Babol university of Medical Sciences
Current Research in Medical Sciences
ISSN: 2538-6212
Student Research Committee
Current Research in Medical Sciences

Physical activity among healthy pregnant women and its association with socio-demographic, obstetric characteristics and quality of sleep: A cross-sectional study

Faezeh Habibnejad [1], Fatemeh Maleki [1], Fereshteh Behmanesh [2], Shabnam Omidvar [2*]

1. Student research committee, Babol University of Medical Sciences, Babol, Iran.
2. Social determinants of health research center, Health research institute, Babol University of Medical Sciences

Article Info

Article type:
Research Article

Received: 2 December 2022
Revised: 18 December 2022
Accepted: 22 December 2022

ABSTRACT

Background and Objective: Since it has been proven that physical activity (PA) during pregnancy plays an important role in pregnancy health and outcomes, identifying and understanding the physical activity level among pregnant women and associated factors such as socio-demographics, Obstetric characteristics are the first step in designing optimal interventions. The present study aimed to describe the prevalence of physical activity, also to identify the association of physical activity with demographic and obstetric characteristics as well as the quality of sleep.

Methods: A cross-sectional study was conducted on 220 pregnant women who were referred to health centers in Babol, Iran. Physical activity, socio-demographics, obstetric characteristics, and quality of sleep were measured by questionnaires. BMI was calculated by anthropometric measures.

Findings: Only one-sixth (16.9%) of the women in this study had physical activity as World Health Organization (WHO) recommended for pregnant women. There was no significant association between demographic characteristics and physical activity level during pregnancy. There also was no association between physical activity levels and sleep quality. However, there was a statistically significant relationship between maternal obstetrics characteristics such as gestational trimester, gravidity, and the number of children with physical activity levels ($P<0.05$).

Conclusion: Pregnant women have inactive lifestyles and most of the physical activities were done during the performance of household activities**.** Healthcare professionals and midwives should take action to encourage pregnant women to increase their physical activity levels during pregnancy.

Keywords: Characteristics; Physical activity; Pregnancy; Sleep; Socio-demographic

Cite this article: Habibnejad F, et al. Physical activity among healthy pregnant women and its association with socio-demographic, obstetric characteristics and quality of sleep: A cross-sectional study. *Current Research in Medical Sciences*. 2022; 6(2): 64-73.

Publisher: Babol University of Medical Sciences

***Corresponding Author:** Shabnam Omidvar
Address: Social determinants of health research center, Health research institute, Babol University of Medical Sciences, Babol, Iran
Tel: +989113253139 **E-mail:** shomidvar@yahoo.com

[DOI: 10.22088/crms.6.2.64]

Introduction

Expanding the level of physical activity, and diminishing time spent inactive is important for reaching public health goals (1). Physical activity helps to maintain or increase cardiovascular endurance, muscle strength, endurance, flexibility, coordination, and balance and reduces back pain (2, 3).The psychological benefits of physical activity include better control of temper and increased self-confidence, improved quality of sleep, and reduced stress in pregnancy (4, 5).

The American College of Obstetricians and Gynecologists (ACOG) has made recommendations and encourages all pregnant women to get 150 minutes of moderate-intensity exercise per week (6). The current guidelines for physical activity during pregnancy have been updated to be similar to those for the general population, but have been revised to minimize risk/injury to the mother and fetus and to maximize benefit (7, 8). Studies reported women tend to decrease physical activity during pregnancy (9, 10). Regardless of the many benefits, researches showed that one-fifth to one-third of pregnant women comply with physical activity guidelines (9, 11, 12).

Studies showed sleep disturbances have been associated with increased risk of adverse pregnancy outcomes,such as preterm delivery (13) ,emergency caesarean section (13, 14), depressive symptoms (15-17), gestational hypertension (14, 18) and glucose intolerance (19, 20) Based on these findings, the researchers believe that improved sleep could conceivably lead to better pregnancy outcomes. There are several cross-sectional studies that have examined the link between physical activity and sleep quality during pregnancy, and have shown ambiguous results. Baker et al. found that exercise in early pregnancy was correlated with continuity of sleep (21). Ölmez, however, found no significant difference in sleep quality between groups of pregnant women with different levels of exercise (22).

Differentiating and understanding socio-demographic, behavioral, and health correlated factors among particular populations could be the initial step in planning ideal interventions (23). First of all recognizing socio-demographic factors related to physical activity practices will offer assistance to design interventions for special populations. Furthermore, an understanding of the health determinants related to physical activity (PA) can identify particular considerations to promote PA safely and optimally in certain population groups. The combination of physical activity behavior and health determinants can also highlight unique interactions as common intervention goals, such as the interaction of obesity or pregnancy characteristics with PA and sedentary behavior (24).

Reports from Iran showed that the country is among the medium to high Insufficient Physical Activity (IPA) globally. A growing pattern of sedentary behavior and IPA has previously been reported in a variety of settings (25, 26), and given the disastrous economic burden of IPA on the health system (27), the prevalence of sedentary behaviors was higher amongst Iranian women. Moreover, the pattern of decreased physical activity is largely consistent with reproductive age. The present study aimed to describe the prevalence of physical activity and its domains in pregnant women and the relationship of physical activity to demographic and obstetric characteristics as well as to sleep quality.

Methods

Study setting

We employed the multistage sampling. Firstly, the city and village were considered as stratum (Stratified sampling) then the list of health centers of each stratum was obtained. Then the clusters were selected according to the number of health centers. Further, by convenience sampling method from each cluster, pregnant women who had inclusion criteria were invited to the study. The participants completed a written informed consent form. First, the Perceived Stress Scale (PSS) and Beck Depression Inventory Short form (BDI-S) were completed for them. Based on the scores of the questionnaires if they were

[DOI: 10.22088/crms.6.2.64]

identified as depressed or with severe anxiety, they were excluded from the study. Otherwise, they were asked to complete a demographic questionnaire, pregnancy physical activity (PPAQ), and Pittsburg Sleep Quality Index (PSQI). The study was conducted in Babol/Iran during 2019.

Instruments

1. Demographic characteristics questionnaire: consisting of age, occupation, education, and residence information, gestational age.
2. Physical Activity in Pregnancy Questionnaire (PPAQ): PPAQ is self-administered and lasts approximately 10 minutes. Average weekly energy expenditure (METhours/week) is calculated as the reported time spent on each activity multiplied by its intensity and added together to get the weekly score. This questionnaire consisted of questions that measure the level of physical activity in 4 different components, including Occupational (5 questions), Household/caregiving (16 questions), transportation (3 questions), Sports/exercise (8 questions) and a total of 32 questions were asked. Persian version of PPAQ validated by Kazemi et al[28] the intensity, type, frequency, and duration of physical activity was reported per day as minutes and hours. Each activity was classified according to the intensity in Metabolic Equivalent Task (MET): light (1.5–< 3.0 METs), moderate (≥ 3–< 6.0 METs), or vigorous (≥ 6.0 METs). The average number of MET-hr/week expended in each intensity level was calculated.
3. Pittsburgh Sleep Quality Index (PSQI): The Pittsburgh Questionnaire consists of 9 questions that assess the time of going to bed, the time of waking up, the amount of sleep per day, and other issues related to the pattern and mental quality of sleep. The spectrum of scores ranges from zero to three, so that more points are allocated for more unfavorable sleep situations. A score of 5 or higher indicates poor sleep quality. This questionnaire has been used in various studies in the country and its validity has been reviewed and confirmed [29]. In the study, the reliability of the questionnaire was estimated to be 0.79 using Cronbach's alpha [30].
4. Perceived Stress Scale (PSS): The 14 items of the Perceived Stress Scale (PSS) are used to determine the stress levels of participants in their lives [31]. Participants were asked to describe how often they faced stressful events in the past week. Responses were given on a 5-point Likert scale ranging from 0 (never) to 4 (very often) and the total score ranged from 0 to 56.
5. Beck Depression Inventory (BDI): The Beck Depression Inventory Short Version (BDI-S) consists of 13 items assessing the severity of depression symptoms. BDI-S total scores range from Zero to 39, using statements scored from 0 to 3. The questionnaire scoring was: normal (0–3); 4 - 7, mild depression; 8 - 11 mild to average depression; 12 to 15 moderate depressions; and 16 to 39 severe depressions. Psychometric properties of the Persian version have been reported in a previous study (32).

Inclusion criteria

Being pregnant, Being literate, gestational age 18 to 36 weeks, willing to participate in the study, filling out the informed consent form.

Exclusion criteria

Known sleep disorders before pregnancy (self-report), age under 18, having any chronic disease affecting sleep or physical activity such as thyroid disorders, known depression and having movement disorders due to disability, etc. Drug and alcohol abuse, the experience of an unfortunate accident during the last 6 months (such as loss of family members, etc.), and if they were known as depressed or anxious person.

[DOI: 10.22088/crms.6.2.64]

Sample Size

Sample size was determined by $n = \left(\frac{Z_{1-\alpha/2}+Z_{1-\beta}}{\frac{1}{2}\times\ln\left(\frac{1+r}{1-r}\right)}\right)^2 + 3$ based on the assumption of a 95% confidence interval with a margin of error of 5%, β at 0.20 and the expected correlation coefficient equal 0.20. In order to allow for missing and incomplete, the sample size was considered to be 220. After completing the data collection, all collected questionnaires were assessed for completeness, correctness. Then**,** data were entered, cleaned, and analyzed using SPSS Statistics version 25. Descriptive statistics were calculated using frequencies with percentages for categorical variables and median and associated ranges. Categorical data were analyzed using Chi-square and Fisher's test.

Results

Two hundred and twenty pregnant women participated in the study, but 13 were excluded from the study after filling out the Perceived stress scale (PSS) and Beck Depression Inventory (BDI). Therefore, 207 pregnant women were assessed. The participants in the study age ranged from 18 to 41 years and the mean age of pregnant women and their spouses were 28.7±5.6 and 33.1±5.1 years, respectively. Table 1 shows the socio-demographic characteristics of the participants according to their physical activity levels. In the present study, we found no significant association between demographic characteristics and the physical activity level during pregnancy. We also did not find an association between the level of physical activity and sleep quality as well as all sleep subscales. However, there was a statistically significant relationship between maternal obstetrics characteristics such as gestational trimester, gravidity, and the number of children with the level of physical activity (P <0.05), Table 2.

Table 1. Distribution of sociodemographic characteristics and sleep quality according to their physical activity level during pregnancy (n=207)

Variables		N(%)	Level of physical activity		Chi-square/Fisher P value
			Inactive	Active	
Age(years)	18-25	69(33.3)	53(30.8)	16(45.7)	0.193
	26-34	103(49.8)	90(52.3)	13(37.1)	
	35-41	35(16.9)	29(16.9)	6(17.2)	
Education level	Elementary	42(20.3)	34(19.8)	8(22.9)	0.179
	Diploma	96(46.4)	76(44.2)	20(57.1)	
	University	69(33.3)	62(36.0)	7(20.0)	
Occupation	Employee	9(4.4)	8(4.7)	1(2.9)	0.351
	Homemaker	191(93.2)	159(93.5)	32(91.4)	
	Freelancer jobs	5(2.4)	3(1.8)	2(5.7)	
Residency	Urban	99(47.8)	82(47.7)	17(48.6)	0.535
	Rural	108(52.2)	90(52.3)	18(51.4)	
Efficiency of income	Good enough	88(42.5)	72(41.9)	16(45.7)	0.901
	Moderate	105(50.7)	88(51.2)	17(48.6)	
	Not enough	14(6.8)	12(6.9)	2(5.7)	
BMI	<18.5	5(2.4)	4(2.4)	1(2.9)	0.268
	18.5-24.9	97(46.9)	81(47.1)	16(45.7)	
	25-29.9	73(35.3)	57(33.1)	16(45.7)	
	≥30	32(15.4)	30(17.4)	2(5.7)	
Quality of sleep	Good	100(48.3)	83(48.3)	17(48.6)	0.560
	Poor	107(51.7)	89(51.7)	18(51.4)	

[DOI: 10.22088/crms.6.2.64]

Table 2. Distribution of obstetric characteristics of women according to the level of physical activity during pregnancy

Variables	N	Level of physical activity		P value
		Inactive n(%)	Active n(%)	
Gestational trimester				
Second	86(41.5)	78(45.3)	8(22.9)	0.010*
Third	121(58.5)	94(54.7)	27(87.1)	
Gravidity				
1	69(33.5)	51(29.8)	18(51.4)	0.013*
≥2	137(66.5)	120(70.2)	17(48.6)	
Number of children				
0	75(36.2)	57(33.1)	18(51.4)	0.033*
≥1	132(63.8)	115(66.9)	17(48.6)	
History of stillbirth				
Yes	2(1.0)	2(1.2)	0(0.0)	0.690
No	205(99.0)	170(98.8)	35(100.0)	
History of abortion				
Yes	40(19.3)	136(79.1)	31(88.6)	0.143
No	167(70.7)	36(20.9)	4(11.4)	
Planned Pregnancy				
Yes	173(83.6)	142(82.6)	31(88.6)	0.274
No	34(16.4)	30(17.4)	4(11.4)	

*: <0.05

Table 3 exhibits the descriptive analysis of energy expenditure in MET per week as PPAQ developers recommended. It also shows the distribution of the level of intensity and types of activities. As the table shows, minimum, maximum, and median energy expenditure of total physical activity was 10.5, 243.2, and 68.2, respectively. The most noteworthy mean and median energy expenditure was found for light activities (33.7 and 28 MET-hour per week, respectively), while the least mean and median can be seen in vigorous activities. According to the type of physical activity, household/caregiving activity obtained the most energy expenditure. The least energy expenditure was obtained from sport/exercise. Among all the socio-demographic and maternal variables, only age, the number of children, and gravidity were associated with exercise practice during pregnancy. Interestingly, quality of sleep was associated with practice exercise during pregnancy (P<0.05).

Table 3. Energy expenditure as measured in MET h/week by total activity, intensity level and activity type

Activity	Min	Max	Mean	Percentile		
				25th	50th (median)	75th
Total activity	10.5	243.2	79.3	43.7	68.2	105
Intensity						
Sedentary	0	98	20.8	5.2	14	31.5
Light	1.75	108.5	33.7	17.5	28	47.2
Moderate	0	105	24.5	10.5	19.2	35
Vigorous	0	54.2	2.4	0	0	1.7
Type						
Household/caregiving	0	127.7	37	15.7	28	50.7
Occupational	0	84	2.6	0	0	0
Sport/exercise	0	78.7	8	0	1.7	10.5

[DOI: 10.22088/crms.6.2.64]

Table 4. Distribution of the variables associated with exercise during pregnancy (n=207)

Variables		N(%)	Exercise during pregnancy		P value
			No	Yes	
Age	18-25	69(33.3)	27(24.5)	42(43.3)	0.018
	26-34	103(49.8)	63(57.3)	40(41.2)	
	35-41	35(16.9)	20(18.2)	15(15.5)	
Number of children	0	75(36.2)	27(24.5)	48(49.5)	0.000
	≥1	132(63.8)	83(75.5)	49(50.5)	
Gravid	1	69(33.3)	26(23.6)	43(44.3)	0.001
	≥2	137(66.7)	83(76.4)	54(55.7)	
Quality of sleep	Good	100(48.3)	47(42.7)	53(54.6)	0.026
	Poor	107(51.7)	63(57.3)	44(45.4)	

Discussion

The present study aimed to assess physical activity levels and related factors during pregnancy. Total physical activity levels in the study were similar to other developing countries such as Ethiopia and Saudi Arabia (33, 34). Approximately one-sixth (16.9%) of the women in this study had physical activity as WHO recommended for pregnant women (≥150 min moderate-intensity exercise per week). Other studies also reported that between one-fifth or one-third of women during pregnancy meet physical activity recommendations (9, 11, 35, 36). In studies from Ethiopia and China (37), only 8.4 and 7.4% of the pregnant women meet the recommended international guidelines for physical activity during pregnancy, respectively. It shows physical activity among pregnant women from developing countries is significantly lower compared to similar studies conducted in other countries, such as the United States (77.5%) (38).The difference in the level of physical activity reported from different countries and cultures may be due to differences in the characteristics of the subjects, and instruments. The most common kind of activity performed by women in the present study was walking. The results are in accordance with other published research (39).

In the present study, obstetric characteristics including gestational trimester, gravidity, number of children showed a significant association with the physical activity of pregnant women. The results were in accordance with a recent study (40). We found an association between the number of children and being active physically. The finding was in accordance with several studies that showed women who had at least one child are more inactive during pregnancy (41, 42). However, there were studies that reported the opposite result (43, 44) others demonstrated no significant association between parity and physical activity during pregnancy (38, 45). On the other hand, the prevalence of participating in exercise was lower in multiparous women. The result was consistent with other studies (36, 44). The reason behind it could be lack of time and perception of no need for exercise as they have a load of household activities. We also found an association between gestational trimester and physical activity. It was in accordance with other studies (9, 36). However, Our results are consistent with previous study, which have shown that women in the third trimester are more likely to meet physical activity guidelines than women in the first trimester (46). While is inconsistent with a study from Poland (47), and South Africa (40) which found physical activity, to be higher in women in the first trimester than in the third trimester. However, no association was found between physical activity and demographic characteristics, which was similar to research conducted in Saudi Arabia (34).

We did not find an association between the physical activity level and quality of sleep, while in several studies a significant relationship was observed between physical activity in pregnancy and sleep quality (48, 49). It seems the risk factors of poor sleep quality among pregnant women are complex. For example, nausea, vomiting and nocturia during the first trimester, fetal movements, low back pain and

[DOI: 10.22088/crms.6.2.64]

some other psychological factors in the third trimester in pregnant women might affect sleep quality and lead to poor sleep quality in pregnant women (50). Recent studies demonstrated that psychological symptoms are a major predictor of poor sleep quality. Therefore, we assumed that the reason for the difference between our findings and other studies might be due to difference approach in our study. As we screened the participants for perceived stress as well as depressive symptoms before including them in the study, hence it seems what affects sleep most is the mental state of the person and not their level of physical activity. Although we did not find an association between physical activity and quality of sleep but the results comply that the prevalence of practicing exercise was significantly higher among good sleepers. However, we have not surveyed the intensity, duration, type, and chronotype of the exercises that they performed, which may play the role as confounders in the impact of exercise on sleep quality.

Limitations

First, it was a cross-sectional study, and the causality relationship cannot be defined clearly. In addition, PPAQ is a self-assessment tool, which may overestimate the time allotted to different activities, and may lead to recall bias.

Conclusion

This study identified that pregnant women have inactive lifestyles and most of the physical activities were done during the performance of household activities. It exhibited that parity, gestational age, and gravidity as related factors to physical activity levels, and indicated that there was no association between socio-demographic characteristics, except for age. Moreover, there was no association between quality of sleep and physical activity level. Although, practicing exercise was found to be associated with sleep quality.

Acknowledgement

The authors would like to thank the participants for contributing in the project. We appreciate student research committee and Health Research Center of Babol University of Medical Sciences for approving the study.

Competing Interests

None.

References

1. Sallis, J.F, N. Owen, and M.J. Fotheringham. Behavioral epidemiology: a systematic framework to classify phases of research on health promotion and disease prevention. Ann Behav Med, 2000. 22(4): 294-298.
2. Price B, S. Amini, and K. Kappeler. Exercise in pregnancy effect on fitness and obstetric outcomes. Aust Fam Physician, 2014. 43. 541-542.
3. Artal, R., The role of exercise in reducing the risks of gestational diabetes mellitus in obese women. BEST PRACT RES CL OB, 2015. 29(1). 123-132.
4. Piercy K.L, Troiano R.P., Ballard R. M, Carlson S. A, Fulton J. E., Galuska D. A. et al., JAMA, 2018. 320(19). 2020-2028.
5. Sinclair, I, St-Pierre M, Elgbeili G, Bernard P, Vaillancourt, C. Gagnon S, et al., Psychosocial stress, sedentary behavior, and physical activity during pregnancy among Canadian women: Relationships in a diverse cohort and a nationwide sample. Int J Environ Res Public Health, 2019. 16(24). 5150.

[DOI: 10.22088/crms.6.2.64]

6. American College of Obstetricians and Gynecologists. ACOG Committee Opinion No. 650: 126, Physical activity and exercise during pregnancy and the postpartum period. Obstet. Gynecol.2015. e135-e142.
7. World Health Organization (WHO). [(accessed on 17 November 2021)]; Available online: www.who.int.
8. Coupon JU. Physical activity and exercise during pregnancy and the postpartum period. Celebration of Wellness. 2020(29).
9. Downs, D.S, Devlin C.A, and. Rhodes R.E, The power of believing: Salient belief predictors of exercise behavior in normal weight, overweight, and obese pregnant women. J Phys Act Health 2015. 12(8). 1168-1176.
10. Pereira M. A, Rifas-Shiman S. L, Kleinman, K. P, Rich-Edwards J. W, Peterson K. E and Gillman M. W . Predictors of change in physical activity during and after pregnancy: Project Viva. Am J Prev Med, 2007. 32(4): 312-319.
11. Perales M, Santos-Lozano A, Ruiz J. R, Lucia A and Barakat R . Benefits of aerobic or resistance training during pregnancy on maternal health and perinatal outcomes: A systematic review. Early Hum.Dev, 2016. 94. 43-48.
12. Todorovic J, Terzic-Supic Z, Bjegovic-Mikanovic V, Piperac P, Dugalic S, Gojnic-Dugalic M.Factors associated with the leisure-time physical activity (LTPA) during the first trimester of the pregnancy: The cross-sectional study among pregnant women in Serbia Int. J Environ Res Public Health , 2020. 17(4). 1366.
13. Li R, Zhang J, Zhou R, Liu J, Dai Z, Liu D, et al., Sleep disturbances during pregnancy are associated with cesarean delivery and preterm birth. J. Mater.Fetal Neonatal Med, 2017. 30(6). 733-738.
14. Sharma S, Nehra A, Sinha S, Soneja M, Sunesh K, Sreenivas V, et al. Sleep disorders in pregnancy and their association with pregnancy outcomes: a prospective observational study. Sleep Breath, 2016. 20(1). 87-93.
15. Gonzalez-Mesa E, Cuenca-Marin C, Suarez-Arana M, Tripiana-Serrano B, Ibrahim-Diez N, Gonzalez-Cazorla A, et al. Poor sleep quality is associated with perinatal depression. A systematic review of last decade scientific literature and meta-analysis. J Perinat Med, 2019. 47(7). 689-703.
16. Gao M, Hu J, Yang, L, Ding N, Wei X, Li L, et al. Association of sleep quality during pregnancy with stress and depression: a prospective birth cohort study in China. BMC pregnancy and childbirth, 2019. 19(1). 1-8.
17. Yu Y, Li M, Pu L, Wang S, Wu J, Ruan L, et al., Sleep was associated with depression and anxiety status during pregnancy: a prospective longitudinal study. Archives of women's mental health, 2017. 20(5). 695-701.
18. Pengo M.F, Rossi G.P, Steier J, Obstructive sleep apnea, gestational hypertension and preeclampsia: a review of the literature. Curr Opin Pulm Med, 2014. 20(6). 588-594.
19. Facco F. L, Grobman W. A, Reid K. J, Parker C. B, Hunter S. M, Silver R. M, et al., Objectively measured short sleep duration and later sleep midpoint in pregnancy are associated with a higher risk of gestational diabetes. AJOG, 2017. 217(4). 447. e1-447. e13.
20. Zhong C, Chen R, Zhou X, Xu S, Li Q, Cui W, et al. Poor sleep during early pregnancy increases subsequent risk of gestational diabetes mellitus. Sleep Med, 2018. 46. 20-25.
21. Baker J.H, Rothenberger S. D, Kline C. E, Okun M. L. Exercise during early pregnancy is associated with greater sleep continuity. Behav Sleep Med, 2018. 16(5). 482-493.
22. Ölmez, S., Keten H. S, Kardaş S, Avcı F, Dalgacı A. F, Serin S etal. Factors affecting general sleep pattern and quality of sleep in pregnant women. Turk J Obstet Gynecol, 2015. 12(1). 1.
23. Bauman A.E, Reis R. S, Sallis J. F, Wells J. C, Loos R. J, Martin B. W. et al. Correlates of physical activity: why are some people physically active and others not? Lancet, 2012. 380(9838). 258-271.
24. Charansonney, O.L, Després J.-P, Disease prevention—should we target obesity or sedentary lifestyle? Nat Rev Cardiol, 2010. 7(8). 468-472.
25. Guthold R, Stevens G. A, Riley L. M, Bull F.C. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1• 9 million participants. Lancet Glob. Health, 2018. 6(10). e1077-e1086.

[DOI: 10.22088/crms.6.2.64]

26. Koohpayehzadeh J, Etemad K, Abbasi M, Meysamie A, Sheikhbahaei S, Asgari F, et al. Gender-specific changes in physical activity pattern in Iran: national surveillance of risk factors of non-communicable diseases (2007–2011). Int J Public Health, 2014. 59(2). 231-241.
27. Ding D, Lawson K. D, Kolbe-Alexander T. L, Finkelstein E. A, Alexander P. T, Finkelstein E. A, Katzmarzyk P. T, Van Mechelen W et al. The economic burden of physical inactivity: a global analysis of major non-communicable diseases. Lancet, 2016. 388(10051):1311-1324.
28. Kazemi A.F, Hajian S, and. Sharifi N, The Psychometric Properties of the Persian Version of the Pregnancy Physical Activity Questionnaire. Int J Women's Health, 2019. 7(1). 54-60.
29. Goreyshi S.A.A, Aghajani A. Sleep quality in Zanjan university medical students. Tehran Univ Med J 2008;66(1). 61-67.
30. Manavipour D, Psychometric properties of the sleep questionnaire. Neurosci. J. Shefaye Khatam, 2015. 3(3). 16-20.
31. Cohen, S, Kamarck T, Mermelstein R, A global measure of perceived stress. JHSB, 1983. 385-396.
32. Rajabi G.R, Psychometric properties of Beck depression inventory short form items (BDI-13). Iran J Psychiatry, 2005. 1(4). 291-8.
33. Hailemariam, T.T., Gebregiorgis Y. S, Gebremeskel B. F, Haile T. G, Spitznagel T. M. Physical activity and associated factors among pregnant women in Ethiopia: facility-based cross-sectional study. BMC pregnancy and childbirth, 2020. 20(1). 1-11.
34. Aljehani, M.A, Alghamdi L. F, Almehwari O. B, M. Hassan A.-H. Exercise among pregnant females in maternity and children hospital in Jeddah, Saudi Arabia, 2019: Prevalence and barriers. Fam Med Prim, 2021. 10(6). 2394.
35. Baena-García L, Ocón-Hernández O, Acosta-Manzano P, Coll-Risco I, Borges-Cosic M, Romero-Gallardo L, et al., Association of sedentary time and physical activity during pregnancy with maternal and neonatal birth outcomes. The GESTAFIT Project. Scand J Med Sci Sports, 2019. 29(3). 407-414.
36. Nascimento S.L, Surita F. G, Godoy A. C, Kasawara K. T, Morais S. S. Physical activity patterns and factors related to exercise during pregnancy: a cross sectional study. PloS one, 2015. 10(6). e0128953.
37. Yin Y.-N, Huang Y, Liu X.-H, Luo B.-R. Assessment of physical activity status among pregnant women in southwestern China. Front. Nurs., 2019. 6(2). 135-141.
38. Evenson K.R, Savitz A, and. Huston S.L, Leisure-time physical activity among pregnant women in the US. Paediatr. Perinat Epidemiol, 2004. 18(6). 400-407.
39. Connolly C.P, Conger S. A, Montoye A. H, Marshall M. R, Schlaff R. A, Badon S. E, et al. Walking for health during pregnancy: a literature review and considerations for future research. JSHS, 2019. 8(5). 401-411.
40. Okafor U.B, Goon D.T. Physical Activity Level during Pregnancy in South Africa: A Facility-Based Cross-Sectional Study. IJERPH, 2020. 17(21). 7928.
41. Davenport M.H , Meah V. L, Ruchat S.-M, Davies G. A, Skow R. J, Barrowman N, et al., Impact of prenatal exercise on neonatal and childhood outcomes: a systematic review and meta-analysis. BJSM, 2018. 52(21). 1386-1396.
42. Gaston A, Cramp A. Exercise during pregnancy: a review of patterns and determinants. J Sci Med Sport, 2011. 14(4). 299-305.
43. Watson P.E, McDonald B.W, Activity levels in pregnant New Zealand women: relationship with socioeconomic factors, well-being, anthropometric measures, and birth outcome. Appl Physiol Nutr Metab, 2007. 32(4). 733-742.
44. Kikuchi-Noguchi H, Shiraishi M, Matsuzaki M, Haruna M. Physical activity levels in the second trimester of pregnancy and related demographic factors: A cross-sectional secondary data analysis. Cogent Medicine, 2019. 6(1). 1704607.
45. Chasan-Taber, L, Schmidt M. D, Pekow P, Sternfeld B, Manson J, Markenson G. Correlates of physical activity in pregnancy among Latina women. JMCH, 2007. 11(4). 353-363.

[DOI: 10.22088/crms.6.2.64]

46. da Silva, S.G, Ricardo L. I, Evenson K. R, Hallal P. C. Leisure-time physical activity in pregnancy and maternal-child health: a systematic review and meta-analysis of randomized controlled trials and cohort studies. Int J Sport Med, 2017. 47(2). 295-317.
47. Antosiak-Cyrak K.Z, Demuth A. A study of physical activity levels of pregnant women using the Polish version of Pregnancy Physical Activity Questionnaire (PPAQ-Pl). Ginekol. POL, 2019. 90(5). 250-255.
48. Tan, L, Zou J, Zhang Y, Yang Q, Shi H., A longitudinal study of physical activity to improve sleep quality during pregnancy. Nat Sci Sleep, 2020. 12. 431.
49. Nodine, P.M, Leiferman J. A, Cook P. F, Matthews E, Tolsma M. The impact of physical activity on sleep during pregnancy: A secondary analysis. Clinics Mother Child Health, 2016. 13. 245.
50. Sedov I.D, Cameron E. E, Madigan S, Tomfohr -Madsen L. M. Sleep quality during pregnancy: a meta-analysis. Sleep Med Rev, 2018. 38. 168-176.

[DOI: 10.22088/crms.6.2.64]