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Effect of extended parallel process model training on enhancing physical activity of overweight pregnant women: A randomized controlled trial

Atena Hakimzadeh, Sepideh Hajian[1], Maryam Afrakhteh[2], Fatemeh Rafiei[3]

Student Research Committee, Department of Midwifery, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran, [1]Department of Midwifery, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran, [2]Department of Obstetrics and Gynecology, Tajrish Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran, [3]Department of Biostatistics and Epidemiology, School of Health, Tehran University of Medical Sciences, Tehran, Iran

Address for correspondence:
Prof. Sepideh Hajian, Department of Midwifery, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
E-mail: s.hajian@sbmu.ac.ir

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Abstract:

BACKGROUND: The present study determined the effect of extended parallel process model (EPPM) based training on enhancing the physical activity of overweight pregnant women.

MATERIALS AND METHODS: This randomized controlled clinical trial examined 100 overweight pregnant women referred to prenatal care clinics in Mahdiye and Shohadaye Tajrish Hospital, in August 2022. The participants were assigned into two intervention and control groups through random allocation. The intervention group underwent EPPM-based training three times (18–20, 26–30, and 37–38 weeks of gestation), while the control group received regular prenatal care. The training content and approach were designed and presented based on the four constructs of EPPM, that is, perceived susceptibility, perceived severity, perceived efficacy, and perceived self-efficacy. The 32-item Pregnancy Physical Activity Questionnaire (PPAQ) was used to measure and compare the participants' four activity types at three rounds (18–20, 26–30, and 37–38 weeks of gestation) and their physical activity calendar in two periods. The data were analyzed by the Statistical Package for the Social Sciences (SPSS) version 16 software at a significance level of < 0.05.

RESULTS: After the educational intervention, the mean physical activity scores of the intervention and control groups were1462.2 ± 477.67and 861 ± 381.29 (P < 0.001; CI = 95%) in the first round, 1278.15 ± 480.31 and 675 ± 375.03 (P < 0.001; CI: 95%) in the second round, respectively. The mean weight gain value in the second trimester equaled 4.09 ± 0.76 and 4.52 ± 0.71for the intervention and the control group, orderly. This difference was significant in the second trimester (P = 0.002) but not in the third. Likewise, a comparative analysis of the neonates' anthropometric indices and prenatal complications revealed no significant differences.

CONCLUSION: The EPPM-based educational intervention effectively contributes to motivating pregnant women and changing their behavior toward improving their physical activity and can be employed to encourage them to enhance their physical activity during pregnancy.

Keywords:

Exercise, gestation, health promotion, overweight, prenatal education

Introduction

Body mass index (BMI) or Quetelet index is an indicator of body mass status for both sexes and at any age, which is calculated by dividing weight in kilograms by the square of height in meters. The result of this formula is in four ranges; underweight (<18.5), normal weight (18.5–24.9), overweight (25–29.9), and obesity (>30).[1] According to the report of the World Health Organization (WHO), the incidence of overweight and obesity is increasing in all age groups throughout the world. Based on the statistics released by this organization in 2016, 39% of

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adults (≥18 years) are overweight, and 13% are obese.[2] Iran is not an exception in this regard, and studies reveal a growing number of overweight and obese individuals.[3] This problem also influences women of reproduction ages, such that we can argue that around 50% of females with BMIs of >25 kg/m^2 enter the pregnancy phase.[2] Overweight mothers are prone to gain unexpected weight during pregnancy, while abnormal obesifying during pregnancy is closely associated with prenatal complications,[4] the most familiar of which are gestational diabetes and hypertension, maternal cardiovascular changes, Abnormal weight gain during infancy,[5] fetal macrosomia, hard labor due to the shoulder dystocia and low Apgar score of the neonate, increased risk of fetus death, and the need for a cesarean, which accompany anesthesia-related complications like thromboembolic incidences and other problems such as postsurgery infection, increased postpartum hemorrhage, and mortality.[6]

Although the gestational overweight problem is associated with various risk factors, such as alcohol consumption, smoking, and chronic diseases,[7] many risk factors, for example, high BMI, are changeable, and suitable training toward modifying lifestyle and enhancing physical activity properly can control weight gain during pregnancy.[8]

A review study shows that 23–29% of pregnant women rarely adhere to the advice provided by the National Health and Nutrition Examination Survey (NHANES) on physical activity.[9] Also, The Women's Sports Deputy in Iran also reports that only 6% of the 30% of women's sports statistics belong to pregnancy exercises.[10] Many pregnant women are discouraged from performing physical activities, and a large number also follow an inactive lifestyle due to being concerned about fetal traumas and premature birth risks. This is while evidence shows that moderate-intensity physical activities during pregnancy bring about positive impacts even in already-inactive women. Although exercises are crucial in the life of women of reproductive age, studies on physical activity during pregnancy have not witnessed considerable progress. In other words, despite longtime studies on pregnant women's physical activity, how it impacts pregnancy outcomes, for example, the type of delivery and birth weight of the newborn, is still under discussion.[11]

Today, the necessity for applying behavior-change theories and models to boost the efficiency of health instructions and plans is not covert to researchers. One of these influential health promotion models aiming to alter risky individual behaviors is the Extended Parallel Process Model (EPPM) on which if individuals believe that they are intensely prone to suffer from diseases or exposed to health-related risks, they are highly motivated to cope with their causing threats, and thus, assessing the efficacy of the solutions starts.[12,13] Despite the current evidence on promoting physical activity during pregnancy to bestow health to mothers and newborns,[14] the most efficient approach to preventing maternal and fetal complications is undetermined. It seems that there are still concerns about the safety of exercising during pregnancy.[15] Considering the mentioned factors, the significance of weight gain during pregnancy, and maternal and fetal complications, this study investigated the effect of EPPM-based training on improving the physical activity of pregnant overweight women.

Materials and Methods

Study design and setting

The present randomized controlled clinical trial examined 100 overweight pregnant women referring to prenatal care clinics in Mahdiye And Shohaday-e- Tajrish Hospital (two teaching hospitals in Tehran, the capital of Iran), in August 2022. In these centers, pregnant women were visited minimally eight times from the outset to the end of their pregnancy according to the country's midwifery care protocol. These visits included no specific training based on health promotion models targeting lifestyle modification except routine care including advices for healthy nutrition. For instance, if a mother was overweight, she was just provided with general advice in the form of individual training by the physician for observing regimens and having physical activities, like daily walking (if not prohibited). For this purpose, the researcher attended the mentioned prenatal care centers regularly and selected eligible pregnant women based on the inclusion criteria after explaining the study's purpose and acquiring their written informed consent. Then, the participants were randomly assigned into two intervention and control groups based on the random allocation list prepared by the R software. Thus, the participants of both teaching hospitals were selected and entered into the intervention and control groups in the study.

Study participants and sampling

The researcher estimated the sample size at 45 subjects per group by referring to Hajian *et al*.'s[14] study and using $\frac{(z_{1-\frac{\alpha}{2}} + z_{1-\beta})^2 (s_1^2 + s_2^2)}{d^2}$ the formula while considering that , d = 30, $\alpha = 0.05$, and $\beta = 0.2$. With a probability of a 25% attrition rate due to the four-phase follow-up visits, the sample size was increased to 100 individuals (50 per group). Pregnant women with the following characteristics were entered into the study:

Residence in Tehran city, aging between 20 and 40 years, having elementary literacy for reading and writing, being

in the 18-20 weeks of gestation, possessing BMIs between 25 and 29.9 at the beginning of pregnancy, having singleton pregnancy, having a low-risk pregnancy, that is, the absence of any medical and midwifery constraints for doing moderate physical activities, lacking systemic physical or mental illness, and not using weight-losing regimens or specific medicines.

The participants were excluded from the study in the case of one of the below conditions:

The need for using any chemical or herbal medications (except nutritional supplements suggested during pregnancy, such as folic acid, iron, and multivitamins according to national guidelines) that interfere with normal weight gain during pregnancy, mother's unwillingness to continue participating in the study or her simultaneous involvement in other surveys with similar educational interventions, the incidence of any medical diseases or obstetrics disorders that necessitate special care for the mother/fetus and interfere with the current intervention and childbirth before the 37th week of the gestation.

Accordingly, if a participant did not participate in the first session of the educational intervention or did not attend the second follow-up visit, another participant was replaced based on the inclusion criteria [Figure 1]. To decrease the sample attrition probability, the researcher explained the purpose of the study and the significance of the subjects' participation and obtained their phone numbers to remind them of the follow-up visits.

Data collection tool and technique

Pregnancy Physical Activity Questionnaire (PPAQ): This 32-item scale categorizes the 24-hour physical activities into four groups, including household activities (16 items), transportation (3 items), occupational activities (5 items), sports and exercises (8 items) and estimates their intensity based on the metabolic equivalent of task (MET) index, a unit for calculating calorie intake during physical activities.[16] In this questionnaire, sedentary, light, moderate, and vigorous physical activities have MET values of 1.5, 3.5, 4, and 8, respectively. To estimate the total amount of physical activity, it is necessary to add the amount of [light physical activity × MET × number of days], to [moderate physical activity in min × MET] × number of days and the amount of [vigorous physical activity in min × MET × number of days] in a week. The validity of the original and Persian forms of PPAQ has been confirmed in several studies,[16,17] and the reliability of this scale was determined through a pilot study on 15 eligible pregnant women with a Cronbach's alpha of 0.996 and intra-class correlation coefficient (ICC) of 0.992–0.996.

A demographic and reproductive form and a research-made checklist on prenatal complications were the other instruments of the study. The face and content validities of the questionnaires were examined by midwifery and reproductive health experts.

Intervention content

The educational intervention was formulated as simple, motivational, and executable messages in the form of advice and instructions based on physical activities

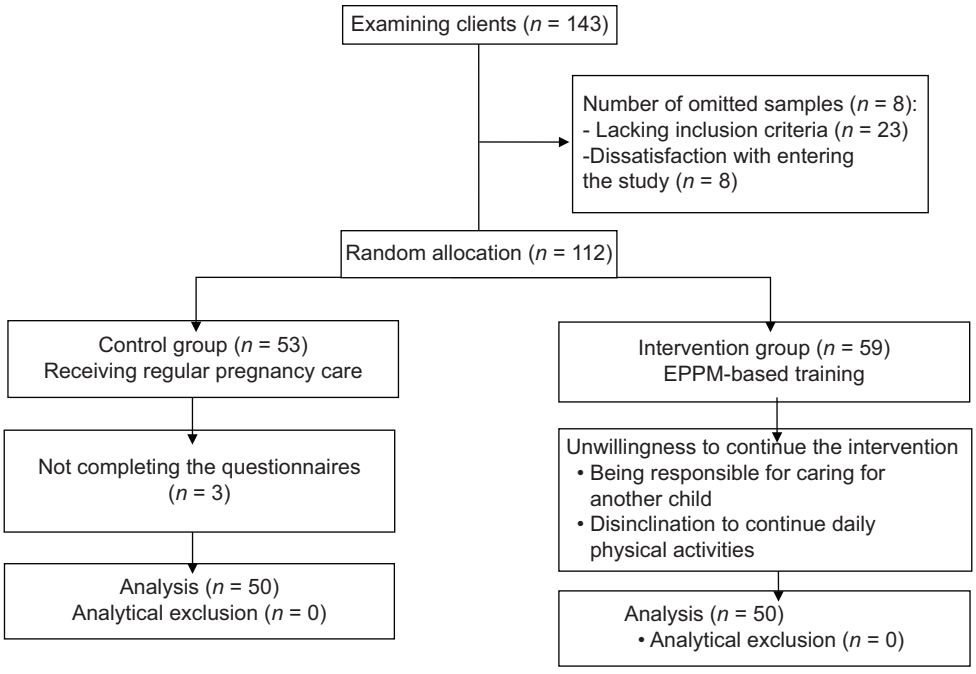

Figure 1: Participation flowchart

and simple and executable exercises during pregnancy, and significant points on food preparation and regimen modification, based on the comprehensive nutrition guide for pregnant and lactating mothers,[18] corrective exercises in pregnancy, labor, and postpartum,[19] Krause' Food and Nutrition Care Process,[20] and Pregnancy in Obese Women: Clinical Management.[21] The basic principle in developing the components of the program was to observe the order of the educational program based on four main EPPM constructs, including perceived susceptibility, perceived severity, perceived efficacy, and perceived self-efficacy, which emphasized audiences' perceptions of the threat and the development of strengthening of efficacy.[22] The file containing the educational content was delivered to three midwifery and reproductive health faculties to examine the content validity. Therefore, the statements were probed given their ambiguity, difficulty, use of common language, and application of specialized terminologies, and suggested corrections were applied. Table 1 outlines the stages of the intervention.

Hence, the guideline for applying the model's constructs was used to design and implement the intervention, which was based on provoking a sense of threat pertaining to the risks of pregnancy overweight to the mother and fetus/neonate in participants, inducing the efficacy of the risk reduction approaches, and strengthening their self-efficacy by teaching appropriate pregnancy weight control methods and simple and executable exercises.

For this purpose, eight programs, each containing five exercises, were designed. The participants were asked to perform them in the morning and before lunch throughout the week. The researcher provided all instructions in in-person and face-to-face sessions in the pregnancy care clinic. It was suggested that the exercises minimally last 10 min at first and then be lengthened to 30-40 min in the case of participants' willingness and convenience. Two exercise programs were delivered to the individuals as pamphlets in the second and third rounds, and four exercise programs were sent to the subjects as educational films and pictures with explanations through available virtual media. In addition to these exercises, relaxation workouts, aiming to alleviate the likely pregnancy anxiety and concerns mostly seen in overweight women, were taught for the purpose of preventing sudden eating behaviors, such as overeating and binge eating that result from mental anxiety and stress,[14] tuning rest time, and catering to sleep health. The participants were to use these practices at fixed times of the day. It is worth mentioning that all women were advised to fill out the designed calendar containing PPAQ items and return them to the researcher within two selected inter-visit weeks. This step enabled the researcher to compare individuals' physical activities in both groups.

Ethical consideration

This study was registered in the research ethics committee of the School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences with the IR.SBMU.PHARMACY.REC.239/1400 ethics code in 2021-12-14 and the Iranian Registry of Clinical Trials (IRCT) with the IRCT20211207053310N1 Number. At the beginning of the study when each participant agreed to enter the study, the researcher acquired the participants' written informed consent and assured them that participation would impose no cost and that their information would remain confidential and would only be used for research purposes. Furthermore, the participants were allowed to withdraw from the study at any stage. They were also required to contact the researcher and seek guidance in the case of any question, ambiguity, or problem during the study or refer to the hospital if necessary. This research did not involve gathering biological samples for storage.

Table 1: Summary of the intervention

	Intervention group	Control group	Questionnaire completion
First round (weeks 18–20)	10–15 min in-person training to enable mothers to perceive the threats of overweight and inactivity to themselves and their fetuses/neonates and make them sensitive to the likely complications of prenatal overweight (perceived threat); follow-ups included sending educational clips, presenting real samples and evidence pertaining to the overweight complications during pregnancy through virtual messengers until the next round; encouraging samples to think about weight control methods during pregnancy	Conventional pregnancy care	Demographic and reproductive form and PPAQ questionnaire
Second and third rounds (weeks 26–30 and 37–38)	10–15 min in-person training to enable mothers to perceive the efficacy of the safe, effective, and executable methods of physical activity in pregnancy, such as various types of light aerobic exercises, and learn relaxation to reduce stress before exercising and emotional eating; follow-ups included sending reminder messages for exercises and educational films through virtual messengers until the third round	Conventional pregnancy care	PPAQ
Fourth round (postnatal care)	regular postnatal care, examining and recording prenatal complications		Prenatal complications checklist

PPAQ=Pregnancy Physical Activity Questionnaire

Statistical analysis

Data analysis in this research were performed using Statistical Package for the Social Sciences (SPSS) version 16 software. It examined the relationships and associations between categorical variables using the Chi-square and Fisher's exact tests. The hypothesis of the normality of the data was tested using the Kolmogorov–Smirnov test. To compare the means of quantitative variables in two groups, either the Student's *t*-test or its non-parametric equivalent, the Mann–Whitney U test, was used. Repeated measures analysis of covariance was conducted to examine mean changes in values across the three-time points while adjusting for the confounding effect of baseline values. In addition, the Wilcoxon test was employed to examine changes in the mean values (pre-post), and the Analysis of covariance (ANCOVA) test was used to compare the mean values (post-intervention) in two groups while adjusting for the confounding effect of baseline. The significance level was set at $P < 0.05$.

Results

In the present study, five participants from the intervention group and three participants from the control group were excluded due to their lack of interest in completing the questionnaire repeatedly, and four participants from the intervention group were excluded due to their lack of interest in continuing the recommended physical activities. It is worth noting that the dropout of any participant from the intervention group was not due to the occurrence of adverse effects or difficulty with physical activity. Finally, the study continued with 100 participants (50 in each group). The participants' mean age was 29.24 ± 5.17 within the range of 20–39 years. The majority of the study participants were women with a high school diploma 42 (42%) and home wives 98 (98%). The mean height was 162.01 ± 3.69 cm within the range of 156–172, the mean weight was 72.96 ± 5.01 kg within the range of 62–86, and the mean body mass index (BMI) was 27.78 ± 1.49 within the range of 25–29.8. There were no statistically significant differences in demographic and clinical characteristics between the two groups ($P > 0.05$) [Table 2].

The results showed that the mean weight gain in the second trimester was 0.4 ± 0.76 kg in the intervention group and 4.2 ± 7.1 kg in the control group, within the range of 3–7 kg, which had a statistically significant difference between the two groups ($P = 0.002$). In addition, the mean weight gain in the third trimester was 3.31 ± 0.7 kg in the intervention group and 3.5 ± 0.54 kg in the control group, within the range of 2–5 kg, and there was no statistically significant difference between the two groups ($P = 0.117$) [Figure 2].

The initial comparison between the average scores of physical activity revealed significant differences between the two groups before the intervention ($P < 0.0001$). These differences were observed during the first visit ($P < 0.001$) and the second visit ($P < 0.001$), indicating that in all three instances, the intervention group had a higher average physical activity. For this purpose, a repeated measures analysis of variance was conducted to assess the changes in average physical activity while adjusting for the confounding effect of baseline scores. The results showed that the adjusted mean score of physical activity was 1255.09 ± 31.41 in the intervention group and 883.08 ± 31.41 in the control group, with a statistically significant difference between the two groups ($P < 0.001$). This finding further supports the higher average physical activity levels in the intervention group. Furthermore, the interaction effect between time and group ($P = 0.230$) was, indicating the absence of a significant difference in temporal changes between the groups [Table 3].

Table 2: Reproductive and individual characteristics of the participants in two groups of study

Variable	Intervention	Control	Statistic	*P*
	Mean±SD	Mean±SD		
Mother Age (years)	5.15±29.10	5.25±29.38	−0.269	0.788*
BMI	42.1±27.76	1.58±27.79	1197	0.715‡
Pregnancy order	1.32±2.28	1.55±2.4	1210	0.774‡
Gestational age at the beginning of the study (week)	1.12±18.46	1.16±18.8	1043.5	0.139‡
	n (%)	*n* (%)	Statistics	*P*
Maternal educational level:			2.785	0.239‡
0–9	17(%34)	12(%24)		
9–12	29(%58)	29(%58)		
>12	4(%8)	9(%18)		
Maternal occupational status:			2.813	0.495†
Housewife	50(%100)	48(%96)		
Employee	0	2(%4)		
Hypothyroidism and levothyroxine use	6(%12)	7(%14)	0.088	0.999§

SD=standard deviation. BMI=body mass index. *T-Student †Fisher's exact ‡Mann–Whitney §Chi-square

Furthermore, in examining each dimension of the PPAQ, the results showed that there was a significant difference in the adjusted mean scores between the two groups in the dimensions of "House hold" (P = 0.209), "Transportation and commuting" (P = 0.012), "Recreation and exercise" (P = 0.0001), and "Occupational activity" (P = 0.157). This indicates that the adjusted mean scores for "Transportation and commuting" and "Recreation and exercise" had a significant difference between the two groups, with higher scores in the intervention group [Figure 3].

For a more detailed examination of the physical activity status in the two groups from the beginning, the results of the physical activity calendar, which was designed to better assess and compare the physical activity of pregnant

Table 3: Comparison of repeated measure test results mean scores of physical activity score in the two study groups

Physical activity	Mean±SD (18–20 Week)	Mean±SD (26–30 Week)	Mean±SD (37–38 Week)	Estimated Marginal Means±SE	Repeated measure test		
					Within subject	Between group	Time *group
Intervention	1177.2±516.99	1462.2±477.68	1278.15±480.31	1255.09±31.41	F=0.395	F=66.485	F=1.458
Control	863.34±412.10	861±381.29	675±375.03	883.08±31.41	P=0.531	P=0.0001	P=0.230
P*	0.0001	0.0001	0.0001				

SD=standard deviation. *Mann–Whitney U

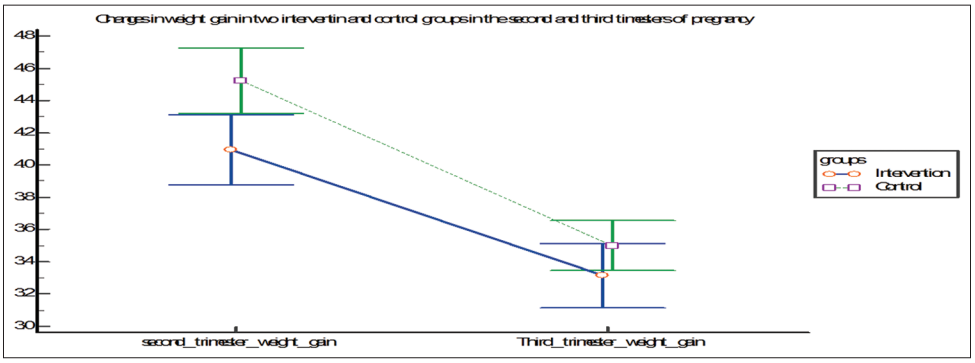

Figure 2: Changes in weight gain in two intervention and control groups in the second and third trimesters of pregnancy

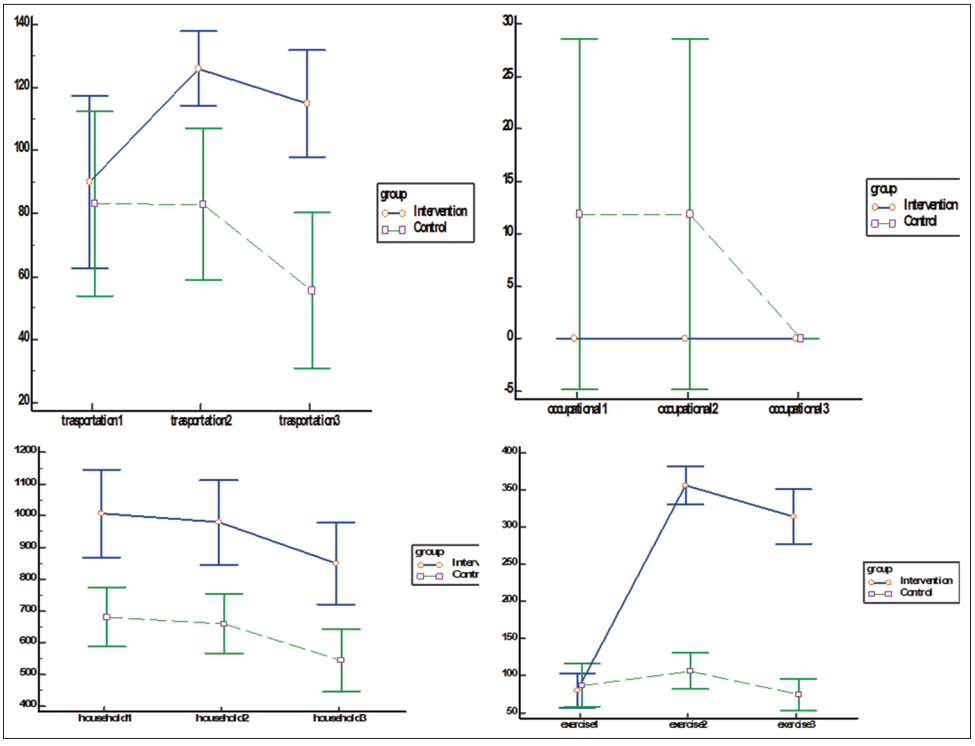

Figure 3: Comparison of mean and standard deviation of different areas of The Pregnancy Physical Activity Questionnaire in two groups

women, showed that the mean total score of the physical activity calendar before the study was 2886.11 ± 868.71 in the intervention group and 1903 ± 860.77 in the control group. This indicated a statistically significant difference in the average physical activity between the two groups initially ($P < 0.0001$). Therefore, considering this significant difference in the total score of the physical activity calendar before the intervention, ANCOVA was used for further investigation. The results showed that by controlling the confounding effect of the physical activity calendar score at baseline, the post-intervention physical activity calendar score in the intervention group was 2494.161 ± 113.67, and in the control group, it was 2116.089 ± 113.67, with a significant difference between the mean scores of the two groups ($P < 0.001$) [Table 4]. The changes in the mean total score of the physical activity calendar increased from 2886.11 ± 868.71 to 3320.19 ± 1220.37 in the intervention group ($P = 0.0001$). Furthermore, in the control group, the mean total score of the physical activity calendar decreased from 1903 ± 860.77 to 1690.06 ± 883.48 ($P = 0.005$). The mean increase in the total score of the Physical Activity Calendar in the intervention group was 434.08 ± 802.66, while the mean decrease in the total score of the physical activity calendar in the control group was 212.94 ± 693.03 units [Table 5 and Figure 4].

As evident from the graph, the changes in the mean "Transportation and commuting" and the changes in the mean "Recreation and exercise" between the groups had a statistically significant difference ($P < 0.0001$), with higher and increasing mean changes observed in the intervention group.

In the final stage of the study, the assessment of the perinatal outcome checklist showed that the mean weight of the newborns was 3406.6 ± 329.91 gm, ranging from 2700 to 4000 gm. The mean height of the newborns was 49.74 ± 1.3 cm, ranging from 47 to 53 cm, and the mean head circumference of the newborns was 0.68 ± 58.33 cm, ranging from 32 to 35 cm. The mean Apgar score in both groups was nine in the first minute and 10 in the fifth minute [Table 6].

None of the participants experienced pregnancy complications, childbirth complications such as, neonatal respiratory distress, dystocia, meconium passage, neonatal resuscitation, neonatal hospitalization, neonatal abnormalities, or neonatal death. However, 2 (4%) individuals of newborns in the intervention group and 1 (2%) individual of newborns in the control group developed jaundice shortly after birth. However, there was no statistically significant difference in the distribution of jaundice between the two groups ($P = 0.999$).

Discussion

The present study aimed to investigate the effect of EPPM-based training on improving the physical activity of pregnant overweight women. The results showed

Table 4: The results of covariance analysis for mean scores of physical activity calendar in two study groups

Group	Mean±SE	CI 95% for mean		Statistic	*P*
		Lower	Upper		
Intervention	2494.161±113.67	2668.549	3119.773	20.521	0.0001
Control	2116.089±113.67	1890.477	2341.701		

Table 5: Comparison of mean scores of physical activity calendar in two study groups

Physical activity	Mean±SD (18–30 Week)	Mean±SD (30–38 Week)	Difference Mean	*P*†
Intervention	2886.11±868.71	3320.19±1220.37	−434.08±802.66	0.0001
Control	1903±860.77	1690.06±883.48	212.94±693.03	0.005
*P**	0.0001	0.0001		

SD=standard deviation. **Mann–Whitney U †Wilcoxon

Table 6: Pregnancy and neonatal outcomes in two intervention and comparison groups

Variable	Intervention	Control	Statistic	*P*
	Mean±SD	Mean±SD		
Neonatal weight	324.09±3419.8	338.4±3393.4	1159	0.529*
Neonatal height	1.23±49.5	1.34±49.98	1012.5	0.091*
Head circumference	640.64±33.5	0.71±33.66	1118.5	0.316*
	n (%)	*n* (%)	Statistic	*P*
Jaundice	2(%4)	1(%2)	0.344	0.999†
NVD	31(%62)	28(%56)	0.372	0.542‡
Cesarean	19(%38)	22(%44)		

NVD=Normal Vaginal Delivery, SD=standard deviation. Mann–Whitney U *†Fisher's exact ‡Chi-square

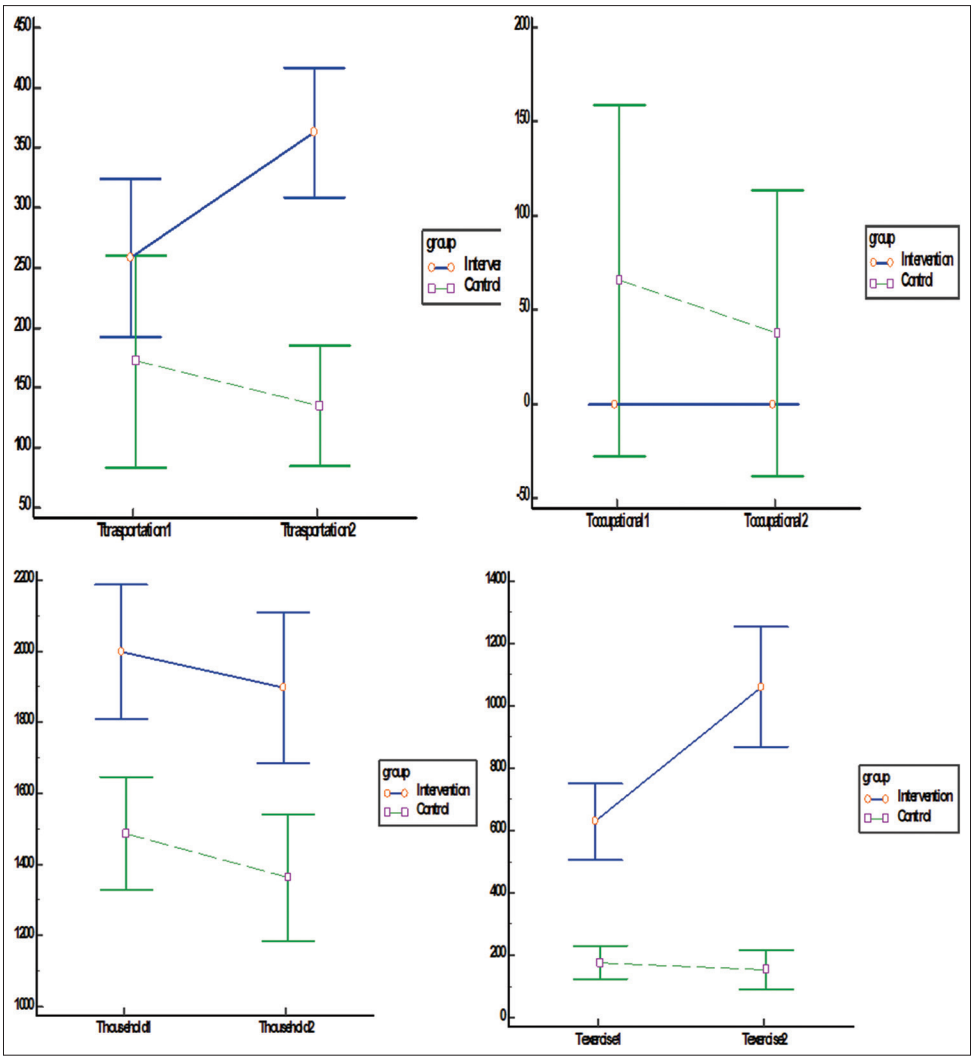

Figure 4: Comparison of mean and standard deviation of different areas of The Pregnancy Physical Activity Calendar two groups

that EPPM-based training enhanced the mean scores of PPAQ subscales, except for occupational activities. It may be because many of the participants in both groups were housewives, and such a finding was not unexpected. However, the maximum influence of the training was observed in the "sports and exercises" and "transportation" domains in the second and third visits due to the desired impact of the EPPM-based training. According to this model, risk protection is motivated when individuals believe and accept that (1) risk(s) threaten their health (perceived susceptibility), (2) feel the severity of risk(s) and consider themselves susceptible to those risk(s), similar to others (perceived severity), and (3) perceive that they can overcome threats by self-care and self-protection, resulting from changing beliefs, attitudes, and behaviors based on the suggested outcomes (perceived efficacy).[23]

According to the results, training based on EPPM and the designed protocol was relatively efficient, and the intervention not only brought about no complications to the mother and neonate but also accompanied stable effects on attitudinal change and anxiety reduction in doing physical activity during pregnancy minimally for four months.

Although the application of the health belief model (HBM) in a study improved the mean score of the model constructs and increased pregnant women's physical activity in the intervention group, this surge failed to reach suitable moderate and vigorous levels.[24] However, another study aiming to determine the effect of mobile-based training on improving pregnant women's activities provided positive and promising results regarding the physical activity of pregnant women.[25] Likewise, another study revealed that an awareness-raising intervention could improve pregnant women's knowledge of the benefits and safety aspects of physical activity during pregnancy and enhance their efficacy for doing physical activity during this period.[26]

Furthermore, the average weight gain was lower in the intervention than in the control group in the second trimester. Although the weight gain pattern in both groups fell into the permissible range for women with high BMIs (3–7 kg), it seems that adherence to a scheduled physical activity program can control this pattern. It is worth mentioning that the intervention and control groups were not significantly different in their mean weight gain scores in the third trimester. It may be attributed to consuming more foodstuffs due to experiencing increased appetite after physical activity in this trimester and limiting exercises in the last pregnancy weeks.

Moreover, the results showed that the intervention did lead to delivery and neonatal complications and the weight, height, and head circumference of the newborn negatively. Although Park *et al*.[27] reported that physical activity during pregnancy had a protective effect on low birth weight, fetal growth restriction, and premature birth, another study displayed that the weight of newborns was lower as a result of exercising during pregnancy, compared to other neonates, but fell into the normal range.[15] In 2009, another survey found a positive relationship between regular physical activities and the high birth weight of newborns.[28] Hence, although some studies agree that physical activity training during pregnancy does not noticeably influence pregnancy and neonatal outcomes, the present study reached positive results, the most important of which is the impact of the stepwise EPPM-based training on altering individuals' attitudes and perceptions of the potential risks of being overweight and development of self-efficacy after performing physical activities and reaching balanced weights during pregnancy.

Limitations and recommendation

Among the limitations of the present study, we can refer to the probability of under-reported or over-reported physical activities by the participants, though by using identical instruments and considering similar follow-ups, the researcher attempted to monitor women in both groups constantly to make the reported values less different. Besides, due to the impossibility of blinding the researcher and participants at the beginning of the study, the fourth member of the research team ran the blinded statistical analysis of the data for the purpose of minimizing the supervision bias.

Considering the negative impacts of being overweight during pregnancy, future studies are suggested to examine the effect of other health-promoting models on pregnant overweight women's healthy lifestyles and compare their findings with the results of the present study so that the most effective model is applied to provide training and midwifery counseling services to pregnant overweight women.

Conclusion

Since one of the strategies to improve the health of mothers in primary care is to provide preventive care without the use of drugs or costly and minimally invasive interventions, the importance of using modern training by using effective models and low cost should be considered. Therefore, it is recommended to use a well-designed educational program based on the EPPM, in compiling materials for pregnant women and the content of childbirth preparation classes to create motivation in increasing physical activity during pregnancy, especially for overweight pregnant women.

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Conflicts of interest

There are no conflicts of interest.

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