Relationship of Objectively Measuring Physical Activity and Sitting Time on Plasma Lipid Metabolism During Pregnancy

Hanqing Chen
Sun Yat-sen University First Affiliated Hospital
Casper J. P. Zhang
The University of Hong Kong Li Ka Shing Faculty of Medicine
Xuanbi Fang
Jinan University School of Medicine
Zijian Tan
Jinan University School of Medicine
Ni Yan
Jinan University School of Medicine
Wai-Kit Ming
Sun Yat-sen University First Affiliated Hospital
Zilian Wang (wangzil@mail.sysu.edu.cn)
Sun Yat-sen University First Affiliated Hospital

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Abstract

Background: Physical activity (PA) was commonly associated with pregnancy outcomes, including plasma lipids. We hypothesized that women with more PA would improve plasma lipid status than those with less PA during pregnancy. This study aimed to investigate the association of PA and sitting time with blood lipids in the first two trimesters.

Methods: A prospective study was performed among 197 cases aged 18 to 40 recruited from a regional university affiliated hospital in south China. accelerometer were used to measure maternal PA in two trimesters (first measurement within 10^{th} to 14^{th} week of gestation and second measurement within 20^{th} to 24^{th} weeks of gestation; 7 consecutive days for each measurement). Maternal fasting venous blood was collected to test plasma lipids (cholesterol, triglyceride, low- and high-density lipoprotein [LDL and HDL]) in each of two trimesters.

Results: A total of 197 cases completed this study. After adjusting for age and pre-pregnancy BMI, moderate PA of the first trimester was inversely linear associated with triglycerides in early pregnancy (β=-0.231, P=0.002). And it was also inversely significant linear association with triglycerides of the second trimester (β=-0.196, P=0.006). Moderate PA in early pregnancy showed a positively non-significant linear association with HDL levels of the first trimester (β=0.134, P=0.068). However, sitting time of the second trimester were positively non-significant associated with total cholesterol (β=0.126, P=0.080) and LDL levels (β=0.124, P=0.082) of the second trimester.

Conclusions: Sitting time of the second trimester would positively associated with total cholesterol and LDL levels of the mid pregnancy. Higher moderate PA of early pregnancy was associated with lower triglycerides, and this effect lasting to the mid pregnancy. Therefore, pregnant women should be encourage to increase moderate PA and decrease sitting time from early pregnancy to improve lipid status.

Introduction

Physical activity (PA) is an essential factor for maintaining the normal function of the human body. Physical activity during pregnancy decreased the risk of gestational diabetes mellitus, pre-eclampsia, and obesity [1–3]. Therefore, the American College of Obstetricians and Gynecologists (ACOG) has emphasized the positive role of PA on pregnancy with recommended PA levels in pregnancy for at least 30 minutes of moderate activity on most or all days of the week or at least 150 minutes a week [4].

Lipoprotein and lipid physiology during pregnancy has a great effect on the fetal, newborn, and maternal development. Lipids provide appropriated nutrition for fetus throughout pregnancy, physiologically changes of which reflect the increase in maternal insulin resistance. Dyslipidemia during pregnancy increased the risk of adverse perinatal outcomes and was associated with other comorbidities[5]. High level of serum lipids during pregnancy increased the risk of pre-eclampsia and gestational diabetes mellitus[6], while regular physical activity during pregnancy could reduce the risk of pre-eclampsia, diabetes[3]. Therefore, we hypothesized that physical activity during pregnancy would improve lipid levels.

There were some evidence on the relationship between adult physical activity and blood lipids, which showed that moderate and/or vigorous PA in adults were negatively correlated with triglycerides and LDL levels[7–9]. However, there were few evidence on the relationship between physical activity and lipids during pregnancy. Moreover, these studies showed contradictory results. One study showed that PA during the gestation was related to total cholesterol and triglyceride levels, which would decrease when PA increased [10]. However, another study showed that the levels of cholesterol and high-density lipoprotein remained unchanged before or after exercising[11]. Nevertheless, these studies did not compare subgroups of different stage of pregnancy, which were related to blood lipids level. And these studies were conducted only one stage of pregnancy, which can be limited to reflect a comprehensive overview. Meanwhile, these studies were retrieved from and conducted in foreign countries, which might not provide insights into the situations in China. And activity questionnaires were used in these studies. There few studies used accelerometer to detect PA on the correlation with lipids during pregnancy. Therefore, the purpose of this study was to use a triaxial accelerometer to accurately evaluate the daily PA of single pregnant during the first and second trimester, then analyze the association of physical activity and sitting time with plasma lipids during the two trimesters, including total cholesterol (TC), triglycerides (TGs), low- and high-density lipoprotein (LDL and HDL, respectively).

Materials And Methods

Participants selection

A prospective cohort study was performed to examine the effect of daily PA on plasma lipid status of pregnant women with no contraindications for PA at the First Affiliated Hospital of Sun Yat-sen University. All participants signed the informed consent before participated in this study. Inclusion criteria were age 18–40 years and single live fetus with no fetal malformation confirmed by ultrasound in early pregnancy. Exclusion criteria were hypertension, diabetes, twin or multiple pregnancies, history of cervical incompetence, threatened abortion, placenta previa, vaginal bleeding, heart disease, retinopathy, hyperthyroidism, lupus erythematosus, chronic kidney disease, malignant tumor, mental disorder, and/or refusal to participate in the study. Ethical approval was granted by the Ethics Committee of the First Affiliated Hospital, Sun Yat-sen University (2017)296).

Data collection

Demographic data, including age, parity, way of conception, marital status, history of spontaneous abortion, education level (high school and below versus university and above), work (full-time work versus other), annual family income (< 10000 yuan/person with low income versus ≥ 10000 yuan/person with high income), height (unit: m), pre-pregnancy weight (unit: kg), pre-pregnancy body mass index (BMI, unit: kg/m^2), smoking and husband smoking were collected by face-to-face interview at the first antenatal examination(10-14 weeks of gestation).

Physical activity

Maternal PA was measured using accelerometry-based activity monitors in the week following the first and second trimesters (10–14 and 20–24 weeks respectively, which recorded as T1, T2) as described previously[12-13]: Actigraph GT3X plus(ACT) (Actigraph Inc., Florida, US), verified by calorimetry, oxygen consumption and double standard water method, was a reliable physical activity measurement and recording instrument (with sensitivity higher than 98% and specificity higher than 99%) for measuring in human physical activity (walking, running, cycling) and body posture (standing and sitting)[12,14]. Participants were asked to wear ACT for consecutive 7 days at each stage (including 5 weekdays and 2 weekends). A elastic belt was used to fix the device to the right hip for 24 hours except for bedtime and watering activities including swimming and bathing, and operated accelerometer following manufacturer's instructions. Before each wearing, the accelerometer was charged and set to wearing session to avoid confusion with the previous wearing. Analyses were performed using Actilife 6.13.3 to retrieve mean counts per minute (cpm), a continuous measure of physical activity intensity and sedentary time and a clinically significant and frequently used indicator of an active lifestyle. An epoch length of 60 seconds and a frequency rate of 30 Hz were used. After data filtering, a wearing time more than 10 hours per day lasting for at least 5 days (four weekdays and one weekend) in each stage was considered as valid, and thus included for analysis. Continuous 0 cpm more than 60 minutes was rated as nonwear time and were excluded from analysis. Finally, duration in moderate and/or vigorous activity intensity (MVPA) was calculated using Freedson's cut-off of PA intensity of adults (1998)[15]. PA values were divided into four categories: (1) sedentary time (< 100 cpm), (2) light PA (100–1951cpm), (3) moderate PA(1952–5724 cpm), and (4) vigorous PA (≥ 5725cpm)[15]. Average time in minutes per day (min/d) will be recorded for sedentary time (ST) and each type of PA time. Pregnant women who met the recommendation PA level(at least 150 min of MVPA during a typical week[16]) were defined as "active". Otherwise, they were defined as "inactive".

Blood sample testing

Serum lipid testing methods of this study have been described in the previous article of our team [17]. The first blood sample collection was completed after the first time of accelerometer wearing and the second blood sample was collected at 24^{th}-28^{th} week of gestation, 2 ml venous blood samples were collected between 08:00 and 10:00 AM after overnight fasting (at least 8 but not more than 14 h). All blood samples were sent to the Biochemistry Laboratory of the First Affiliated Hospital, Sun Yat-sen University, Guangzhou. Biochemical parameters including TCs, TGs, HDL, LDL, and apolipoproteins were measured with standard enzymatic procedures on an automatic chemistry analyzer (Abbott Aeroset, United States).

Statistical analysis

Statistical analysis was performed using IBM SPSS statistical package version 19.0 (SPSS, Inc., Chicago, IL). Continuous variables were described using mean ± standard deviation (SD), and categorical variables were described using counts and percentages. Paired t-tests were used to analyse continuous variables. Logistic linear regression analysis were used to analyze the relationship between physical activity and blood lipids adjusting for maternal age and pre-pregnancy. Differences were considered significant for p-value < 0.05.

Results

Two hundred and twenty-eight pregnant women agreed to participate in this study. There were 31 cases did not finish the sensor wearing, then 197 women providing valid accelerometer-based data were included for analysis, with the mean age of 30.0 ± 3.1 years and the average wearing time of 14.2 ± 1.2 h, of which 70.6% of the sample population was primipara, 8.1% had overweight/obese problem, and 8.1% were advanced age (Table 1).

Sitting time and PA time of the two trimesters were showed in Table 2. Sitting time of the second trimester were lower than those of the first trimester(539.1 vs. 549.7min/d，P=0.035). However, there were no difference in light PA, moderate PA and MVPA between the two trimesters. There were rare vigorous PA during the two stages. The median vigorous PA time were 0 both in the two trimesters, with range 0.0～1.3min/d in trimester 1 and range 0.0～2.0min/d in trimester 2.

When a 150 min per week of cut-off MVPA was adopted, participants showed a lower TG levels compared to the counterparts who did not in the first trimester(1.36 vs. 1.22 mmol/L, P=0.029). But there was no difference in TG levels between the two groups in the second trimester. Also, TC, HDL and LDL levels of the first and second trimester were no difference between the cases who reached the PA recommendation or not(Table 3).

Logistics linear regression analysis of sedentary time and different type of PA levels of the early pregnancy with lipid levels(including total cholesterol, triglycerides, HDL and LDL) (after adjusting for maternal age and pre-pregnancy BMI) during early pregnancy were shown in Table 4. Moderate PA in trimester 1 was negatively associated with triglyceride levels in the early pregnancy (β=-0.231, P=0.002, R^2=0.088). MVPA of the first trimester was also inversely associated with triglycerides levels in the early pregnancy (β=-0.232, P=0.002, R^2=0.088). And moderate PA had some positively evidence of statistical significance on HDL levels (β=0.134, P=0.068, R^2=0.055), MVPA also had similar effect on HDL levels in trimester 1 (β=0.134, P=0.068, R^2=0.054). Moderate PA and MVPA were no relationship with total cholesterol and LDL levels during early pregnancy (β=-0.048～-0.027, P＞0.05). Sedentary time, light PA and vigorous PA were no association with lipid levels (total cholesterol, triglycerides, HDL and LDL) of the first trimester (β=-0.122～0.060, P＞0.05).

The effect of sedentary time and PA levels of the first trimester and the second trimester on lipid levels (including total cholesterol, triglycerides, HDL and LDL) of trimester 2 were shown in Table 5. After adjusting for maternal age and pre-pregnancy BMI, moderate PA of the first trimester was inversely related to triglyceride levels of the second trimester (β=-0.196, P=0.006, R^2=0.079), and vigorous PA of the early pregnancy was negatively correlated with triglyceride levels of the second trimester (β=-0.148, P=0.043, R^2=0.026). MVPA of the early pregnancy was also inversely associated with triglycerides levels of trimester 2 (β=-0.197, P=0.002, R^2=0.079) . But moderate PA and MVPA during early pregnancy were no relationship with total cholesterol, HDL and LDL levels of trimester 2 (β=-0.082～0.108, P＞0.05). Sedentary time and light PA were no association with lipid levels of the second trimester (β=-0.021～0.081, P＞0.05).

After adjusting for maternal age and pre-pregnancy BMI, sedentary time of trimester 2 was some positively evidence of statistical significance on total cholesterol levels of the second trimester (β=0.126, P=0.080, R^2=0.054), and was also some positively evidence of statistical significance on LDL levels of the second trimester (β=0.124, P=0.082, R^2=0.054). But, the sedentary time of the second trimester was no related to triglyceride and HDL levels of trimester 2 (β=-0.001～0.056, P＞0.05). Moderate PA during the second trimester was some negatively associated with triglyceride levels of the second pregnancy (β=-0.130, P=0.076, R^2=0.033), MVPA of trimester 2 had similar relationship with triglyceride levels of the second pregnancy (β=-0.129, P=0.077, R^2=0.033). But moderate PA and MVPA during the second pregnancy were no relationship with total cholesterol, HDL and LDL levels of trimester 2 (β=-0.039～0.110, P＞0.05). Light PA and vigorous PA were also no association with lipid levels of the second trimester (β=-0.052～0.051, P＞0.05).

Discussion

In this study, the accelerometer was implemented to assess PA and sedentary behavior time of the first two trimesters. Accelerometer can more effectively evaluate PA during pregnancy[18]. But there was few research of PA assessed by accelerometer on lipid levels during pregnancy.

The plasma lipids increased with the increase of gestational age, which adapts to the physiological changes during pregnancy[19]. However, dyslipidemia was closely related to adverse pregnancy outcomes, high levels of lipid during pregnancy increased the risk of pre-eclampsia and gestational diabetes mellitus[6], and triglyceride levels in early pregnancy increased the risk of large for gestational age (OR1.11, P = 0.04) [20]. Therefore, it was very important to improve lipids during pregnancy.

Some studies evaluated the relationship between physical activity and lipid levels during pregnancy, which self-reported physical activity questionnaires were commonly used to assess physical activity. Researches on PA and lipids seldom used accelerometer to assess physical activity during pregnancy. In a study from Schreuder et al. involving 3025 cases, physical activity questionnaire was used to assess PA in the past week at the first antenatal examination in the early pregnancy(average 12.9 weeks of gestation), then non fasting plasma lipids (TG, TC, free fatty acids) were measured. The results showed that when compared to cases which reported no any physical activity, pregnant women reported with any activity in the first trimester was negatively correlated with TC levels (β = -0.25～-0.11, P = 0.05-0.07), and also negatively correlated with TG (β = -0.05～-0.004, P < 0.05)[10]. Research from Butler et al. including 925 pregnant women, detected non fasting blood lipids (TC, TG and HDL) at about 13 weeks of gestation, and evaluated the leisure activities of pregnant women in the past 7 days with physical activity questionnaire. The results showed that the TG level of those who reported any activity was 12.7mg/dl lower than those who did not report any activity, while the activity during pregnancy was negatively correlated with TC and TG in early pregnancy[21]. The two studies detected non fasting blood lipids, and the self-reported physical activity questionnaire was used to evaluate physical activity of the first pregnancy. It is not clear whether the PA during the early pregnancy could continue to affect the increased blood lipid level with the increase of pregnancy. However, a meta-analysis from Mudd et al showed that the level of TG decreased with physical activity increasing during pregnancy, but the recommended amount of activity during pregnancy (MVPA > 150 min per week) did not show a significant difference[19]. The results of studies which using accelerometer to evaluate PA on the relationship with blood lipid levels during pregnancy were different from those of using self-reported questionnaires. A study from Loprinzi et al included 206 cases, which used accelerometer to monitor physical activity for 7 days, then analyzed the relationship between PA and blood lipids. The results showed that there was no correlation between PA and TG level, and MVPA was positively correlated with HDL (b = 6.76, P = 0.01)[22], but the cases included in this article were at the three trimesters. It was not a continuous assessment of the same case in the three stages of pregnancy, and the blood lipid level was not divided into three stages, 107 cases were fasting TG, 105 cases were fasting LDL. They did not analyze the effect of PA level of different stages on blood lipid levels in different stages of pregnancy, and the activity level and blood lipid level changed during pregnancy; mixed PA data and blood lipid data of the three stages may lead to inappropriate conclusions. In another study, blood samples were taken to detect blood lipids after 9 days of monitoring physical activity using accelerometer in the early pregnancy (15-17 weeks of gestation), and 50 cases completed the study. The results showed that there was no correlation between physical activity and TC and TG in early pregnancy[23], but the sample size of this study was small, and only detected blood lipids in early pregnancy. The conclusions of these studies were contradictory. Although the researches using questionnaire had enough large sample, but self-reported physical activity questionnaire usually overestimate PA and underestimate sedentary time during pregnancy[24-25]. And the sample of studies using accelerometer was small. Moreover, sample only on overweight/obese cases, which results could not extend to normal cases.

Results of our study showed that moderate PA and MVPA in the first trimester had negative correlation with triglyceride levels in the first trimester (β = -0.232, P = 0.002), and they also had inversely relationship with triglyceride levels in the mid trimester (β = - 0.197, P = 0.002), which suggested that moderate PA or MVPA in early pregnancy may continue to affect triglycerides in mid pregnancy. MVPA of the first trimester also had a partial positive correlation with HDL levels (β = 0.134, P = 0.068), which was similar to the results of Loprinzi et al[22]. And the results of this study showed that MVPA in the second trimester was also negatively correlated with triglycerides of the second trimester(β= - 0.129, P = 0.077). This results were similar with the results of study from van Poppel et al[26]. The study of van Poppel et al[26] showed that MVPA in 15 weeks of gestation were negatively associated with triglycerides of 32 weeks of gestation(β=−0.28, 95 % CI −0.49,−0.08 mmol/L), although the sample size was small(24 cases) with all were overweight/obese. This indicated that moderate to vigorous PA in early pregnancy could improve lipid metabolism. In this study, a large sample size (197 cases) was included, and the same population was monitored in the first and second trimester, with fasting lipids detected each stages so as to reduce confusion factors. Moreover, all cases of our study need wear accelerometer for 7 consecutive days each trimester, which could more accurately reflect the physical activity of pregnancy.

There is no relationship between vigorous PA and blood lipid level during the first two pregnancy, which may be related to the fact that pregnant women participate very rare in vigorous physical activity in this study, with the median of vigorous PA in the first and second trimester both were 0. This study also found no relationship between light PA and blood lipid levels during pregnancy.

Previous studies showed that there was no significant difference between sedentary time and blood lipids in early pregnancy[23,27]. In the study of Nayak et al including 46 overweight and obese cases, which used accelerometer to monitor sedentary time at 15, 24 and 32 weeks of gestation, showed that sitting time before 15 weeks of gestation was not related to blood lipid in early pregnancy, while sitting time at 24 weeks of gestation was related to total cholesterol (β=0.06; 95% CI 0.02 – 0.10) and HDL levels (β=0.02; 95% CI 0.01 – 0.03), while they were no significant difference with triglyceride and LDL levels[27].But the sample size was small(46 cases), and all were overweight/obese, which would make contradictory conclusion. On the contrary, research from loprinzi et al. showed a positive

correlation between sitting time and LDL(b= 0.12, P = 0. 02)[22]. However, for the cases of three stages of pregnancy included in this study, the relationship between sedentary time and blood lipids in each stage of pregnancy was not analyzed separately, which may be confused the results. These studies were not distinguishing the stages of pregnancy,or with small sample size.

The results of our study showed that there was no significant relationship with sedentary time and blood lipid levels (TC, TG, HDL and LDL)in early pregnancy, which was similar with the results of the study from Acosta-Manzano et al.[23]. However, our study showed that sitting time in the second trimester was some evidence of positively correlated with triglycerides (β = 0.126, P = 0.080) and LDL levels in the second trimester(β = 0.124, P = 0.082),which were not found in previous report. Therefore, we speculate that sedentary time in early pregnancy was not enough to effect the change of blood lipid level in early pregnancy, while more sitting time in the second trimester would affect triglycerides and LDL levels in the second trimester.This results indicated that pregnant women should decrease sitting time in mid pregnancy.

Limitations

Because pregnant women need to wear sensor for two times, thus this study was not a randomized controlled study. But all cases had finished two times sensor wearing, and fasting blood were tested in the two times. This would reduce confusion factors.

Conclusion

The sitting time decreased with the increased of trimesters. And moderate PA in the early pregnancy were inversely associated with triglycerides in the early pregnancy, which was lasting to the middle pregnancy. Sitting time in the second trimester would have positively associated with total cholesterol and LDL in mid pregnancy.

Abbreviations

PA
physical activity
MVPA
moderate and/or vigorous physical activity
TC
total cholesterol
TG
triglyceride
LDL
low density lipoprotein
HDL
high density lipoprotein
ACOG
American College of Obstetricians and Gynecologists
BMI
body mass index
ACT
Actigraph GT3X plus

Declarations

Ethics approval and consent to participate

Ethical approval was granted by the Ethics Committee of the First Affiliated Hospital, Sun Yat-sen University (2017)296). All participants signed the informed consent before participated in this study.

Consent for publication

Not applicable.

Availability of data and materials

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Hanqing Chen and Wai-Kit Ming contributed to the concept of this article and the analysis and interpretation of data. Hanqing Chen has composed the article draft. Casper J. P. Zhang provided guidance on data processing and revised the manuscript. Zijian Tan and Ni Yan contributed to both the analysis and interpretation of data. Zilian Wang and Xuanbi Fang raised the idea of this article and contributed to the study design and manuscript revision.

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Tables

Table1. Demographic data of the study sample (*N* = 197)

	Mean ± SD or n (%)
Age (years)	30.0 ± 3.1
≥ 35	16 (8.1)
< 35	181 (91.9)
Pregnancy BMI (kg/m2)	20.8 ± 3.0
< 18.5	42 (21.3)
18.5–24.9	139 (70.6)
≥ 25.0	16 (8.1)
Wearing time (h/day)	14.2 ± 1.2
T1 (h/day)	14.3 ± 1.3
T2 (h/day)	14.2 ± 1.1
Education level	
Graduate and above	179 (90.9)
High school	18 (9.1)
Occupational status	
Full time job	159 (80.7)
Others	38 (19.3)
Income	
High	95 ()48.2
Low	102 (51.8)
Smoking before pregnancy	5 (2.5)
Husband smoking during pregnancy	32 (16.2)
Way of conception	
In vitro	29 (14.7)
Spontaneous	168 (85.3)
History of Spontaneous abortion	38 (19.3)
Parity	
0	139 (70.6)
1	58 (29.4)
Marital status	
Married	194 (98.5)
Unmarried	3 (1.5)

BMI: body mass index; SD: standard deviation

Table 2. Sitting time and physical activity of the first and second trimester

Stages	ST	Light PA	Moderate PA	MVPA
T1	549.7(75.8)	209.8(61.4)	25.2(16.2)	25.3(16.2)
T2	539.1(71.8)	211.5(59.5)	23.9(16.6)	24.0(16.6)
P value	0.035	0.620	0.130	0.128

ST: Sedentary time; PA: physical activity; MVPA: moderate to vigorous physical activity; T1: 1st trimester; T2: 2nd trimester

Table 3. Association between physical activity meeting PA recommendation and lipid levels of pregnant women

Lipids (mmol/L)	Trimester 1			Trimester 2		
	Inactive	Active	P value	Inactive	Active	P value
TC	4.92 ± 0.83	4.88 ± 0.93	0.764	6.27 ± 0.94	6.37 ± 1.33	0.529
TG	1.36 ± 0.44	1.22 ± 0.41	0.029	1.90 ± 0.67	1.99 ± 0.74	0.962
HDL	1.71 ± 0.32	1.76 ± 0.32	0.228	1.98 ± 0.34	2.03 ± 0.39	0.331
LDL	2.75 ± 0.51	2.73 ± 0.64	0.768	3.53 ± 0.64	3.58 ± 0.88	0.657

TC: total cholesterol; TG: triglyceride; HDL: high-density lipoprotein, LDL: low-density lipoprotein

Table 4. Associations of lipid levels with physical activity levels and sitting time during first trimester

PA	TC			TG			HDL			LDL		
Value#	B	β	P	B	β	P	B	β	P	B	β	P
ST	1.335	0.016	0.827	-3.500	-0.020	0.786	-5.572	-0.024	0.741	2.760	0.022	0.765
Light PA	3.243	0.047	0.504	-3.209	-0.022	0.754	11.217	0.060	0.402	3.069	0.030	0.676
Moderate PA	-0.486	-0.027	0.715	-8.753	-0.231	0.002	6.660	0.134	0.068	-1.283	-0.047	0.523
Vigorous PA	-0.011	-0.057	0.438	-0.049	-0.122	0.105	0.017	0.032	0.675	-0.022	-0.074	0.321
MVPA	-0.497	-0.027	0.709	-8.802	-0.232	0.002	6.677	0.134	0.068	-1.304	-0.048	0.517

#: model adjusted for maternal age and pre-pregnancy BMI; PA: physical activity; TC: total cholesterol; TG: triglyceride; HDL: high-density lipoprotein; LDL: low-density lipoprotein; ST: sedentary time; MVPA: moderate to vigorous physical activity

Table 5. Relationship of physical activity levels and sedentary time of the first and second trimester with lipid levels of the second trimester

Stage	PA	TC			TG			HDL			LDL		
	Value[#]	B	β	P	B	β	P	B	β	P	B	β	P
T1	ST	5.315	0.081	0.258	0.056	0.001	0.994	-0.838	-0.004	0.954	7.498	0.077	0.280
	Light PA	-0.992	-0.019	0.789	-0.604	-0.007	0.921	1.727	0.011	0.881	-1.665	-0.021	0.761
	Moderate PA	-0.075	-0.005	0.941	-4.514	-0.196	0.006	4.698	0.108	0.134	-0.608	-0.029	0.684
	Vigorous PA	-0.009	-0.058	0.427	-0.036	-0.148	0.043	0.008	0.017	0.814	-0.018	-0.082	0.260
	MVPA	-0.083	-0.006	0.935	-4.551	-0.197	0.006	4.706	0.108	0.134	-0.626	-0.030	0.676
T2	ST	7.773	0.126	0.080	5.696	0.056	0.438	-0.149	-0.001	0.991	11.415	0.124	0.082
	Light PA	-2.662	-0.052	0.470	-1.181	-0.014	0.847	-4.767	-0.030	0.678	-3.592	-0.047	0.510
	Moderate PA	-0.336	-0.023	0.750	-3.077	-0.130	0.076	4.907	0.110	0.133	-0.838	-0.039	0.591
	Vigorous PA	0.002	0.011	0.883	0.013	0.051	0.487	0.018	0.038	0.608	0.003	0.013	0.863
	MVPA	-0.334	-0.023	0.751	-3.064	-0.129	0.077	4.925	0.110	0.132	-0.835	-0.039	0.592

#: model adjusted for maternal age and pre-pregnancy BMI; PA: physical activity; TC: total cholesterol; TG: triglyceride; HDL: high-density lipoprotein; LDL: low-density lipoprotein; ST: sedentary time; MVPA: moderate to vigorous physical activity