

Physical activities patterns among Indonesian pregnant women: a cross-sectional study

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ABSTRACT

Many evidence revealed that physical activity (PA) has positive effects on pregnancy outcomes. Healthy pregnant women are suggested to have a combination of PA in light to moderate-intensity activities for 150 minutes per week. The purpose of this study was to analyze the type, the intensity of PA of pregnant women, and the average energy expenditure per week. A cross-sectional study involving 110 pregnant women who came from four community health centers in Bandung city, Indonesia was carried out from April to June 2021. The pregnancy physical activity questionnaire (PPAQ) was used to collect data. Descriptive data were presented using median and percentile. Mann-Whitney and Kruskal Wallis test were used to statistical test. The results of the study where the median energy expenditure per week was 250.50 METs. Most of the PA was light-intensity activities and household/child caring activities. There were still 10% pregnant women who did not exercise. Employed pregnant women had energy expenditure per week higher compared to unemployed pregnant women. Sports/exercise activities were seldom been carried out. This study demonstrated that during pandemic COVID-19, pregnant women are still doing PA. During pandemic COVID-19, health care providers should motivate healthy pregnant women to exercise by creating innovations using social media or online platforms so that pregnant women can exercise at home safely.

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1. INTRODUCTION

Pregnancy is a unique period that can be experienced by a woman. Hormonal, physiological, and biomechanical changes make most pregnant women difficult to move and reluctant to do physical activity (PA) [1], [2]. Adequate PA during pregnancy has positive effects both for the pregnant woman and the fetus [3], [4]. Pregnant women without complications who regularly exercise may have many benefits to their physical and psychological health. Many reports stated that regular PA/exercise may prevent musculoskeletal low back pain, reduce excessive maternal weight gain, prevent gestational diabetes mellitus and hypertensive disorders of pregnancy, and prevent depression in the postpartum period [5]–[8]. Moreover, it may decrease the incidence of cesarean births that make in the increase of vaginal delivery [7]–[9]. Moderate amounts of PA were related to the increase in birth weight. On the contrary, both low and high amounts of PA were associated with birth weight decrease [5].

The metabolism during pregnancy changes. It designs to achieve both the mother and fetus's metabolic demands [4]. Some evidence discovered that substrate needed by the fetus to develop is fulfilled during maternal PA, but in the presence of adequate nutrition [4]. Regular exercise, especially during the second half of pregnancy increases endothelial nitric oxide synthase (e NOS) expression, nitric oxide (NO) production, and decreases reactive oxygen species generation in the mitochondrial respiratory chain in placental mitochondria [10]. A systematic review revealed that regular exercise affects the placental components such as placental weight, inter villous space, villous volume, villous vascular volume, and stem villi although further studies should be carried out with better samples and good quality methodology [11]. Hence, It clarifies the positive effects of exercise on human placental related to improving fetal oxygenation [11].

World Health Organization (WHO) stated that PA is defined as any bodily movement produced by skeletal muscles that require energy expenditure [12]. This definition can be used for pregnant women as well, since there is no specific definition of PA for pregnant women [7]. The PA domain generally includes leisure, occupational, domestic/household activities, and transportation [12]. The Asia-Pacific consensus on PA and exercise in pregnancy and the postpartum period stated that PA during pregnancy is beneficial and safe for pregnant women without complications or contraindications [7]. The absolute contraindications to PA with the potentially harmful effects for mothers and/or fetuses include severe respiratory diseases, severe acquired or congenital heart disease with exercise intolerance, uncontrolled or severe arrhythmia, placenta abruption, vasa previa, uncontrolled type 1 diabetes, intrauterine growth restriction, active preterm labor, severe preeclampsia, and cervical insufficiency [7], [8]. Therefore, pregnant women who have certain medical problems must be accessed by various pre-exercise screening tools early before commencing PA which can help their healthcare providers to decide whether this pregnant woman can exercise safely [3], [7], [8].

The compliance of pregnant women doing PA varied. A study conducted in Saudi Arabia discovered that from 300 pregnant women, 65.3% of pregnant women were not exercising during pregnancy [13]. Other studies of 1,179 Chinese pregnant women revealed 92.60% were classified as an inactive lifestyle [6]. The PA decreased from the first to the second trimester and the first to the third trimester of the pregnancy [14].

PA assessment has been carried out widely in the world to measure the energy expenditure daily and weekly of pregnant women. The assessment can be objective by observation in the field, pedometry, accelerometry, and subjective by using a self-administered questionnaire [15]–[17]. Pregnancy physical activity questionnaire (PPAQ) was developed by Chasan-Taber *et al.* and was published in 2004 [18]. This instrument consists of 33 questions self-administered questionnaire of a comprehensive four domains PA assessment (household and caregiving, transportation, occupation, and sports/exercise). It measures the frequency and the duration of the activities which an intensity value is assigned to each activity. The activities can be analyzed for the total energy expenditure per week, by the intensity of PA, and by type of PA [18]. This study was conducted to analyze the energy expenditure per week, the intensity, and the type of PA in pregnant women during pandemic COVID-19 in Indonesia using PPAQ.

2. RESEARCH METHOD

A cross-sectional study was carried out on pregnant women who routinely came to a community health center for antenatal check-ups. Bandung city is divided into four zones (North, West, East, and South) and from each zone, one community health center was selected randomly using a computer. The study was conducted from April to June 2021 and was approved by the research ethics committee, Universitas Padjadjaran, Indonesia (No: 201/UN6.KEP/EC/2021). The sample size was counted by the descriptive categorical formula with expected for a proportion (p) of 50%, $\alpha=0.05$, and precision (d) of 10%. A total of a hundred and ten pregnant women were recruited by consecutive sampling and fulfilled the inclusion criteria: between 16 and 40 years old, gestational age in the I, II, or III trimesters, second pregnancy or more, and have a baby who was more than six months old and or a living child under five years old, had no contraindications to PA such as diabetes mellitus; hypertension; heart, lung, kidney, and other chronic diseases that require continuous treatment; did not have obstetric complications such as premature rupture of membranes (PROM), preeclampsia/eclampsia, antepartum bleeding, placenta previa, vasa previa, placental abruption, multiple pregnancies, and intrauterine growth restriction (IUGR). Those contraindications and complications were determined by the midwives that worked at the selected community health centers.

Subjective measurement of PA at pregnant women used the self-reported PPAQ that developed by Chasan-Taber *et al.* [18]. The PPAQ consists of 36 questions whereas 33 questions are questions on activities carried out by pregnant women which include sedentary/inactivities (3 activities), household/caregiving (13 activities), occupation activities (5 activities), and sports (9 activities). Each question has its calculated value to see the average energy expenditure per week (MET-hours/week-1) caused by each activity by multiplying

the duration of time spent in each activity by its intensity and summed to derive the weekly score. From the calculations, the average intensities were grouped into 4 categories: sedentary activity (<1.5 METs), light-intensity activity (1.5 to <3.0 METs), moderate-intensity activity (≥ 3.0 to ≤ 6.0 METs), and vigorous-intensity activity (>6.0 METs) [6], [18]. Moreover, it was classified into household/caregiving activity, occupational activity, transportation, and sports/exercise [18]. The PPAQ has been translated to *Bahasa* Indonesian by Felyanti [19]. Before collecting data for this study, the Indonesian version of the PPAQ was tested its reliability and validity. A total of 30 pregnant women were recruited consecutively from one community health center out of the chosen community health centers. The reliability and validity of the PPAQ were tested using Rasch modeling [20]. The test revealed that the questionnaire was reliable and valid. Person reliability value was 0.82, item reliability value was 0.85, and cronbach's alpha value was 0.85. Moreover, raw variance explained by measure was 34.1% and raw variance value unexplained by measure did not exceed 15%.

Characteristic variables such as age, education level, occupation, gestational age, and parity were also collected. Age was divided into 19-29 years old and 30-40 years old. Education level consisted of below or equal to junior high school, senior high school, and under/postgraduate. Occupation consisted of "no" and "yes". Gestational age was divided into the first, second and third trimesters. Parity consisted of one, two, and \geq three parity. Statistical tests and analyses were conducted with IBM SPSS software version 21.0. The characteristic variables (age, education level, occupation, gestational age, and parity) were calculated to describe the frequency and percentage of each variable. Duration of activities was calculated as follows:[18]

- 1) Questions number 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 20, 21, and 22 the following duration scores correspond to the duration categories: 0, 0.25, 0.75, 1.5, 2.5, and 3.0. Multiply values by seven days per week.
- 2) Questions number 12, 13, 32, 33, 34, 35, and 36 the following duration scores correspond to the duration categories: 0, 0.25, 1.25, 3.0, 5.0, and 6.0. Multiply values by seven days per week.
- 3) Questions number 17, 18, 19, 23, 24, 25, 26, 27, 28, 29, 30, and 31 the following duration scores correspond to the duration categories 0, 0.25, 0.75, 1.5, 2.5, and 3.0. These values are already in weekly form.

The value of intensity field-based measurements in pregnant women is used to represent activity intensity for walking and light to moderate-intensity household tasks [18] and also based on compendium-based MET values [21]. The duration of time spent in each activity is multiplied by its intensity to arrive at the average energy expenditure per week (MET-hours/week) [18]. Based on the calculations, the average weekly energy expenditure was attributed into [18]:

- 1) Total activity=sum of (duration*intensity) for questions from number 4 to number 36.
- 2) Sedentary activity=sum of (duration*intensity) for questions number 11, 12, 13, 22, and 32.
- 3) Light-intensity activity=sum of (duration*intensity) for questions number 4, 5, 7, 15, 16, 17, 18, 20, 34, and question number 30 and 31 if open-ended activities are <2.9 METs.
- 4) Moderate-intensity activity=sum of (duration*intensity) for questions number 6, 8, 9, 10, 14, 19, 21, 23, 24, 27, 28, 29, 33, 35, 36, and question number 30 and number 31 if open-ended activities are >3.0 and <6.0 METs.
- 5) Vigorous-intensity activity=sum of (duration*intensity) for questions number 25, 26, and question number 30 and 31 if open-ended activities are >6.0 METs.
- 6) Household/caregiving activity=sum of (duration*intensity) from questions number 4 to 10 and from questions 15 to number 19.
- 7) Occupational activity=sum of (duration*intensity) from questions number 32 to number 36.
- 8) Transportation=sum of (duration*intensity) from questions number 20 to number 22.
- 9) Sports/exercise=sum of (duration*intensity) from questions number 23 to number 31.

The result of the METs calculation was tested using the Kolmogorov-Smirnov test to identify if the data were normally distributed or not. The test result showed that the data were not normally distributed making the presentation of data in this study use the median value and percentile. Data were analyzed statistically by Mann-Whitney and Kruskal-Wallis test to compare mean within the groups based on demographic and obstetric characteristics.

3. RESULTS AND DISCUSSION

One hundred and ten women participated in this study, with a mean age of 29.35 ± 5.12 years old. Almost sixty percent of the participants were aged between 19-29 years old. The youngest pregnant woman

was 19 years old and the oldest one was 39 years old. Regarding education, more than seventy percent of participants had education above or equal to secondary education, only 27.3% had low education. Most of them were housewives, only 31.8% had an occupation, among others as an employee in a private business, and a teacher. The majority of the participants were pregnant with their second child and were in their third trimester of pregnancy. The demographic and obstetric characteristics were presented in Table 1.

Table 1. Demographic and obstetric characteristics of the study population

Demographic characteristics	Obstetric characteristics (n=110)						
	Parity			Total	Gestational age		
	One	Two	≥Three		First trimester	Second trimester	Third trimester
Age (years)							
Mean (SD)=29.35 (5.12)							
19-29	56	5	0	61	9	17	35
30-40	19	22	8	49	6	15	28
Total	75	27	8	110	15	32	63
Education							
Below or equal to Junior high school	22	5	3	30	2	10	18
Senior high school	38	19	3	60	8	19	33
Under/Postgraduate	15	3	2	20	5	3	12
Total	75	27	8	110	15	32	63
Occupation							
Unemployed	53	17	5	75	9	23	43
Employed	22	10	3	35	6	9	20
Total	75	27	8	110	15	32	63

Notes: SD=Standard deviation

According to the PPAQ questionnaire, the form of PA in pregnancy were slow walking, fast walking, hiking, jogging, pregnancy gymnastic class, swimming, dancing, and others. This study revealed that most of the pregnant women did slow walking as the main PA weekly. Almost half of the respondents did fast walking and the rest of the form of PA was carried out below 40% as shown in Table 2. Walking is the most common form of PA during pregnancy [22], [23]. Some scientific studies revealed that walking during pregnancy have strong benefits both for the maternal and fetal health [5]–[9], [24]. Walking is easy to be carried out by pregnant women and is part of their daily activities. Walking can be done anywhere and anytime, such as household activities, going to work, recreation activities, going to the market, and taking care of children. Furthermore, walking can be done by every family member without having to spend money or using specific tools for exercise [22]. Surprisingly, the pregnancy gymnastic class that was one of the routine programs was carried out very low. A study revealed that they had low motivation in doing pregnancy exercise. They came to the place where the pregnancy gymnastic class was carried out if there were blood test examinations during the class [25]. The benefits of the pregnancy gymnastics if was done routinely two times a week for 30 minutes, were increase enzymatic antioxidants that could reduce oxidative damage, strengthen the muscles, and reduce pain so that the labor process can be delivered smoothly [9], [26], [27]. American college of obstetricians and gynecologists, PA in pregnancy is safe, in the absence of obstetric or medical complications or contraindications, Various PAs can be carried out safely, such as walking, stationary cycling, aerobic exercises, dancing, resistance exercises (using body weights or elastic bands), stretching exercises, and water aerobics [26].

This study also revealed that not all pregnant women did exercise during their pregnancy and the average energy expenditure per week that came from exercise/sports was very low compared to other activities. This study discovered that some pregnant women did not exercise or do recreation activities (10%). However, most of them did various forms of exercise or recreation weekly as shown in Table 3. Some studies revealed that there were barriers to exercise in pregnancy. There are multifactor contributed to low PA among pregnant women, among others the demographic factors (age, education, income, and parity) that are difficult to modify [28]. A literature review revealed that there were 3 major factors related to low participation of PA during pregnancy. Those factors were intrapersonal, interpersonal, and environmental factors. The intrapersonal factors were: i) pregnancy-related symptoms and limitations, ii) time constraints, iii) perceptions of already being active, iv) lack of motivation, and v) mother-child safety concerns. The interpersonal factors were; i) lack of advice and information and ii) lack of social support. The environmental factors were; i) adverse weather and ii) lack of resources [28]–[31]. PA tends to decrease in frequency and intensity during pregnancy compared to pre-pregnancy [14]. Other studies discovered that participation in pa was related to gestational age. in the first trimester, the pregnant women often nauseated and felt fatigue which hindered them to engage with PA [30], [32]. As soon as they felt better, they tend to participate in various PAs. Especially in the third trimester, their body shape and size changes decreased their mobility and

increased their risk of falling awareness [32]. This study was carried out during the COVID-19 pandemic. There were some restrictions to go outside to prevent the spreading of the disease, especially for pregnant women, and gymnastics classes were closed. The median level of total physical activity 250.50 MET-h/week with light-intensity activity was the most contributed to the weekly energy expenditure. Moreover, household and or caregiving activities were the most contributed to the weekly energy expenditure as shown in Table 4.

Table 2. Distribution of exercise or recreation forms using PPAQ among respondents

Exercise or recreation activities (n=110)	Yes n (%)	No n (%)
Slow walking	89 (80.9)	21 (19.1)
Fast walking	50 (45.5)	60 (54.5)
Hiking	21 (19.1)	89 (80.9)
Jogging	44 (40)	66 (60)
Pregnancy gymnastic	29 (26.4)	81 (73.6)
Swimming	29 (26.4)	81 (73.6)
Dancing	24 (21.8)	86 (78.2)

Table 3. Various forms of exercise or recreation per week using PPAQ among respondents

Form of exercise or recreation activities per week (n=110)	n (%)
Never	11 (10.0)
Only one form	25 (22.7)
Two forms	21 (19.1)
Three forms	21 (19.1)
Four forms	15 (13.6)
Five forms	9 (8.2)
Six forms	2 (1.8)
Seven forms	6 (5.5)

Table 4. Intensity and type of PA per week using PPAQ among respondents

Activities	Min	25 th	Median	75 th	Max
Intensity (MET-h-week ⁻¹)					
Total activities	59.70	166.39	250.50	340.01	663.05
Sedentary	1.75	18.38	36.40	72.06	160.65
Light-activity	22.85	81.33	110.60	174.87	301.70
Moderate-activity	.00	39.65	81.19	138.82	334.35
Vigorous-activity	.00	.00	.00	5.25	28.50
Type (MET-h-week ⁻¹)					
Household/Caregiving activities	28.35	106.91	161.35	219.32	459.20
Occupational activities	.00	.00	.00	51.32	262.50
Transportation activities	.00	4.38	15.75	41.35	136.50
Sports/Exercise	.00	2.40	8.70	15.24	70.18

Notes: PPAQ=Pregnancy physical activity questionnaire, MET-h week⁻¹=average energy expenditure per week, Min=minimum; 25th-25th percentile, 75th-75th percentile, and Max=maximum

The total energy expenditure per week in this study was higher compared to several countries such as Japan [5], China [6], Brazil [22], and Spain [23], however light activities contributed more than 50% energy expenditure per week similar to those countries [5], [6], [23]. Every country has its standard PA for pregnancy [3], [26]. Overall, many countries suggested that pregnant women without contraindications should have PA in moderate-intensity activities and avoid vigorous-intensity activities [3], [26]. A report by Hinman *et al.* stated that moderate and high-intensity exercise in normal pregnancies is safe for the development of the fetus and has many benefits, but should be implemented according to the PA level before pregnancy [8]. According to the Indonesian standard PA for pregnancy, published by the Ministry of Health, every pregnant woman without complications or contraindications should enter for PA with light to moderate intensity activities with a pulse between 100-140 beats per minute [27]. The PA should be a combination of aerobic exercise and resistance muscle training [3], [26], [27].

However, each trimester has its own goal and intensity. The goal during the first trimester is to maintain or increase the endurance of the heart and lungs. The PA is carried out three times a week in the form of walking, static bicycles, aerobic exercise with light intensity for 10-20 minutes. The Kegel exercise is carried out five times a week. During the second trimester, the purpose of exercise is not only to maintain or increase the endurance of the heart and lungs, but increase the strength of the abdomen, pelvic floor, and legs muscles as well. The PA is carried out the same as in the first trimester and is added with muscle strength in the form of pregnancy gymnastics two times a week. The Kegel exercise is still done five times a

week. The third trimester is to increase the strength of the respiratory, back, and pelvic floor muscles. Physical activity (PA) in the form of walking with a light intensity of 10-20 minutes three times a week. Pregnancy gymnastics and the kegel exercise are still carried out as in the second trimester [27].

Household activities were the main PA. This finding is similar with studies in Japan, Portugal, and Spain [5], [14], [22], [23]. On the contrary, a study in China revealed otherwise. The source of the main energy expenditure per week came from occupational activities. This was mainly due to the “one-child” regulation, the pregnant women were rarely involved in household/caregiving activities and most of the respondents were employed [6]. Regarding sports/exercise, this study discovered that pregnant women spent very little time on it. This situation also happened in Japan, China, Portugal, Spain, and Brazil [5], [6], [14], [22], [23].

Demographic factors can act as a predictor or barrier factors to participate in PA, hence they are difficult to modify [28]. By demographic characteristics, there was no difference in the intensity of PA except for education and occupation status. Undergraduate/postgraduate pregnant women had energy expenditure per week from sedentary activities higher compared to below undergraduate pregnant women. There was a difference in the intensity in the PA between employed and unemployed pregnant women. More than 75% of unemployed pregnant women had median energy expenditure per week that were lower than the employed pregnant women. This study revealed that there were differences in occupational, transportation, and sports/exercise activities related to educational status. Moreover, there were differences in occupational, and transportation activities related to occupation status. Many studies discovered various results. A literature review discovered that greater education was a significant predictor of greater exercise participation [30], [33]. On the contrary, there was no association between education and exercise [30]. The relationship between exercise and employment was measured. A study discovered that unemployed pregnant women were more likely to exercise in comparison with employed women [30], however another study found professional women were twice as likely to engage in aerobic exercise compared to unemployed women [30]. This finding is similar with a study in Japan that working led to higher PA [5]. Detailed results of intensity and type of PA according to demographic characteristics were presented Table 5 (see in Appendix).

This study also measured the average energy expenditure per week related to obstetric status. This study revealed that there was no difference in average energy expenditure per week of the total activities, intensity, type of PA among parity and gestational age, and except the vigorous-intensity activity regarding gestational age. In the first and third trimesters, the vigorous-intensity activity tended to be lower than in the second trimester. This study also discovered that pregnant women who were in their first and third trimesters had lower median energy expenditure per week compared to the second trimester that came from sports/exercise activities Table 6 (see in Appendix). This study discovered that obstetrical status did not influence the intensity and the type of PA. This is in contrast to a study in Portugal which found that there was a decrease in values of the energy expenditure per week from the first trimester to the second trimester of pregnancy and from the first trimester to the third trimester of pregnancy [14].

The findings of this study presented some limitations. The study was conducted during pandemic COVID-19 in Indonesia. There were some restrictions for pregnant women to go outside, and the pregnancy gymnastic classes were closed. A self-administered questionnaire to measure the energy expenditure per week may lead to misclassification possibility. Another limitation, this study was a cross-sectional study. It cannot analyze the behavior changes in PA during pregnancy, although allows researchers to gather information about PA by different characteristics in a short period of time.

4. CONCLUSION

Being physically active during a normal pregnancy is safe and has many potential benefits. During pandemic COVID-19, health care providers should motivate healthy pregnant women to exercise light to moderate-intensity activities according to the woman’s preconception of PA level. These activities can be done by creating innovations using social media or online platforms so that pregnant women can exercise at home safely.

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REFERENCES

- [1] L. Stefani, G. Mascherini, and G. Galanti, "Indications to promote physical activity during pregnancy," *Journal of Functional Morphology and Kinesiology*, vol. 2, no. 3, p. 31, Aug. 2017, doi: 10.3390/jfkm2030031.
- [2] L. Dipietro *et al.*, "Benefits of physical activity during pregnancy and postpartum: An umbrella review," *Physiology & behavior*, vol. 176, no. 10, pp. 139–148, 2017, doi: 10.1249/MSS.0000000000001941.
- [3] I. Tsakiridis, D. R. Bakaloudi, A. C. Oikonomidou, T. Dagklis, and M. Chourdakis, "Exercise during pregnancy: a comparative review of guidelines," *Journal of Perinatal Medicine*, vol. 48, no. 6, pp. 519–525, Jul. 2020, doi: 10.1515/jpm-2019-0419.
- [4] Z. M. Ferraro, L. Gaudet, and K. B. Adamo, "The potential impact of physical activity during pregnancy on maternal and neonatal outcomes," *Obstetrical and Gynecological Survey*, vol. 67, no. 2, pp. 99–110, Feb. 2012, doi: 10.1097/OGX.0b013e318242030e.
- [5] H. Kikuchi-Noguchi, M. Shiraishi, M. Matsuzaki, and M. Haruna, "Physical activity levels in the second trimester of pregnancy and related demographic factors: A cross-sectional secondary data analysis," *Cogent Medicine*, vol. 6, no. 1, p. 1704607, 2019, doi: 10.1080/2331205x.2019.1704607.
- [6] Y. N. Yin, Y. Huang, X. H. Liu, and B. R. Luo, "Assessment of physical activity status among pregnant women in southwestern China," *Frontiers of Nursing*, vol. 6, no. 2, pp. 135–141, Jul. 2019, doi: 10.2478/FON-2019-0020.
- [7] R. Lee, S. Thain, L. K. Tan, T. Teo, and K. H. Tan, "Asia-Pacific consensus on physical activity and exercise in pregnancy and the postpartum period," *BMJ Open Sport and Exercise Medicine*, vol. 7, no. 2, p. e000967, May 2021, doi: 10.1136/bmjsem-2020-000967.
- [8] S. K. Hinman, K. B. Smith, D. M. Quillen, and M. S. Smith, "Exercise in pregnancy: a clinical review," *Sports Health*, vol. 7, no. 6, pp. 527–531, Nov. 2015, doi: 10.1177/1941738115599358.
- [9] K. Sinaga, N. L. Lubis, and H. Santosa, "Relationship between childbirth assistant and pregnant gymnastics with smooth delivery to mothers at the work area Health office of Simalingkar in 2019," *Internasional Journal of Current Research*, vol. 11, no. 08, pp. 6156–6159, 2019.
- [10] R. Ramírez-Vélez, J. Bustamante, A. Czerniczyniec, A. C. Aguilar De Plata, and S. Lores-Arnaiz, "Effect of exercise training on enos expression, no production and oxygen metabolism in human placenta," *PLoS ONE*, vol. 8, no. 11, p. e80225, Nov. 2013, doi: 10.1371/journal.pone.0080225.
- [11] W. K. Neto and E. F. Gama, "Exercise effect on placental components: Systematic review and meta-analysis," *Revista Brasileira de Medicina do Esporte*, vol. 21, no. 6, pp. 485–489, 2015, doi: 10.1590/1517-869220152106142913.
- [12] World Health Organization, *Physical activity and sedentary behaviour*. Geneva: WHO, 2020.
- [13] A. Bukhari, B. Al-Deibani, B. Alsalmi, A. Alhakami, and N. Alsafari, "Level of physical activity during pregnancy: women's perception and Its modifiable barriers," *International Journal of Advanced Research*, vol. 4, no. 12, pp. 1115–1120, Dec. 2016, doi: 10.21474/ijar01/2499.
- [14] P. C. Santos *et al.*, "Physical activity patterns during pregnancy in a sample of Portuguese women: a longitudinal prospective study," *Iranian Red Crescent Medical Journal*, vol. 18, no. 2, Mar. 2016, doi: 10.5812/ircmj.22455.
- [15] A. G. W. LeBlanc and I. Janssen, "Difference between self-reported and accelerometer measured moderate-to-vigorous physical activity in youth," *Pediatric Exercise Science*, vol. 22, no. 4, pp. 523–534, Nov. 2010, doi: 10.1123/pes.22.4.523.
- [16] W. Freedson, P., Bowles, H.R., Troiano, R. & Haskell, "Assessment of physical activity using wearable monitors: Recommendations for monitor calibration and use in the field," *Medicine and Science in Sports and Exercise*, vol. 44, no. 1 Suppl 1, pp. S1–S4, 2012, doi: 10.1249/MSS.0b013e3182399b7e.
- [17] H. R. Bowles, "Measurement of active and sedentary behaviors: closing the gaps in self-report methods," *Journal of Physical Activity & Health*, vol. 9 Suppl 1, no. s1, pp. S1–S4, Jan. 2012, doi: 10.1123/jpah.9.s1.s1.
- [18] L. Chasan-Taber, M. D. Schmidt, D. E. Roberts, D. Hosmer, G. Markenson, and P. S. Freedson, "Development and validation of a pregnancy physical activity questionnaire," *Medicine and Science in Sports and Exercise*, vol. 36, no. 10, pp. 1750–1760, Oct. 2004, doi: 10.1249/01.MSS.0000142303.49306.0D.
- [19] M. Felyanti, "Analysis of physical activity on the quality of life of pregnant women at the Plaju Health Center, Palembang City (In Indonesia: *Analisis aktifitas fisik terhadap kualitas hidup ibu hamil di Puskesmas Plaju Kota Palembang*)," in *2nd Sriwijaya International Conference of Public Health (SICPH 2019)*, 2019, vol. 25, no. Sicph 2019, pp. 47–50.
- [20] B. Sumintono and W. Widhiarso, *Aplikasi model Rasch untuk penelitian ilmu-ilmu sosial*. Cimahi: Trim Komunikata Publishing House, 2014.
- [21] B. E. Ainsworth *et al.*, "Compendium of physical activities: an update of activity codes and MET intensities," *Medicine and Science in Sports and Exercise*, vol. 32, no. 9 SUPPL., pp. S498–S516, Sep. 2000, doi: 10.1097/00005768-200009001-00009.
- [22] S. L. Nascimento, F. G. Surita, A. C. Godoy, K. T. Kasawara, and S. S. Morais, "Physical activity patterns and factors related to exercise during pregnancy: a cross sectional study," *PLoS ONE*, vol. 10, no. 6, p. e0128953, Jun. 2015, doi: 10.1371/journal.pone.0128953.
- [23] M. Á. Oviedo-Caro, J. Bueno-Antequera, and D. Munguía-Izquierdo, "Transcultural adaptation and psychometric properties of Spanish version of pregnancy physical activity questionnaire: the pregnactive project," *Gaceta Sanitaria*, vol. 33, no. 4, pp. 369–376, Jul. 2019, doi: 10.1016/j.gaceta.2017.12.004.
- [24] C. P. Connolly *et al.*, "Walking for health during pregnancy: A literature review and considerations for future research," *Journal of Sport and Health Science*, vol. 8, no. 5, pp. 401–411, Sep. 2019, doi: 10.1016/j.jshs.2018.11.004.
- [25] V. E. Prameswari and S. N. Selly, "Motivation of pregnant woman to implement the pregnancy gymnastic," *International Journal of Nursing and Midwifery Science (Ijnms)*, vol. 1, no. 1, pp. 32–38, Dec. 2017, doi: 10.29082/ijnms/2017/vol1/iss1/34.
- [26] K. R. Evenson *et al.*, "Guidelines for physical activity during pregnancy: Comparisons from around the world," *American Journal of Lifestyle Medicine*, vol. 8, no. 2, pp. 102–121, 2014, doi: 10.1177/1559827613498204.
- [27] Indonesian Ministry of Health, *Guide to physical exercise techniques during pregnancy and childbirth (In Indonesia: Panduan teknik latihan fisik selama kehamilan dan nifas)*. Jakarta: Kemenkes RI, 2010.
- [28] C. V. N. Coll, M. R. Domingues, H. Gonçalves, and A. D. Bertoldi, "Perceived barriers to leisure-time physical activity during pregnancy: a literature review of quantitative and qualitative evidence," *Journal of Science and Medicine in Sport*, vol. 20, no. 1, pp. 17–25, Jan. 2017, doi: 10.1016/j.jsams.2016.06.007.
- [29] D. Da Costa and K. Ireland, "Perceived benefits and barriers to leisure-time physical activity during pregnancy in previously inactive and active women," *Women and Health*, vol. 53, no. 2, pp. 185–202, Feb. 2013, doi: 10.1080/03630242.2012.758219.
- [30] A. Gaston and A. Cramp, "Exercise during pregnancy: a review of patterns and determinants," *Journal of Science and Medicine in Sport*, vol. 14, no. 4, pp. 299–305, Jul. 2011, doi: 10.1016/j.jsams.2011.02.006.
- [31] I. Walasik, I. Szymusik, K. Kwiatkowska, and K. K. Kaczyńska, "Physical activity patterns among 9000 pregnant women in poland: A cross-sectional study," *International Journal of Environmental Research and Public Health*, vol. 17, no. 5, p. 1771, Mar. 2020, doi: 10.3390/ijerph17051771.




- [32] J. Cioffi *et al.*, "Physical activity in pregnancy: Women's perceptions, practices, and influencing factors," *Journal of Midwifery and Women's Health*, vol. 55, no. 5, pp. 455–461, Sep. 2010, doi: 10.1016/j.jmwh.2009.12.003.
- [33] Y. Lü, Y. Feng, S. Ma, Y. Jiang, and L. Ma, "Changes in physical activity across pregnancy among Chinese women: a longitudinal cohort study," *BMC Women's Health*, vol. 21, no. 1, p. 236, Dec. 2021, doi: 10.1186/s12905-021-01377-3.

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APPENDIX

Table 5. Intensity and type of PA using PPAQ according to demographic characteristics among Indonesian pregnant women

Activities	Demographic characteristics	Min	25 th	Median	75 th	Max	p-value
Intensity (MET-h week-1)							
Total activities	Age:19-29 years	59.70	165.23	240.38	332.31	621.35	.676
	Age:30-40 years	101.15	165.55	261.53	366.50	663.05	
	Below or equal to junior high school	59.70	162.33	261.87	328.31	663.05	.578
	Senior high school	64.13	164.02	246.36	327.25	621.35	
	Under/Postgraduate	101.15	197.85	272.45	501.98	660.18	
	Unemployed	59.70	141.70	218.00	296.28	663.05	.000
Sedentary	Employed	129.55	233.58	331.28	518.88	660.18	
	Age:19-29 years	1.75	16.10	36.40	65.45	160.65	.365
	Age:30-40 years	4.55	21.96	35.35	106.75	146.30	
	Below or equal to junior high school	1.75	11.38	39.20	60.42	138.78	.001
	Senior high school	1.75	13.30	30.63	58.36	137.90	
	Under/Postgraduate	4.55	31.85	58.45	117.69	160.65	
Light-activity	Unemployed	1.75	11.55	30.63	47.25	114.80	.000
	Employed	1.75	35.35	78.58	118.65	160.65	
	Age:19-29 years	22.85	79.54	110.25	167.74	301.70	.831
	Age:30-40 years	36.23	88.29	119.35	178.85	288.40	
	Below or equal to junior high school	22.85	78.49	108.38	157.28	285.08	.659
	Senior high school	34.30	87.02	111.74	176.27	301.70	
Moderate-activity	Under/Postgraduate	36.23	94.94	133.70	180.78	288.40	
	Unemployed	22.85	64.68	107.45	148.93	301.70	.000
	Employed	36.23	106.75	165.20	201.55	288.40	
	Age:19-29 years	.00	39.29	76.95	136.90	324.20	.556
	Age:30-40 years	.00	48.67	83.50	141.36	334.35	
	Below or equal to junior high school	9.40	52.43	87.39	155.22	334.35	.617
Vigorous-activity	Senior high school	.00	39.55	75.22	121.30	219.60	
	Under/Postgraduate	.00	34.82	94.65	186.75	308.35	
	Unemployed	.00	27.10	68.88	110.45	334.35	.003
	Employed	21.60	46.80	112.80	192.18	324.20	
	Age:19-29 years	.00	.00	1.63	5.25	28.50	.902
	Age:30-40 years	.00	.00	.00	4.13	11.50	.247
Type (METs)	Below or equal to junior high school	.00	.00	1.75	5.25	20.25	
	Senior high school	.00	.00	.00	4.50	28.50	
	Under/Postgraduate	.00	.00	1.63	5.06	11.50	
	Unemployed	.00	.00	.00	4.88	20.25	.010
	Employed	.00	.00	1.75	6.25	28.50	
	Household/Care giving activities	Age:19-29 years	28.35	104.20	158.73	215.19	459.20
Age:30-40 years		64.23	108.09	174.48	221.03	450.45	
Below or equal to junior high school		28.35	107.80	132.29	214.42	450.45	.433
Senior high school		43.93	113.62	179.55	221.38	459.20	
Under/Postgraduate		51.45	98.00	163.05	231.60	378.00	
Unemployed		28.35	102.73	152.95	211.40	459.20	.088
Occupational activities	Employed	54.08	131.08	179.73	232.05	402.85	
	Age:19-29 years	.00	.00	.00	21.96	262.50	.429
	Age:30-40 years	.00	.00	.00	71.75	243.95	
	Below or equal to junior high school	.00	.00	.00	66.46	262.50	.001
	Senior high school	.00	.00	.00	5.95	149.98	
	Under/Postgraduate	.00	1.40	63.88	91.00	243.95	
Transportation activities	Unemployed	.00	.00	.00	.00	63.00	.000
	Employed	.00	27.30	76.83	124.78	262.50	
	Age:19-29 years	.00	4.38	13.13	26.25	84.00	.527
	Age:30-40 years	.00	.00	26.25	58.62	136.50	
	Below or equal to junior high school	.00	4.38	15.75	34.57	136.50	.180
	Senior high school	.00	.00	13.56	40.69	68.25	
Sports/Exercise	Under/Postgraduate	.00	13.13	22.75	64.75	84.00	
	Unemployed	.00	.00	13.13	34.13	136.50	.008
	Employed	.00	13.13	20.13	64.75	84.00	
	Age:19-29 years	.00	2.84	9.05	17.35	70.18	.260
	Age:30-40 years	.00	2.40	8.55	13.46	43.03	
	Below or equal to junior high school	.00	4.02	10.11	17.95	41.00	.039
Sports/Exercise	Senior high school	.00	1.70	7.32	13.18	70.18	
	Under/Postgraduate	.00	5.55	11.13	16.44	43.03	
	Unemployed	.00	2.40	8.00	13.35	70.18	.114
	Employed	.80	5.28	9.63	17.98	43.03	

Table 6. Intensity and type of PA using PPAQ according to obstetric characteristics among Indonesian pregnant women

Activities	Obstetrics characteristics	Min	25 th	Median	75 th	Max	p-value	
Intensity (METs)	Total activities	Parity: one	59.70	160.88	244.98	333.35	663.05	.654
		Parity: two	127.00	157.68	254.25	438.70	632.50	
		Parity: ≥three	167.23	217.11	268.38	310.45	646.38	
	Sedentary	Trimester 1	110.10	139.83	163.88	289.58	632.50	.249
		Trimester 2	59.70	172.08	250.50	362.65	663.05	
		Trimester 3	64.13	184.70	263.48	343.48	646.38	
		Parity: one	1.75	14.18	36.40	63.53	160.65	.679
		Parity: two	8.75	22.93	35.35	104.30	137.90	
		Parity: ≥three	4.55	15.67	38.85	91.61	134.05	
Light-activity	Trimester 1	8.75	13.13	35.00	46.38	118.65	.800	
	Trimester 2	1.75	13.26	36.31	77.31	160.65		
	Trimester 3	3.68	21.00	42.00	73.50	146.30		
	Parity: one	22.85	76.13	110.60	170.98	301.70	.532	
	Parity: two	36.23	87.15	110.43	185.68	288.40		
	Parity: ≥three	88.73	102.25	147.35	173.29	224.00		
	Trimester 1	36.23	64.58	94.68	183.75	288.40	.545	
	Trimester 2	22.85	87.20	107.88	163.14	285.08		
	Trimester 3	34.30	79.63	119.35	176.58	301.70		
Moderate-activity	Parity: one	.00	39.70	81.15	121.33	334.35	.829	
	Parity: two	.00	28.90	81.23	146.00	246.03		
	Parity: ≥three	28.75	45.39	75.75	144.51	282.08		
	Trimester 1	15.75	20.55	52.23	81.23	225.45	.116	
	Trimester 2	13.05	60.55	96.94	175.76	334.35		
	Trimester 3	.00	39.70	83.50	138.43	324.20		
	Parity: one	.00	.00	1.63	5.25	28.50	.816	
	Parity: two	.00	.00	.00	5.25	10.50		
	Parity: ≥three	.00	.00	.81	2.97	6.25		
Vigorous-activity	Trimester 1	.00	.00	.00	1.63	5.25	.028	
	Trimester 2	.00	.00	1.75	5.25	28.50		
	Trimester 3	.00	.00	.00	5.25	20.25		
	Type (METs)	Trimester 1	51.45	76.65	108.68	189.53	348.78	.321
		Trimester 2	28.35	93.76	163.71	245.74	450.45	
		Trimester 3	43.93	118.35	174.48	217.70	459.20	
	Occupational activities	Parity: one	.00	.00	.00	27.30	262.50	.433
		Parity: two	.00	.00	.00	72.45	149.98	
		Parity: ≥three	.00	.00	.00	81.86	179.03	
Trimester 1		.00	.00	.00	79.80	124.78	.519	
Trimester 2		.00	.00	.00	69.78	243.95		
Trimester 3		.00	.00	.00	27.30	262.50		
Transportation activities	Parity: one	.00	4.38	15.75	33.25	136.50	.798	
	Parity: two	.00	.00	20.13	42.00	70.00		
	Parity: ≥three	.00	4.38	27.13	50.53	68.25		
	Trimester 1	.00	.00	13.13	46.38	70.00	.524	
	Trimester 2	.00	6.13	20.13	42.00	136.50		
	Trimester 3	.00	4.38	13.13	34.13	113.75		
Sports/Exercise	Parity: one	.00	3.55	9.60	18.15	70.18	.223	
	Parity: two	.00	2.40	8.00	13.35	18.75		
	Parity: ≥three	.00	.60	5.79	12.34	17.95		
	Trimester 1	.00	1.95	3.55	9.35	14.93	.012	
	Trimester 2	.00	6.96	11.63	20.08	70.18		
	Trimester 3	.00	2.40	8.55	16.55	43.03		