided by the Ministry of Health and Medical Education on stretching and resistance workouts during pregnancy, and training videos based on a book (Childbirth Preparation) [32].and using an educational booklet containing Pender's Health Promotion Model that had been already prepared. The training courses were executed by the researcher, a

master of psychology, and a midwife who is an expert onpregnancy sports. The number and duration of educational sessions (as can be seen in table 1) have been arranged based on the educational contents, the participants' conditions, and the experts' views. The dates and times of the classes were then coordinated with the participants. For ensuring about conducting physical activities by pregnant women and reminding the educational tips, the researchers called and sent them messages (twice a week) in the first two weeks. Then, calling and sending messages were conducted once a week with the intervention group, so that the physical activity plan would be conducted in the best way possible. Commitment to action and the progress status of pregnant women in doing physical activities were evaluated by completing self-report forms (recording physical activities on a weekly basis). During the study, as many as 6 participants (4 participants from the intervention group and 2 from the control group) withdrew from the study for different reasons. In the intervention group,the participants withdrew for different reasons including lacking willingness to participate in the study, the illness of a family member, and threat to abortion. As for the control group, two participants were excluded from the study for having gestational diabetes and moving to another city. Then, 6 weeks after the educational intervention, 40 participants of the intervention group, and 42 participants of the control group were compared, and the physical activity questionnaires were recompleted by them (at 27-31 gestational weeks). The data were coded and entered into SPSS-25, and they were analyzed by using both descriptive (frequency and mean) and analytical tests (Chi-squared test, independent t-test, paired t-test, and Fisher's exact test). A $P<0.05$ was considered to be significant for the statistical analysis.

Table 1. The educational content of physical activity sessions based on Pender's Health Promotion Model

Sessions	The aims of Pender's Health Promotion Model	Session Content
First	Familiarity with physical activity in pregnancy Ananalysis of previous behaviors Observed benefits	Highlighting the significance of physical activity in pregnancy and the barriers to physical activities, and stopping safe physical activities and sports during pregnancy; Investigating the success or failure of previous physical activities; Emphasizing the strong points of pregnant women (if they have succeeded), encouraging them to continue physical activities by reminding them that physical activities are a lot easier for them to conduct and they can continue their physical activities under the supervision of a physician or a midwife; Encouraging pregnant women who have no experience of conducting physical activities by emphasizing that their failure is not owing to their inability, but it is mainly due to lack of time; Promoting their awareness and knowledge and highlighting the benefits and advantages of physical activities; Having a good feeling toward oneself, feeling responsibility toward oneself and the fetus, and having control over one's health are among the benefits of physical activities.
Second	Observed barriers	Discussing observed barriers Requesting the pregnant women to identify the existing barriers and providing strategies for overcoming such barriers; The pregnant women were ensuring that they could conduct physical activities in smaller scales and they could conduct them more easily; Correcting any kind of misunderstanding about physical activities by providing a better understanding about the benefits of physical activities; Providing the pregnant women with a free education DVD as an incentive and guide to action;
Third	Increased self-efficacy Commitment to action	Expressing self-efficacy strategies; 1. Conducting physical activities at smaller scales, easier ways, and more practical methods; 2. Expressing the experience of successful pregnant women as successful models; 3. Encouraging the learners when they fail or succeed in doing physical activities; 4. Reducing and managing stress with relaxation methods, and listening to music during physical activities; Concluding a commitment letter between the researcher and the participants for conducting physical activities and providing self-report forms for initiating the physical activities and stabilizing it up to one month with intervention
Fourth	Interpersonal influencer (social support) Situational influencer (environment)	The significance of social and family support in continuing physical activity with the presence of the intervention group and their family members (their husbands) Reminding the husbands that they need to encourage their wives for continuing physical activities not only in words but also through actions. They can walk with pregnant women and express their support; The role of a midwife in providing social support for pregnant women and their participation in physical activity programs; Investigating the environmental barriers and strategies for overcoming such barriers.
Fifth	The practical implementation of physical activities	Reviewing previous contents and the practical implementation of physical activities.

Finding

The findings of the present study indicated that the two intervention and control group were not significantly different in terms of age (intervention: 29.60 ± 5.80 years, and control: 27.50 ± 4.31 years), gestational age (intervention: 17.38 ± 1.53 weeks, and control: 17.48 ± 1.59 weeks), and body mass index (intervention 25.54 ± 4.19, and control: 26.33 ± 4.24) (P>0.05). Most of the women in both groups experienced a singleton pregnancy and had one living child and had not experienced any former pregnancies. Most of them had the educational level of high school diploma, and they were housewives. Their husbands were mostly self-employed and they were average in terms of economic conditions. Most of the women of the control group had not experienced any physical activity before the pregnancy. However, in the intervention group, half of the participants had experienced physical activities, and the other half had not experienced any physical activity. The findings indicated that the two groups were not significantly different in terms of demographic variables, and they were almost homogenous (P>0.05). The demographic characteristics of women of both groups are indicated in table 2.

The physical activity and its domains were compared and analyzed in both groups both before the intervention and six weeks after the intervention; the results are presented in table 3. According to the findings of independent t-test results, before conducting the intervention, the intervention and control group were not significantly different in terms of physical activities and any of its domains (P>0.05). However, comparing the scores six weeks after the intervention indicated that except for the domains of inactive/sedentary activities (P=0.065) and occupational activities (P=0.057), there is a significant difference between the intervention and control groups in terms of the total score of physical activities (P<0.001) and other domains (P<0.001); the scores of the intervention group were significantly higher than those of the control group. An intra-group comparison indicated that in the intervention group, the scores of light physical activity (P<0.001), moderate physical activity (P<0.001), intense physical activity (P<0.001), household activity (P<0.001), sports activity (P<0.001), and the total score of physical activity increased significantly six weeks after the intervention. However, in the control group, the scores of light physical activity (P=0.012), household activity (P=0.014), and the total score of physical activity (P=0.006) reduced significantly six weeks after the intervention (in comparison to the scores recorded before the intervention), but the difference was not significant in other domains (P>0.05). The changes observed six weeks after the intervention (in comparison to the pre-intervention scores) were highly significant in the total score of physical activity (P<0.001) and all domains (P<0.001) except for sedentary activity (P=0.36) and occupational activity (P=0.42); the intervention group's scores were significantly higher than those of the control group. The results are presented in table 4.

Table 2. The comparative demographic characteristics of pregnant women in intervention and control groups

Variable		Intervention	Control	Test Results
Age * (year) (mean ± standard deviation)		29.60 ± 5.80	27.50 ± 4.31	p=0.06
Gestational age * (week)) (mean ± standard deviation)		17.38 ± 1.53	17.48 ± 1.59	p=0.77
BMI * (mean ± standard deviation)		25.54 ± 4.19	26.33 ± 4.24	p=0.40
Number of pregnancies ** number (percentage)	1	28 (70)	29 (60)	P=0.99
	2	25 (10)	10 (23.8)	
	3	2 (5)	3 (7.1)	

Cont... **Table 2. The comparative demographic characteristics of pregnant women in intervention and control groups**

Number of deliveries ** number (percentage)	0	28 (70)	29 (69)	P=0.99
	1	10 (25)	12 (23.8)	
	2	2 (5)	3 (7.2)	
Number of living children ** number (percentage)	1	10 (83.3)	10 (76.9)	P=0.99
	2	2 (16.7)	3 (21.1)	
Educational level ** Number (percentage)	Reading and writing	4 (10.0)	4 (9.5)	P=0.86
	Junior High school	2 (12.5)	8 (19.0)	
	High School	20 (50.0)	18 (42.9)	
	Academic	11 (27.5)	12 (28.6)	
Employment status ** Number (percentage)	Employed at home	3 (7.5)	0 (0.0)	P=24
	Employed outside home	5 (12.5)	7 (16.7)	
	housewife	32 (80.0)	35 (83.3)	
Husband's employment status ** Number (percentage)	Construction worker	6 (15.0)	7 (16.7)	P=0.32
	Office clerk	10 (25.0)	5 (1.19)	
	Self-employed	23 (57.5)	30 (71.4)	
	Retired	1 (2.5)	0 (0.0)	
Economic Status ** Number (percentage)	Good	12 (30.0)	12 (28.6)	P=0.93
	Average	25 (62.5)	28 (66.7)	
	Poor	3 (7.5)	2 (4.8)	
Having physical activity ¥ Number (percentage)	Yes	20 (50)	11 (26.2)	P=0.07
	No	20 (50)	31 (73.8)	

*independent t-test, **Fisher's exact test

Table 3. The comparison of physical activity and its domains in pregnant women before the intervention and six weeks after the intervention in intervention and control groups

Time / Physical activity and its domain	Group	Pre-intervention		Six weeks after the intervention		Paired t-test
		Mean	Standard deviation	mean	Standard deviation	
Inactive (sedentary) activity	Intervention	38.4	20.39	38.25	18.18	P=0.81
	Control	33.70	19.07	30.83	17.44	P=0.100
Independent t-test		P=0.25		P=0.065		
Light activity	Intervention	59.20	25.08	100.73	23.84	P<0.001
	Control	63.22	26.33	53.87	22.64	P=0.012
Independent t-test		P=0.48		P<0.001		
Moderate activity	Intervention	13.55	18.55	52.44	27.15	P<0.001
	Control	7.37	8.89	6.87	8.49	P=0.73
Independent t-test		P=0.056		P<0.001		
Intense activity	Intervention	0.12	0.36	1.57	1.09	P<0.001
	Control	0.02	0.12	0.01	0.065	P=0.78
Independent t-test		P=0.09		P<0.001		
Household activity	Intervention	57.84	22.23	89.41	27.95	P<0.001
	Control	61.13	27.42	51.46	20.44	P=0.014
Independent t-test		P=0.55		P<0.001		
Occupational activity	Intervention	64.40	42.72	81.72	39.24	P=0.0.65
	Control	31.32	22.10	40.07	28.16	P=0.10
Independent t-test		P=0.10		P=0.057		
Sporting activity	Intervention	3.82	4.90	27.45	12.27	P<0.001
	Control	2.39	3.61	2.50	3.57	P=0.83
Independent t-test		P=0.13		P<0.001		
Total score of physical activity	Intervention	116.29	38.71	185.45	42.77	P<0.001
	control	109.41	35.75	95.88	33.95	P=0.006
Independent t-test		P=0.40		P<0.001		

Table 4. The comparison of post-intervention (six weeks after the intervention) and pre-intervention changes in terms of physical activity and its domains in pregnant women of both intervention and control groups

Group / Changes (before-six weeks)	Intervention		Control		Independent t-test
	Mean	Standard deviation	Mean	Standard deviation	
Inactive (sedentary) activity	-0.48	12.87	-2.87	11.05	P=0.36
Light activity	41.52	24.67	-9.34	23.16	P<0.001
Moderate activity	38.88	19.95	-0.49	9.32	P<0.001
Intense activity	1.45	0.97	-0.006	0.14	P<0.001
Household activity/caring for children	31.56	28.52	-9.66	24.37	P<0.001
Occupational activity	17.32	15.33	10.20	12.74	P=0.42
Sporting activity	23.62	9.63	0.11	3.45	P<0.001
Total score of physical activity	69.16	36.50	-13.53	30.43	P<0.001

Discussion

In the present study, by applying the constructs of Pender's Health Promotion Model, it was attempted to investigate experiences, personal characteristics, emotions, and specific cognitions of behavior. The physical activity of pregnant women was designed and conducted with an accurate holistic program. According to the findings of the present study, an educational intervention based on Pender's Health Promotion Model had a significant effect on promoting pregnant women's physical activity. Rahimian et al have stated that Pender's model-based educational program promotes the physical activities of health volunteers [33].The results of the present study on women's performance in conducting sporting activities during pregnancy indicated that the total mean score of physical activity increased significantly in the intervention group after the intervention. However, the total mean score of physical activity decreased significantly in the control group after the intervention. This can indicate that women have come to a correct understanding of conducting physical activity during pregnancy; they show more willingness for conducting such activities. In a study conducted by Shakeri et al on the effect of education on pregnant women's physical activity, it has been indicated that after the educational sessions for the intervention group, the post-intervention score of intervention group's physical activity was significantly different from that of the control group [34]. In a similar study by Rezaeyan et al,Training in both theoretical and practical parts could have a significant effect on the performance of physical activity of pregnant women [35]. This is in line with the results of the present study. However, although the benefits of physical activity during pregnancy have been emphasized in other studies, it has been indicated that a significant reduction was observed in the physical activities conducted by women during pregnancy; this is not in line with the result of the present study. In a study conducted by Szmeja et al, it was attempted toimplement the required intervention by presenting a DVD (an educational video) for correcting the physical activities conducted by obese and overweight pregnant women at week 36. However, there was no significant difference between the groups [36]. Moreover, in another study

conducted by Guelinckx et al, the intervention was done through providing brochures; the physical activity of the intervention groups reduced significantly especially at the third trimester [37]. The main reason behind the lack of effectiveness of such intervention and the contradictory results with the present study can be due to different reasons including the method of conducting the intervention, different educational material and content, and gestational age. Most of the aforementioned studies have been conducted at the late months of pregnancy. It is evident that at such times, the mothers are dealing with numerous limitations arising from the fetal growth and weight. However, the present study was conducted at week 16-20, and the positive effects of the intervention on maternal physical activityare completely evident. In the present study, the mean scores of sedentary and occupational activity of the intervention group were not statistically significant before and after the intervention. However, as for other domains and activities including light activity, moderate activity, intense activity, household activity, and sporting activity, a significant statistical difference was observed after Pender's-Model based intervention; this indicates the effectiveness of the intervention. In the study conducted by Santos et al with the aim of determining the level of physical activity in the first trimester, it has been indicated that the physical activity level was low. The mean score of household activity was higher than the mean scores of otherevaluated activities, and the mean score of intense activity was low (in comparison to light and moderate activity). The results of the aforementioned study are in line with those of the present study [38].Based on the results of these study, it can be concluded that pregnant women are in an urgent need for receiving training and education about physical activity.Hoffmann etal have conducted a study to investigate the effect of educational intervention on the physical activity of pregnant women. They have indicated that the moderate and intense levels of physical activity and sporting activities of the intervention group were significantly higher than those of the control group. After the intervention, the scores of physical activity reduced in the control group [39].this is in line with the result of the present study. Dodd et al, investigated the effect of educational intervention on the physical activity of overweight women in doing household and occupational activities. The results of their study indicated that the general increase of physical activity in the intervention group is mainly achieved through conducting household activities; it has a significant effect in reducing overweight pregnant women's inactivity [40]. In the study conducted by Mousavi et al, it was attempted to investigate the effect of the educational intervention of self-efficacy and awareness on pregnant women's physical activity. By adopting self-efficacy techniques, the physical activity status of 63% of the intervention group's pregnant women (46 out of 72) was promoted to a moderate level; a significant difference was observed between the two groups in terms of conducting physical activities [41]. It seems that when individuals have a better understanding toward their behavioral benefits, it is more likely that they adopt healthy behaviors. The study conducted by Marquis et al, attempted to investigate the effect of an efficient practical sporting intervention on different groups of women referring to prenatal centers of western Massachusetts. It has been indicated that an educational intervention based on the model of change phases and cognitive-social theory would result in a better performance of pregnant women's physical activity (in comparison to the control group); this is in line with the findings of the present study [42]. Moreover, in the study conducted by Shafieian et al, it was indicated that the educational intervention was highly effective in promoting pregnant women's beliefs and understanding about the advantages and reducing the barriers for conducting physical activities; the intervention resulted in a significant statistical difference in the total mean of physical activity [43]. According to the studies conducted on Pender's Health Promotion Model, it has been indicated that only individuals can conduct physical activities who recognize its benefits as well as the barriers preventing them from conducting such activities.

Despite the positive effect of Pender's Model-based intervention, one of the most important limitations of the present study was the impossibility of controlling the participants in conducting the physical activities; self-reports of the participants were trusted. However, the researcher attempted to be helpful by reminding the participants via telephone and requesting for a physical activity booklet. Another important limitation of the present study was teaching the physical activities

at some selected health centers; the center was not appropriate for the training course intended. Thus, it was attempted to select convenient centers with proper educational equipment. Thus, it is recommended to provide pregnant women with educational materials (as educational videos) appropriate with Physical activities of the trimester. The effects of the virtual education will then be evaluated (first, second, and third).Moreover, it is recommended to investigate the effect of virtual training. In the present study, from among the physical activity domains, sedentary activity and occupational activity had the lowest mean scores. It is recommended to study these items separately in future studies.

Conclusion

The findings of this study clearly indicated that designing and implementing an educational program using Pender's Health Promotion Model had positive effects on promoting physical activity. Promoting physical activity will be possible mainly through encouraging pregnant women to conduct physical activity by recognizing and understanding the needs and effective factors involved in self-efficacy, social support, understanding the benefits and barriers and commitment for conducting physical activity. This is required to be taken seriously by planners and executors of health programs. In order to change the behavior and improve the performance of pregnant women, it is recommended to provide educational and intervention programs during pregnancy based on a similar model.

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