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ORIGINAL RESEARCH

Attitudes and Barriers to Physical Activity and Exercise Self-Efficacy Among Chinese Pregnant Women: A Cross-Sectional Study

Xingchen Shang[1,2,*], Linfei Ye[1,*], Xiaohua Gu[3], Aihua Zhou[4], Yunmei Xu[5], Yiran Zhang[1], Yuexia Liao[1], Lin Li[6]

[1]School of Nursing, Yangzhou University, Yangzhou, People's Republic of China; [2]School of Nursing, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong, People's Republic of China; [3]Delivery Room, Yangzhou Maternal and Child Care Service Centre, Yangzhou, People's Republic of China; [4]Delivery Room, Taizhou Second People's Hospital, Taizhou, People's Republic of China; [5]Obstetrics and Gynecology Department, Baoying People's Hospital, Yangzhou, People's Republic of China; [6]Department of Nursing, The Affiliated Hospital of Yangzhou University, Yangzhou, People's Republic of China

*These authors contributed equally to this work

Correspondence: Lin Li, Department of Nursing, The Affiliated Hospital of Yangzhou University, No. 368, Hanjiang Middle Road, Yangzhou, 225000, People's Republic of China, Tel +86 13585233313, Email 361350908@qq.com

Background: Most pregnant women do not reach the recommendation for physical activity (PA). As a subcategory of PA, exercise is also essential. Evidence on pregnant women's attitudes and barriers to PA and exercise self-efficacy in China is scarce.

Aim: To explore the levels and influencing factors of attitudes and barriers to PA and exercise self-efficacy among pregnant women.

Methods: A cross-sectional study of 311 pregnant women was conducted from August to December 2022. Individual characteristics, pregnant women's attitudes toward exercise, barriers to prenatal PA and exercise, and exercise self-efficacy were measured using the self-designed demographic questionnaire, pregnant women's attitudes toward exercise questionnaire, barriers to prenatal PA and exercise questionnaire, and the pregnancy exercise self-efficacy scale, respectively.

Results: More than 90% of pregnant women believed exercise benefits themselves and their babies, and 40.8% of pregnant women did not know how to exercise. Women encounter different types of barriers to PA and exercise. Intrapersonal barriers included the proportion of feelings of tiredness (56.6%), low energy (54.7%), lack of interest or motivation (49.2%), feelings of illness and morning sickness (46.6%), and large body weight (43.7%). Interpersonal barriers included pregnant women being advised to avoid PA and exercise (49.2%), lack of clear advice about the intensity and dose of exercise (41.8%), no one to exercise with (38.9%), and lack of advice from healthcare professionals (38.6%). Weather conditions were the most significant environmental barriers (41.2%). The total score of pregnancy exercise self-efficacy was (38.50±7.33). Education level, parity, and attitudes toward exercise independently predict pregnant women's attitudes toward exercise, barriers to prenatal PA and exercise, and exercise self-efficacy, respectively.

Conclusion: Pregnant women have a favorable attitude toward exercise and relatively good exercise self-efficacy but lack knowledge of exercise. They face numerous barriers. Medical professionals should encourage pregnant women with lower levels of education to exercise and assist multipara in overcoming obstacles.

Keywords: attitudes, barriers, exercise self-efficacy, physical activity, pregnancy

Introduction

Pregnancy is a life-changing event for most women that places tremendous physical and psychological stresses[1] and leads to hormonal, physiologic, and biomechanical changes, such as increased blood volume, heart rate, and weight gain, that almost always proceed normally.[2] Physical activity (PA) is any bodily movement produced by the contraction of skeletal muscle that needs to expand energy.[3] Exercise is a subtype of PA that is planned, structured, repetitive, and purposefully aimed at improving or maintaining one or more components of physical fitness.[4] Growing evidence shows that regular PA during pregnancy substantially benefits the mother and fetus.[5] The numerous maternal benefits of PA during the gestation period

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consist of reduced risk of excessive gestational weight gain,[6] less chance of gestational diabetes mellitus (GDM) and preeclampsia,[2,7] less possibility of cesarean delivery,[8] relief of pregnancy-related low-back pain,[9] and, to some extent, improved health perception.[10] Additional health benefits of PA for the mother include improved sleep[11] and reduced symptoms of postpartum depression.[12] Moreover, prenatal exercise benefits the fetus in decreasing macrosomia and neonatal respiratory morbidity odds with no increase in the risk of neonatal complications or adverse childhood outcomes.[13]

Considering the valuable benefits during pregnancy, it is necessary to participate in some forms of PA in pregnant populations.[14] However, China has no PA clinical guidelines during pregnancy until now. We tend to refer to other countries' PA guidelines during pregnancy.[15] Most countries' guidelines recommend that moderate-intensity PA be maintained at least 150 minutes per week among women with no pregnancy-related contraindications or complications.[15–17] Despite well-documented health benefits, most pregnant women do not reach the recommendation for PA during pregnancy.[18] Studies in several countries showed that approximately 27.2% to 79.3% of pregnant women have low adherence levels to sufficient PA during pregnancy. Similar results have been demonstrated in recent studies.[3,19] A survey of 1515 pregnant women in Shanghai, China, revealed that the rate of physical inactivity was 47.5% and that only 2.8% of participants engaged in PA as recommended.[20] An observational study from China showed that sedentary behavior is an independent risk factor for mental distress symptoms of pregnant women, including depression and anxiety.[21] Another population-based cross-sectional study showed that a sedentary lifestyle was associated with higher risk of GDM among Chinese pregnant women.[22]

Factors affecting PA during pregnancy are multiple and complex. Several studies have identified intrapersonal (eg, feeling too tired or uncomfortable, childcare needs), interpersonal (eg, partner's influence, lack of a personalized prescription, support from other pregnant women), and environmental factors as barriers to prenatal PA.[23–26] The concept of exercise self-efficacy was created by Bandura, defined as the confidence of an individual overcoming obstacles to PA. It plays a crucial role in establishing and maintaining new healthy behaviors.[27] Previous studies have indicated that self-efficacy is associated with activity during pregnancy.[28] Pregnant women with high exercise self-efficacy are more likely to engage in PA than those with low self-efficacy.[29]

The attitudes and beliefs of pregnant women about prenatal exercise vary among cultures,[30] In traditional Chinese culture, pregnancy is viewed as a vulnerable period that needs rest and recuperation, with several prenatal taboos that may be inconsistent with international guidelines on PA during pregnancy.[31] The two pertinent taboos, "not walking too fast" and "not walking too often", are intended to prevent spontaneous miscarriage and are reportedly followed by most women.[31] Thus, understanding these variations across different cultures and settings is essential to designing a context-specific intervention to promote engagement in PA during pregnancy.[32] However, studies on the participation of pregnant women in PA during pregnancy in China, especially in third-tier cities (a low level of relative development, usually areas with small populations or relatively weak economies), are lacking. Specifically, little information was available about attitudes and barriers to PA and exercise self-efficacy among pregnant women. Clarifying pregnant women's attitudes and barriers to PA and exercise self-efficacy is essential to designing a tailor-targeted intervention to improve Chinese pregnant women's engagement in PA and exercise. Thus, this study aimed to clarify these factors among Chinese pregnant women.

Methods

Recruitment and Participants

This cross-sectional study was conducted from August to December 2022 at 6 Secondary and above hospitals in 2 third-tier cities of Jiangsu Province, China. Participants were eligible if they were 18 years or older, at any trimester with a singleton pregnancy, and could read and write in Chinese. Women with absolute contraindications for PA (eg, preeclampsia, cervical insufficiency, or unexplained persistent vaginal bleeding) during pregnancy were excluded.

Convenient sampling was applied to recruit participants in the hospitals. Pregnant women who received routine prenatal care in the hospital obstetrics departments were recruited in the study. The participants were informed of the purpose and significance of the study before the investigation. Eligible pregnant women were invited to complete the survey in a quiet room. All pregnant women participated in this study entirely voluntarily without additional compensation. Six obstetric nurses and 1 obstetric nursing postgraduate were responsible for the data collection, and they were all

trained by the first author before the investigation. All questionnaires were checked immediately after completion to identify any missing data.

Sample Size Calculation

The sample size was calculated using G*Power 3.1.9.7. To obtain a predictive power of 0.90 with an alpha of 0.05 and an effect size of 0.136[33] with 25 pregnancy insomnia predictors, the minimum sample size of 229 was determined. Considering a 15% nonresponse rate, the sample size should be at least 264.

Outcome Measures

The survey had four parts: individual characteristics, pregnant women's attitudes toward exercise, barriers to prenatal PA and exercise, and the pregnancy exercise self-efficacy scale. The questionnaires were presented in Supplementary Material 1.

The questionnaire of individual characteristics consisted of demographic information (eg, age, education level, occupation, income) and pregnancy-related information (eg, trimester, parity, method of conception, times of abortion, and pre-pregnancy body mass index (BMI)).

Wang Chen designed the questionnaire on pregnant women's attitudes toward exercise.[34] It includes 9 items with 7-point scales ranging from "strong disagreement" to "strong agreement" for each item. Considering reducing the burden of filling for participants, our research team simplified the options to a 5-point scale: 1= strong disagreement, 2=disagreement, 3=neutral, 4=agreement, and 5=strong agreement, respectively. The total score of the questionnaire ranges from 9–45, with a higher score associated with a more active attitude toward pregnancy exercise. In this study, Cronbach's alpha of the questionnaire was 0.95.

The questionnaire on barriers to prenatal PA and exercise was designed based on 2 studies by Okafor.[32] The original questionnaire with 24 items[35] was partially modified based on the relevant literature and group discussion: 1 item was deleted, 1 was added, and 2 were merged. The final questionnaire includes 23 items. Items of "lack of recreational facilities in the area" and "lack of access to physical activity facilities" are similar, and this study focused on PA and exercise, so we only retained the latter. This study merged items of "feel nausea, vomiting, and back pain" and "feeling of discomfort" into "feeling of discomforts like nausea, vomiting, and back pain". Individual motivation or interest is also an essential barrier to prenatal PA,[36] so this study added the "lack of interest or motivation". The original questionnaire is scored on a Likert 4-point scale, including "strong disagreement, disagreement, agreement, and strong agreement". This study supplemented a "neutral" option to evaluate the barriers to PA and exercise comprehensively, and each item is scored on a 5-point scale ranging from 1 to 5. The total score is 23 to 115. In this study, Cronbach's alpha of the questionnaire was 0.96.

Bland revised the pregnancy exercise self-efficacy scale (P-ESES) based on the characteristics of pregnant women, and internal consistency was confirmed by Cronbach's alpha coefficient of 0.838.[37] The Chinese version of P-ESES was modified by Yang Hongmei,[38] including 3 dimensions (overcoming exercise barriers, emotional barriers, and support barriers) and 10 items. Each item is scored on a 5-point scale ranging from 1 to 5. The total score is 10 to 50. The pregnancy exercise self-efficacy can be divided into 3 levels according to the total score: high level (41–50), medium level (21–40), and low level (10–20). In this study, Cronbach's alpha of the scale was 0.96.

To help participants better distinguish PA and exercise, the researchers explained the differences to the pregnant women before the survey. PA is any movement carried out by the muscles that require energy. In other words, it is any movement a person does, such as cooking, feeding children, walking, and swimming. Exercise is a form of PA, a planned, structured, repetitive, and intentional movement to improve or maintain physical fitness.

Statistical Analyses

SPSS V.28 was used to analyze the data. The Kolmogorov–Smirnov test was used to test the normality of the continuous data. As all the continuous variables in this study conformed or substantially conformed to a normal distribution, mean ±standard deviation (SD) was used to describe the continuous variables. Categorical variables were shown as the frequency (percentage). As for pregnant women's attitudes toward exercise, we calculated each item's "strong

agreement" and "agreement" percentages to conveniently explain data. Independent samples *t*-test and one-way ANOVA were used to compare the differences in pregnant women's attitudes toward exercise, barriers to prenatal PA and exercise, and pregnancy exercise self-efficacy. Pearson correlation analysis was applied to analyze the correlations between continuous variables. Multiple linear regression analysis was used to incorporate independent variables ($P < 0.05$) in the univariate analysis to explore factors associated with the pregnant women's attitudes toward exercise, barriers to prenatal PA and exercise, and pregnancy exercise self-efficacy. $P < 0.05$ (two-tailed) was accepted as statistically significant.

Results

Three hundred and twenty women were recruited for the study, but 3 failed to meet the inclusion criteria. Then, 317 questionnaires were distributed and returned, and 6 invalid questionnaires were removed because of regular answers with the same options. Thus, 311 valid questionnaires remained with an effective rate of 98.11%.

Characteristics of the Pregnant Women

The mean age of the participants was (29.27±3.78) years. The average gestational age of the participants was (31.86 ±8.56) weeks. These pregnant women were well-educated, with 81.4% having completed a college degree. Only 37.9% of the women were still on duty during pregnancy. Women in the third trimester accounted for the most significant proportion (74.6%). In total, 66.2% of the women were nulliparous, and nearly half (49.8%) were cared for by their spouses during pregnancy. Most women (87.1%) did not have pregnancy complications (eg, gestational hypertension, gestational diabetes, gestational anemia). Less than half of the women (43.1%) undertook regular exercise (participate in PA or exercise every week ≥ 3 times, and each time lasts ≥30 minutes) before pregnancy, and this number became even more diminutive (40.5%) during pregnancy. Considering the compliance rate is very low, at least 150 minutes/week is too strict to reflect the actual physical activity of pregnant women in China. Thus, we change the investigation standard to reflect the situation with reference to Action for a Healthy China (2019–2030).[39]

Pregnant Women's Attitudes toward Exercise

More than 90% of pregnant women thought exercise during pregnancy was beneficial to themselves and their babies. Almost 20% of the participants thought exercise during pregnancy was unsafe for themselves and their babies. Approximately 85% of pregnant women thought exercise during pregnancy is essential, and they are willing to exercise during pregnancy, while only 68.8% have confidence in exercising during pregnancy. More than 40% of pregnant women did not know how to exercise during pregnancy. Besides, 81.7% of women hope to learn more about what kind of exercise to do during pregnancy.

For the score on each item, the 2 items with the highest scores were related to attitudes toward exercise benefits. Instead, scores of 2 items were lowest and less than 4, "I have confidence in doing exercise during pregnancy" and "I know how to exercise during pregnancy", respectively. Table 1 presents detailed information about pregnant women's attitudes toward exercise.

Table 1 Pregnant Women's Attitudes toward Exercise (N = 311)

Items	Scores (Mean±SD)	Percentage (Agreement + Strong Agreement)
Exercise during pregnancy is beneficial to me	4.40±0.70	92.9%
Exercise during pregnancy is beneficial to my baby	4.39±0.70	92.3%
Exercise during pregnancy is safe for me	4.21±0.76	82.0%
Exercise during pregnancy is safe for my baby	4.20±0.76	81.4%
Exercise during pregnancy is important	4.26±0.75	85.5%

(*Continued*)

Table 1 (Continued).

Items	Scores (Mean±SD)	Percentage (Agreement + Strong Agreement)
I am willing to exercise during pregnancy	4.23±0.77	84.2%
I have confidence in doing exercise during pregnancy	3.99±0.88	68.8%
I know how to exercise during pregnancy	3.80±0.96	59.2%
I hope to know more advice on what kind of exercise to do during pregnancy	4.21±0.78	81.7%

Barriers to Physical Activity and Exercise

To analyze data more conveniently, we combined "strong disagreement" and "disagreement" as disagreement, "agreement" and "strong agreement" as agreement, and kept the "neutral" option. Besides, we summarized the barriers from the 3 domains (intrapersonal, interpersonal, and environmental).[36] The mean scores of items in intrapersonal, interpersonal, and environmental domains were (3.18±0.75), (2.99±0.81), and (3.00±0.86), respectively. Among intrapersonal barriers, the feeling of tiredness (56.6%), low energy (54.7%), lack of interest or motivation (49.2%), the feeling of illness and morning sickness (46.6%), and large body weight (43.7%) scored higher than other barriers. The main interpersonal barriers to PA and exercise reported by the pregnant women were advised to avoid PA and exercise (49.2%), lack of clear advice about the intensity and dose of exercise (41.8%), no one to exercise with (38.9%) and lack of advice from healthcare professionals (38.6%). Weather conditions were the most significant environmental barriers to PA during pregnancy (41.2%). Table 2 presents detailed information about pregnant women's PA and exercise barriers.

Table 2 Barriers to Physical Activity and Exercise (N = 311)

Items	Disagreement n (%)	Neutral n (%)	Agreement n (%)	Scores (Mean±SD)
Intrapersonal barriers				3.18±0.75
Lack of interest or motivation	67(21.5)	91(29.3)	153(49.2)	3.31±1.00
Feeling of tiredness	50(16.1)	85(27.3)	176(56.6)	3.47±0.97
Large body weight	70(22.5)	104(33.4)	136(43.7)	3.26±0.98
Low energy	41(13.2)	100(32.2)	170(54.7)	3.49±0.90
The feeling of illness and morning sickness	63(20.3)	103(33.1)	145(46.6)	3.31±1.01
The feeling of discomfort like nausea, vomiting, and back pain	102(32.8)	101(32.5)	108(34.7)	3.02±1.06
Work commitment	114(36.7)	98(31.5)	99(31.8)	2.96±1.08
Childcare and responsibilities	168(54.0)	80(25.7)	63(20.3)	2.60±1.03
Interpersonal barriers				2.99±0.81
No one to exercise with	82(26.4)	108(34.7)	121(38.9)	3.16±1.03
Advised to avoid physical activity and exercise	52(16.7)	106(34.1)	153(49.2)	3.35±0.99
Lack of support from family or friends	124(39.9)	110(35.4)	77(24.8)	2.80±1.04
My partner and family dislike my involvement in physical activity or exercise	164(52.7).	93(29.9)	54(17.4)	2.56±1.02
Conflicting advice about physical activity or exercise	112(36.0)	116(37.3)	83(26.7)	2.86±1.03
Cultural dislike or disapproval about physical activity and exercise	149(47.9)	95(30.5)	67(21.5)	2.66±1.05
Lack of advice and support on the benefits of physical activity	98(31.5)	103(33.1)	20(6.4)	3.03±1.04
Insufficient and contradictory information	87(28.0)	113(36.3)	111(35.7)	3.08±1.01
Lack of advice from healthcare professionals	72(23.2)	119(38.3)	120(38.6)	3.18±0.98
Lack of clear advice about the intensity and dose of exercise	68(21.9)	113(36.3)	130(41.8)	3.22±0.99

(*Continued*)

Table 2 (Continued).

Items	Disagreement n (%)	Neutral n (%)	Agreement n (%)	Scores (Mean±SD)
Environmental barriers				3.00±0.86
Lack of transport to go to the gym	157(50.5)	87(28.0)	67(21.5)	2.64±1.03
Lack of access to physical activity facilities	142(45.7)	96(30.9)	73(23.5)	2.71±1.04
Lack of money to pay for gym fee	112(36.0)	98(31.5)	101(32.5)	2.95±1.06
Environment not safe to exercise	108(34.7)	113(36.3)	90(28.9)	2.92±1.03
Weather conditions	75(24.1)	108(34.7)	128(41.2)	3.18±0.99
Total				69.72±16.91

Scores of Pregnancy Exercise Self-Efficacy

The total score of pregnancy exercise self-efficacy was (38.50±7.33) at the upper-medium level. Specifically, 85 (27.3%), 224 (72.0%), and 2 (0.6%) women showed high, medium, and low levels of exercise self-efficacy, respectively. As for the score of each dimension, items of "overcome exercise barriers" had the highest scores, followed by items of "overcome support barriers", and items of "overcome emotional barriers" had the lowest scores. Table 3 presents detailed information about pregnant women's scores of pregnancy exercise self-efficacy.

Determinants Associated with Pregnant Women's Attitudes Toward Exercise, Barriers to Prenatal Physical Activity and Exercise, and Pregnancy Exercise Self-Efficacy

The results of Pearson correlation analysis showed that age was not associated with the pregnant women's attitudes toward exercise (r=0.001, P=0.987), barriers to prenatal PA and exercise (r=0.059, P=0.303), and pregnancy exercise self-efficacy (r=0.008, P=0.890).

Table 3 Scores of Pregnancy Exercise Self-Efficacy (N = 311)

Dimensions	Items	Scores (Mean±SD)
Overcome exercise barriers		3.98±0.72
	I am confident that I can overcome barriers and challenges to exercise if I try hard enough.	4.05±0.73
	I am confident that I can find the means and ways to exercise during pregnancy.	4.03±0.76
	I am confident that I can accomplish the exercise goals that I set.	3.92±0.79
	I am confident that confronted with a barrier to exercise, I can find several solutions to overcome this barrier.	3.94±0.80
Overcome emotional barriers		3.63±0.92
	I am confident that I can exercise when I am tired.	3.61±0.95
	I am confident that I can exercise even when I am feeling depressed.	3.65±0.95
Overcome support barriers		3.82±0.79
	I am confident that I can exercise when without the support of my family or friends.	3.82±0.87
	I am confident that I can exercise without the consult of my physician.	3.66±0.95
	I am confident that I can motivate myself to start exercising again after I have stopped for a while.	3.88±0.83
	I am confident that I can exercise even if I have no access to a gym, exercise, training, or rehabilitation facility.	3.95±0.80
The total score of P-ESES		38.50±7.33

Notes: Adapted from Bland HW, Melton BF, Marshall ES, Nagle JA. Measuring Exercise Self-Efficacy in Pregnant Women: Psychometric Properties of the Pregnancy-Exercise Self-Efficacy Scale (P-ESES). *J Nurs Meas*. 2013;21(3):349–359; permission conveyed through Copyright Clearance Center, Inc.[37]

The results of Pearson correlation analysis among pregnant women's attitudes toward exercise, barriers to prenatal PA and exercise, and pregnancy exercise self-efficacy showed that only pregnant women's attitudes toward exercise were related to pregnancy exercise self-efficacy (r=0.633, P<0.01).

The results of the univariate analysis are shown in Table 4. Education level was significantly related to pregnant women's attitudes toward exercise (t=−2.923, P=0.004). Times of abortion (t=−1.989, P=0.048), current stage of pregnancy (F=3.852, P=0.022), and parity (t=−3.304, P=0.001) were shown to be significantly related to barriers to

Table 4 Univariate Analysis of Factors Associated with Pregnant Women's Attitudes toward Exercise, Barriers to Prenatal Physical Activity and Exercise, and Pregnancy Exercise Self-Efficacy (N = 311)

Variables	n (%)	Pregnant Women's Attitudes toward Exercise	Barriers to Physical Activity and Exercise	Pregnancy Exercise Self-Efficacy
Education level				
High school or less	58 (18.6)	35.64±5.96	71.00±15.18	37.12±7.17
College or more	253 (81.4)	38.16±5.93	69.42±17.30	38.81±7.34
t		−2.923	0.640	−1.588
P		0.004	0.523	0.113
Occupation				
Salaried employee	183 (58.8)	37.75±5.95	69.71±16.94	38.68±7.21
Self-employed	72 (23.2)	37.50±5.90	69.67±16.23	38.03±7.35
Others (students, no work, etc.)	56 (18)	37.75±6.41	69.80±1.93	38.50±7.80
F		0.047	0.001	0.202
P		0.954	0.999	0.817
Current employment status				
Does not work	193 (62.1)	37.66±6.36	70.67±16.73	38.62±7.87
On duty	118 (37.9)	37.75±5.40	68.16±17.16	38.29±6.37
t		−0.130	1.270	0.409
P		0.897	0.205	0.683
Habitual residence				
City	231 (74.3)	37.83±5.95	70.36±16.94	38.45±7.17
Countryside	80 (25.7)	37.29±6.19	67.88±16.79	38.64±7.82
t		0.697	1.131	−0.201
P		0.486	0.259	0.841
Personal monthly income (¥)				
≤5000	127 (40.8)	37.26±5.82	70.09±17.09	38.67±7.08
5001–8000	111 (35.7)	37.98±5.57	69.68±16.44	37.78±7.79
>8000	73 (23.5)	37.64±6.95	69.11±17.50	39.27±7.02
F		0.222	0.078	0.971
P		0.801	0.925	0.380
Planned pregnancy				
Yes	203 (65.3)	37.76±5.95	70.39±16.80	38.74±7.07
No	108 (34.7)	37.56±6.14	68.45±17.13	38.04±7.80
t		0.271	0.541	0.804
P		0.787	0.337	0.422
Method of conception				
Natural conception	195 (62.7)	37.74±6.03	69.81±17.05	38.56±7.37
Assisted conception	16 (5.1)	36.75±5.58	68.00±14.32	37.31±6.69
t		0.643	0.416	0.662
P		0.520	0.677	0.508
Times of abortion				
0	216 (52.1)	37.55±5.85	68.46±15.85	38.29±7.05
≥1	95 (30.5)	38.01±6.37	72.58±18.87	38.96±7.94
t		−0.621	−1.989	−0.738
P		0.535	0.048	0.461

(*Continued*)

Table 4 (Continued).

Variables	n (%)	Pregnant Women's Attitudes toward Exercise	Barriers to Physical Activity and Exercise	Pregnancy Exercise Self-Efficacy
Pre-pregnancy BMI (kg/m^2)				
<18.5	38 (12.2)	37.74±6.29	73.26±19.24	38.87±8.19
18.5–23.9	200 (64.3)	37.90±5.76	69.33±16.10	38.28±7.35
>23.9	73 (23.5)	37.10±6.55	68.93±17.79	38.88±6.87
F		0.479	0.967	0.229
P		0.620	0.382	0.795
Current stage of pregnancy				
First trimester	18 (5.8)	40.39±4.06	70.22±17.06	41.33±6.12
Second trimester	61 (19.6)	37.07±5.87	64.39±14.83	38.07±6.70
Third trimester	232 (74.6)	37.65±6.13	71.08±17.20	38.39±7.55
F		2.171	3.852	1.484
P		0.116	0.022	0.228
Parity				
Primiparous	206 (66.2)	37.37±6.15	67.49±16.41	38.20±7.50
Multiparous	105 (33.8)	38.31±5.68	74.09±17.09	39.07±6.97
t		−1.308	−3.304	−0.982
P		0.192	0.001	0.327
Primary caregiver during pregnancy				
Yourself	51 (16.4)	36.98±6.86	69.98±12.10	37.41±8.09
Spouse	155 (49.8)	37.83±5.67	69.05±17.69	38.70±7.25
Parents or others	105 (33.8)	37.83±6.07	70.58±17.81	
F		0.426	0.264	0.665
P		0.653	0.768	0.515
Education level of spouse				
High school or less	64 (20.6)	36.73±5.81	68.34±14.29	37.72±6.79
College or more	247 (79.4)	37.94±6.04	70.07±17.53	38.70±7.46
t		−1.433	−0.728	−0.951
P		0.153	0.467	0.342
Occupation of spouse				
Salaried employee	211 (67.8)	37.93±6.20	69.61±16.86	38.88±7.49
Self-employed	82 (26.4)	36.91±5.68	69.57±16.90	37.41±7.12
Others (students, no work, etc.)	18 (5.8)	38.39±4.96	71.67±18.35	38.89±6.13
F		0.979	0.126	1.212
P		0.377	0.881	0.299
Desired delivery mode				
Natural labor	185 (59.5)	37.90±5.95	69.39±16.97	38.95±6.93
Caesarean section	46 (14.8)	37.30±6.37	72.71±16.29	38.48±8.21
Both are okay	80 (25.7)	37.42±5.96	68.74±17.13	37.46±7.68
F		0.288	0.891	1.146
P		0.750	0.411	0.319
With pregnancy complications				
Yes	40 (12.9)	38.67±6.46	68.18±19.82	39.60±8.74
No	271 (87.1)	37.55±5.93	69.94±16.47	38.33±7.10
t		1.110	−0.617	0.876
P		0.268	0.538	0.386

prenatal PA and exercise. No individual characteristics were associated with pregnancy exercise self-efficacy (P all>0.05).

Those independent variables with $P<0.05$ in the univariate analysis were then entered in the multivariate linear regression model. For the current stage of pregnancy, a dummy variable was set. Generally, when setting dummy

Table 5 Multiple Linear Regression Analysis of Factors Associated with Pregnant Women's Attitudes toward Exercise, Barriers to Prenatal Physical Activity and Exercise, and Pregnancy Exercise Self-Efficacy (N = 311)

Dependent Variables	Independent Variables	*B*	*SE*	*β*	t	*P*	95% CI
Pregnant women's attitudes toward exercise	College or more vs High school or less	2.524	0.864	0.164	2.923	0.004	[0.825, 4.223]
Barriers to prenatal physical activity and exercise	Multiparous vs Primiparous	6.156	2.089	0.172	2.947	0.003	[2.046, 10.267]
Pregnancy exercise self-efficacy	Pregnant women's attitudes toward exercise	0.773	0.054	0.633	14.386	<0.001	[0.667, 0.879]

variables, categories with a specific significance or a particular order level can be chosen as a reference. Trimesters have a specific order of first, second, and third trimesters, so the first trimester was used as a reference group to make the regression coefficients easier to interpret. The results revealed that education level of college or more (β=0.164, *P*=0.004) was significantly related to pregnant women's attitudes toward exercise. Multiparous (β=0.172, *P*=0.003) was significantly related to barriers to prenatal PA and exercise. Pregnant women's attitudes toward exercise (β=0.633, *P*<0.001) were significantly related to pregnancy exercise self-efficacy. The results of multiple linear regression analysis are shown in Table 5.

Discussion

Our study found that most pregnant women held a positive attitude toward exercise and recognized the importance of exercise during pregnancy. Attitude can influence intention-to-action behavior.[40] However, in our study, the proportion of women who exercised regularly during pregnancy was smaller than pre-pregnancy. Healthcare professionals should focus more on facilitating the shift from intention to participation in exercise in pregnant women. In addition, more than a third of the participants had insufficient knowledge of how to exercise during pregnancy, consistent with the result of a qualitative study from Singapore.[41] These findings indicate medical professionals provide detailed and sufficient information about the duration, frequency, and type of exercise during pregnancy to targeted women. Our study also found pregnant women with a college education or higher had a more active attitude toward pregnancy exercise than those with a high school education or less. Thus, healthcare providers should increase education for pregnant women with lower cultural levels on the benefits of exercise during pregnancy and the dangers of inactivity in prenatal care to enhance their positive attitude toward exercise.

In our study, intrapersonal factors, like tiredness, low energy, and lack of interest or motivation, were the predominant barriers to PA and exercise in pregnancy. Similar barriers have been displayed in a study from Southern California.[42] Physical changes have a dynamic trend in different trimesters. For example, while tiredness, illness, and morning sickness are commonly experienced in the first trimester, large body weight is more likely to occur in the third trimester.[26] Therefore, individual-oriented intervention should align with maternal changes and specified barriers during pregnancy to motivate pregnant women's participation in PA and exercise. Regarding interpersonal barriers, being advised to avoid PA and exercise, lack of clear advice about exercise, and having no one to exercise with were the most reported barriers, which align with studies from Iran and Southern California.[19,42] Many guidelines advocate that PA and exercise during pregnancy are safe and recommended if there are no contraindications.[3,43,44] However, influenced by traditional culture, Chinese families believe resting as much as possible can protect the fetus from spontaneous miscarriage.[31] Thus, pregnant women are usually advised to avoid PA and exercise during pregnancy, especially in the first trimester. Accordingly, pregnant women should be aware of the benefits of PA and exercise. Healthcare professionals play an essential role in the PA and exercise of pregnant women.[45,46] They should advocate for appropriate levels of activity and be educated about the contraindications, signs, and symptoms that suggest PA and exercise should be altered to guarantee the safety of pregnant women. In contrast, our study identified the lack of advice from healthcare professionals as a barrier. Moreover, the information that some pregnant women received was commonly contradictory and insufficient. Some factors may explain the phenomenon. First, although midwives are essential in educating and

motivating women to develop or maintain a healthy lifestyle during pregnancy, they lack knowledge of PA and exercise.[47] Thus, PA and exercise should be incorporated into the midwifery/nursing curriculum to enable midwives and other obstetrics and gynecology staff to deliver evidence-based education and counseling to women during antenatal health care.[47] Second, the shortage of midwives and other medical professionals and the overwhelming workload in the Chinese medical system may also contribute to the issues.[48,49] Third, China has no consensus or clinical guideline on PA or exercise during pregnancy. Thus, it is urgent to develop a standard based on Chinese pregnant women's characteristics to guide clinical practice effectively.[15] Spouses served as primary caregivers during pregnancy and should have served as potential promoters of pregnant women's health behavior. Nonetheless, no one to exercise with was reported by 38.9% of pregnant women. A longitudinal study found that couples' patterns of PA change similarly, with both experiencing a significant decrease in PA during pregnancy and after delivery compared to pre-pregnancy.[50] It is vital to promote family-based programs and encourage spouses to do PA or exercise together with women during pregnancy.[50] Most expectant mothers believed that environmental barriers were most influenced by weather in our study, aligning with the results reported by Dolatabadi et al.[19] Inclement weather does sometimes prohibit pregnant women from PA and exercise. In this case, indoor PA or exercise is a good alternative. A quasi-experimental study found mobile apps can be used to promote PA in pregnant women during the COVID-19 pandemic period.[46] Similarly, a mobile app-based intervention may also help encourage indoor PA and exercise for pregnant women affected by the weather. Moreover, it is also crucial to enhance the construction of public health facilities to encourage expectant women to increase their involvement in PA and exercise. Our study also found that multipara encounters more barriers to prenatal PA and exercise than primipara. This could be explained by multipara usually having additional responsibilities for looking after the children. They do not have much time or energy to devote to prenatal PA and exercise. On one hand, healthcare providers can teach pregnant women time management skills to use time better. On the other hand, family members should be encouraged to share the responsibility of child caregiving and other household issues to leave more time for pregnant women to do PA and exercise.

Consistent with studies conducted by Gong et al,[51] our study's total score of P-ESES was (38.50±7.33) at the upper-medium level. The results of our study also indicate that a more active pregnant woman's attitude towards exercise predicts better exercise self-efficacy and a higher education level predicts a more active pregnant woman's attitude towards exercise. Most participants in this study were urban residents with relatively high education levels, which may lead to their increased awareness of pregnancy-related knowledge and the importance of exercise, contributing to their relatively high exercise self-efficacy. Furthermore, overcoming emotional barriers was identified as the dimension with the lowest score, which can remind health professionals to pay attention to the negative emotions of pregnant women. The feelings of tiredness and depression were the prominent negative emotions influencing exercise self-efficacy in this study. A cohort study conducted in Australia reported that the exercise frequency of pregnant women with depression was lower compared to healthy pregnant women,[52] emphasizing the importance of emotion to exercise during pregnancy. As a result, healthcare providers must try to use various methods to improve pregnant women's negative emotions. Inviting pregnant women with similar experiences and benefits from prenatal exercise to share their experiences may increase their exercise self-efficacy and raise their involvement in prenatal exercise.

Implications for Practice and Research

Our study found that pregnant women lack exercise expertise and showed more physical inactivity than pre-pregnancy. Knowledge, Attitude, and Practices (KAP) theory points out that knowledge is the foundation of behavior change, and beliefs and attitudes drive behavior change.[53] In 2020, the World Health Organization (WHO) claimed that every move counts towards better health.[54] This is also applicable to pregnant women. Apart from exercise, other types of PA are also necessary for pregnant women. Therefore, pregnancy PA and exercise education need to be integrated into routine prenatal care to guide pregnant women about appropriate methods of PA and exercise during pregnancy.

Consistent with the Social Ecological Model of Behavior Change,[55] pregnant women face numerous intrapersonal, interpersonal, and environmental barriers. Regarding intrapersonal barriers, future studies should consider using motivational interviewing (MI) techniques, a participant-focused interview that attempts to empower a person by counseling for behavioral change,[56] to improve adherence to PA in pregnant women. Regarding interpersonal barriers, more studies can

explore how to engage partners, family members, or peers in prenatal PA interventions in pregnant women.[24,25] Regarding environmental barriers, future studies can look into using digital interventions (eg, smartphone apps) to promote PA in pregnant women. Furthermore, it would be beneficial to investigate intervention programs that incorporate behavior change techniques to enhance pregnant women's involvement in PA.

Multiparas face more significant barriers to PA and exercise. China has been implementing the "Three-child policy" as a proactive response to population aging since 2021. This means that the number of multiparas has probably increased recently. Therefore, healthcare professionals in mainland China must pay greater attention to the barriers to PA and exercise in multiparas. Further studies could use qualitative research methods to explore multiparas' experience with PA and exercise during pregnancy, the barriers they face, and their coping strategies to provide a basis for designing targeted intervention programs.

Limitations

Despite the meaningful contributions of our study, there are several limitations. First, this study only used self-reported questionnaires to identify barriers subject to bias and individual interpretation. Future research can make use of more objective measurement tools. Second, because of the cross-sectional nature of this study's design, it is impossible to infer the causes of the results from our data. Third, participants in this study came from third-tier Chinese mainland cities, so the findings may not apply to other regions. Future studies with multi-center and large samples are needed to further verify this study's results.

Conclusions

Pregnant women have a positive attitude toward exercise and a relatively high exercise self-efficacy but lack information on how to exercise. They also encounter many intrapersonal, interpersonal, and environmental barriers to PA and exercise. Medical staff should enhance the exercise attitude of pregnant women with lower education levels and help multiparas deal with barriers to PA and exercise. Interventions to promote PA and exercise during pregnancy are warranted.

Abbreviations

PA, physical activity; ACOG, the American College of Obstetricians and Gynecologists; BMI, body mass index; P-ESES, pregnancy exercise self-efficacy scale.

Ethics

This study follows the guidelines of the Declaration of Helsinki. Ethical approval was obtained from the School of Nursing Ethics Committee, Yangzhou University (Approval No. YZUHL2021009). All collected data from the participants were kept confidential and anonymous. Informed consent was obtained from each participant. Participants had the right to withdraw during the study without affecting their medical care.

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Author Contributions

All authors made a significant contribution to the work reported, whether in conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas, took part in drafting, revising, or critically reviewing the article, gave final approval to the version to be published, agreed on the journal to which the article has been submitted, and agree to be accountable for all aspects of the work.

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Disclosure

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