PHYSICAL ACTIVITY PATTERNS AND DAILY STEPS IN BRAZILIAN PREGNANT WOMEN’S SAMPLE

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Abstract

Purpose: to analyze the physical activity (PA) level of pregnant women (PW) according to their gestational trimester and to evaluate multiple measurements of PA.

Methods: 122 PW, 26.5 ± 5.5 years old, and between the 4th and 37th week of pregnancy participated. PA was evaluated by levels of frequency and intensity, duration of walking, and moderate and vigorous PA; and based on the calculation in METs, determined by IPAQ and a pedometer. Data analysis was done by the Kruskall-Wallis, significance level of \( P < .05 \).

Results: a significant decrease was found in the duration of moderate PA in the second-trimester group when compared to the duration of the first and the third trimester groups. There were no differences in walking (4.8 days/week) and moderate PA frequency (3.1 days/week) on average across trimesters. When considering the weekly number of steps, PW had in the first trimester taken an average of 10,789.0 ± 5,676.8 steps, in the second trimester 6,812.1 ± 4,092.4 steps, and in the third trimester 6,746.8 ± 3,572.0 steps. There was no significant difference in the weekly total number of steps between trimesters.

Conclusion: the PA level of PW, using IPAQ or pedometer, was similar regardless of the trimester of the pregnancy.

Key words: pregnancy, physical activity, pedometer, activity assessment

Introduction

The importance of physical activity (PA) in every individual's life is already well documented in the literature. In Brazil, researches about PA level suggest that Brazilian have low PA level. However, a time trend study in PA in the state of São Paulo (the Brazilian’s biggest city) showed that PA levels are increasing, and these trends were mainly explained by increases in walking and moderate-intensity PA [1,2].

The American College of Sports Medicine (ACSM) and the Center for Diseases Control (CDC) recommend all individuals to practice at least 30 minutes of moderate PA per day, in a continuous or cumulative way, aerobic and resistance exercise, on most days of the week [3]. In 2002, the American College of Obstetricians and Gynecologists (ACOG) have endorsed that the ACSM recommendation can also be followed by pregnant women (PW), as long as there are no contraindications to exercise [4].

The literature review shows that PW who were physically active during pregnancy were at a lower risk of developing diseases, such as diabetes or pregnancy-induced hypertension, as well as going into premature labor [5-9]. PA during pregnancy also prevents from unhealthy weight gain [5]. Moreira et al. [6] evaluated the association between weight gain in pregnancy and obesity in children, and found that the children of those PW who gained an excessive weight during pregnancy (≥ 16 kg) presented a higher risk of develop obesity during infancy; a sedentary lifestyle was also found to contribute to the worsening of this condition.

The measurement of PA levels in PW has been a challenge but the general PA patterns during pregnancy presents a tendency to decline due to factors such as: excessive weight gain, backache and edema, which may hinder locomotion [5].

There are a number of pregnancy-induced physiological and psychological changes that can lead a PW to set barriers against exercise. Pregnancy can be associated with increased symptoms of anxiety, fatigue, weight gain, distortion of the body image [10] and sometimes depression. Yet, paradoxically, these problems can be attenuated by the practice of PA, as suggested in studies with non-pregnant women [11].

Pregnancy is an event that leads to a decrease in PA [12]. Chasan-Taber et al. [13] conducted a prospective cohort study from 2000 to 2004 among healthy Latina prenatal care patients in a public clinic and midwifery practice and found that physical activity decreased from prepregnancy to pregnancy. Fell et al. [12] also found this decrease comparing PA during early pregnancy to the year before pregnancy.

Melzer et al. [14] examined the relation between recommended levels of PA during pregnancy and pregnancy outcomes. They conducted an observational study in 44 healthy women in late pregnancy. Active women, who engaged in >30 minutes of moderate PA per day, had significantly better fitness and lower sleeping heart
rate compared to the inactive and the risk for operative
delivery was lower in active women compared to inactive.

Some studies have already been developed with the
objective of assessing PA during pregnancy [5,15-17].
Tools such as questionnaires and accelerometers may
be used in order to determine this behavior [18,19].
The socioeconomic and cultural differences restrict
the usage of some questionnaires which were created
in developed countries because they investigate PA
in leisure time or recreational sports which are rarely
practiced by women low socioeconomic level's, who
predominantly are occupied with housechores PA [20].

Pedometer is a valid option for assessing PA in
research [21]. The first study that used pedometer
to measure PA in PW was conducted by Ogita et al.
[22]. Body activity were measured in 140 PW for each
week of gestation and the results showed decreases in
walking from 25th and later from 36th week of gestation.
A study conducted by Poudevigne & O'Connor [23]
compared levels of PA during the second and third
trimesters in PW and non-pregnant women. They
used two types of questionnaires and a monitor sensor.
Only one of the questionnaires showed a significant
positive and moderate correlation with the monitor
sensor (r= 0.41) and the number of movements reg-
istered by accelerometry using the MTI between the
1st and 3rd trimesters of pregnancy dropped by 23%.

To determine the usefulness method of measure-
ment of PA in PW, Lindseth and Vari [15] compared
the self-reported exercise diary to the pedometer.
The results showed that 6-day pedometer counts in
pregnancy correlated significantly (r = .49, P < .02)
with the women's minutes of exercise self-reported in
their diaries on the same days.

Studies measuring PA level in Brazil have been in-
creasing. It is important to assess PA and check if PW
are following the recommendations to develop all
the benefits that PA can afford. Thus, the purpose of the
present study was to analyze the PA level by trimester
of pregnancy and to multiples measurements of PA
using correlations in Brazilian pregnant women.

Materials and methods

Sample

The sample consisted of PW who were at least in
their fourth week of pregnancy, aged 16 to 40 years,
and who had no medical restriction to PA. One hun-
dred and twenty four PW were recruited, of which
30.3% (n=37) did not agree to use a pedometer and
1.6% (n=2) had medical restrictions against it. Among
the PW who did accept to wear the pedometer, 22%
(n=28) ended up not using the device since they were
close to labor. The final sample was composed of 57
PW who used the device (Figure 1).

The study subjects were assisted by the public pre-
natal program from the city of Sao Caetano do Sul in
Sao Paulo State. All of the recruited PW participated
in meetings that included education sessions on preg-
nancy, promoted by the Healthcare Surveillance Office
of São Caetano do Sul; they were informed about the

Would you like to use a step counter (pedometer) to know how many
steps you walk in a week?

YES

Answer IPAQ and
personal information

Deliver the pedometer and
give the instructions

Contact after 7 days: Are
your calendar in day?

YES

Answer
IPAQ
N=57

NO

NO

Explain why and
answer IPAQ

Next
delivery
N=32

Contra
indication
N=4

Ask why not
N=29

Fig.1. Recruitment sample
objective of the study and signed the informed consent.

**Data Collection**

In order to determine the PA level for each gestational trimester, the shorter version of the International Physical Activity Questionnaire (IPAQ), short form was applied in face to face interview. The IPAQ contains questions regarding the frequency and duration of walking, as well as moderate-intensity PA, including daily routine activities – house chores, occupational and leisure [24]. IPAQ’s validity (0.46 - 0.75) and reliability (rho=0.69 - 0.71 \( P < .01 \)) in Brazil were similar and acceptable compared to other physical activity instruments. The questionnaire was answered twice by those who agreed on using the device at baseline and seven days later.

The analysis of the IPAQ results were conducted according to the consensus between CELAFISCS and the Center of Diseases Control (CDC), considering the criteria of frequency (days/weeks) and duration (minutes/day), and dividing respondents into four categories [25]:

- **Sedentary**: did not practice any physical activity for at least 10 continuous minutes during a week.
- **Irregularly active**: practiced physical activity, though not enough to be considered active, since the total frequency and duration of the different types of activities (walk + moderate + vigorous) did not meet the minimum recommendation.
- **Active**: followed the recommendations
  a) Vigorous: \( \geq 3 \text{ days/week and } 20 \text{ minutes per session} \)
  b) Moderate or walk: \( \geq 5 \text{ days/week and } \geq 30 \text{ minutes per session} \)
  c) Any activity that totaled: \( \geq 5 \text{ days/week and } \geq 150 \text{ minutes/week (walk + moderate + vigorous)} \)
- **Very active**: followed the recommendations
  a) Vigorous: \( \geq 5 \text{ days/week and } 30 \text{ minutes per session} \)
  b) Vigorous \( \geq 3 \text{ days/week and } \geq 20 \text{ minutes per session} + \) moderate and/or walk: \( \geq 5 \text{ days/week and } \geq 30 \text{ minutes per session} \).

Total energy expenditure in a week was calculated in metabolic units (MET), by multiplying the frequency and duration of each type of PA by a value that varies according to intensity – 3.3 for walking; 4.0 for moderate-intensity PA; and 8.0 for vigorous.

After receiving the PW consents, the following de-

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![Fig. 2. Day's calendar example](image)

If you did sports OR exercise, write down the **TYPE** of activity you did, and how much **TIME** you were active.

For example,
- **shopping 1 hour**
- **walk 30 minutes**
mographic information were: pregnancy week, weight before pregnancy and at the time of the interview, body height, parity, place of birth, ethnicity, marital status, educational level, occupation, family income, smoking habits, PA before pregnancy, last menstruation date and expected delivery date.

In order to quantify the number of steps, a Yamax Digiwalker (model SW-200, Japan) pedometer was used. The protocol for the pedometer use was proposed by Tudor-Locke et al. [18], and consisted of using the pedometer attached to clothes, so that the device remained at the waistline, leveled with the iliac crest, for seven consecutive days. Besides the pedometer, the PW were given written instructions on its use and a seven-day diary to record the dates and time the device was worn, the time it was taken off and the total number of steps recorded during each day. The PW also had to answer four objective questions every day of the 7 days (Figure 2). In the event of a positive answer, the type and duration of the activity was requested [18]. The PW were told to not restart the device's step-counter every day so that the total number of steps taken during the week could be recorded on the seventh (last day) the device was used.

**Data analysis**

Mean and standard deviation of the frequency and duration of the physical activities described in the IPAQ, the total number of steps and METs were calculated according to each trimester of gestation. The Kruskall-Wallis analysis was used to compare the three gestation trimesters. The variables for each trimester were compared using the Friedman and Mann-Whitney U analyses, to determine potential differences. Pearson's correlations were also used to verify the association between the number of steps and the total weekly energy expenditure, in METs. The significance level used was set at 0.05.

**Results**

The sample aged from 16 to 40 years old, comprised 47.4% of primiparae, 44% of which were from Sao Caetano do Sul, 26% from Sao Paulo State and 28% from other states, mainly from the Northeast, Brazil. Fifty five percent reported being married, 27% were non-legally partnered and 15% were single. Forty two percent were Caucasian, 16% were from African descendants and the remaining 42% were from Asian origin or mixed races. Forty seven percent of the PW completed high school and 5% completed university. Fifty-one percent were unemployed. Sixty-seven percent of the PW were sedentary before their pregnancy.

Table 1 shows characteristics of the PW who answered the IPAQ.

The IPAQ results for the 122 PW are shown in Table 2. The PW in the second trimester did significantly less moderate-intensity PA when compared to the PW in the first and third trimesters. The second trimester PW presented significantly lower moderate-intensity PA (*P < .05*) duration than the first and third trimesters.

Fifty-seven PW wore the pedometer. The number of steps during the seven days of the week was ana-
lyzed and all three groups had a larger number of steps taken on weekdays (Monday through Friday) than on the weekend (Table 3). PW in the second trimester presented the largest differences (Δ = 35.8%); they walked a lot more on weekdays than on the weekend. PW in the first trimester walked 17.3% more on weekdays than on the weekends, and the PW in the third trimester showed almost no difference (Δ = 0.5%) in the number of steps between weekdays and weekends. There was no significant difference from one trimester group to the other in the number of steps. The highest difference between weekdays and weekends was during the second trimester (Δ = -26.3%). Figure 3 shows the mean values of each day of the week (from Monday to Sunday) per trimester.

The correlation between the number of steps and total weekly energy expenditure in METs (total sum of walk, moderate and vigorous physical activity) was significantly weak (r= .15; \( P < .05 \)). However, when we analyzed the association between the number of walking steps and the energy expenditure in METs trimester. A longitudinal study could be more effective to understand this phenomenon.

The longitudinal study conducted by Poudevigne & O’Connor [23] showed that the number of movements detected by the MTI motion sensor decreased (23%) in PW from the first to the third trimesters, a feature undetected by two questionnaires applied in the sample.

In our study, when we analyzed the total weekly energy expenditure in METs (Table 1), PW in the first trimester were more active when compared to the ones in the second trimester (Δ = 24.2%), and that behavior repeated itself in the average number of steps taken per day (Table 2). PW in the second trimester were less active than the ones in the first, as observed in the total weekly METs as well as in the average number of steps taken per day (Table 3).

Our sample was predominantly low-income. In developing countries as Brazil, the lowest women’s involvement with the practice of exercise directs at attention to occupational and domestic activities [20].

The IPAQ was answered by interview. When PW were asked about how often they walked, for example, they answered based on how many times they went to the supermarket, visited someone, or went to the clinic. In the questions about moderate-intensity PA, they answered based on cooking, cleaning the house, sweeping, washing, and ironing clothes. In the vigorous type, their examples were cleaning the bathroom, walking in side-walks, and washing clothes by hand. These findings suggest that PW could spend too much time in a standing position which could be a risk for low birth weight. All these activities require a lot of time in standing position. Takito et al. [26] evaluated the effects of walking and maternal posture on birth weight, in 152 low-income Brazilian PW. A questionnaire was elaborated to evaluate the frequency and duration of daily PA during the last week. Close to 60% of the PW walked for less than 30 minutes per day. The univariate analysis suggested that there was a protective effect on birth weight in PW who walked for at least 50 minutes a day during the first trimester. Whereas, in the second trimester, remaining in a standing position for over two and a half hours per day was considered by the authors as

### Table 3. Number of steps (x ± s) in PW according to gestational period

<table>
<thead>
<tr>
<th></th>
<th>1° Trimester (N=6)</th>
<th>2° Trimester (N=23)</th>
<th>3° Trimester (N=28)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekdays</td>
<td>11.264.6 ± 5.676,8</td>
<td>7.392.7 ± 4.955,9</td>
<td>6.614.9 ± 3.691,0</td>
</tr>
<tr>
<td>Weekend</td>
<td>9.600.1 ± 7.348,0</td>
<td>5.441.5 ± 3.785,7</td>
<td>5.767.6 ± 3.934,0</td>
</tr>
<tr>
<td>Total weekly</td>
<td>10.789.0 ± 5.933,6</td>
<td>6.812.1 ± 4.092,4</td>
<td>6.746.8 ± 3.572,0</td>
</tr>
</tbody>
</table>

![Figure 3. Number of steps per day of pregnant women according to gestational trimester during one week](image)

(frequency x duration x 3.3), the correlation, although weak was significant (r= .36; \( P < .05 \)).

### Discussion

The purpose of this study was to analyze the PA level in three different groups of PW in each trimester of gestation. In the self-reported assessment (IPAQ), the 2nd trimester group related less duration of moderate-intensity PA type compared to 1st and 3rd
a risk for inadequate birth weight [26]. Therefore, despite our sample had performed many activities in a standing position, it seems that it was not considered a risk to their babies.

The type of physical activity during pregnancy in the sample reported that they had warrants attention. Stamatakis et al. [27] analyzed the impact that domestic activities had on cardiovascular disease prevention in 14,836 adults, and concluded that this type of PA contributed to high energy expenditure, as well as an increase in PA levels. On the other hand, some researchers have shown that benefits of PA, especially the psychological, for PW can be earned when they engaged in leisure time [7,9,28-30].

Pereira et al. [31] explained that there are many factors that can prevent a woman from practicing leisure physical activities during or after pregnancy. Factors such as the socio-economic level, number of children to look after and domestic tasks are a few examples. In the study by Takito et al. [26] PW reported a higher frequency of daily PA such as sweeping, cooking, washing and ironing clothes, even though cooking and washing clothes represented a significant statistical risk for inadequate birth weight, as the PW increased the frequency of those tasks.

Our study also showed that there was a low but significant correlation (r=0.36; P<0.05) between the pedometer and the question in the IPAQ related to walking. Studies with pedometers confirmed that this instrument is not capable of detecting PA intensity [32]. In the study by Lindseth & Vari [15], two PA measures were compared: a PA diary and a pedometer. The correlation between both instruments was significant and moderate-intensity (r=0.49; P<0.05). In addition, some types of activities - such as child care, housework, lifting, biking, and swimming - cannot be adequately measured by the pedometer but may be important in studies examining activity in pregnancy [15].

By analyzing the PA level of PW, we were able to conclude that although the pattern of PA was similar among the three trimesters, moderate-intensity PA was lower in the second trimester. This PA decrease could be explained by the marked decline in PA levels on the weekends during the second trimester. A longitudinal study might be more appropriate to evaluate this phenomenon. The IPAQ seemed to be a good instrument to evaluate the PA level of PW.

One weakness in the study could be that the participation in the Healthcare Surveillance may have changed women's physical activity pattern and their behavior did not represent the usual physical activity level. Another limitation in this study is the number of participants who actually concluded the study: more than half of the sample did not want to wear the pedometer.

Health care professionals are encouraged to provide pregnant and postpartum women with information on recommendations of physical activity, particularly regarding the minimum duration and intensity level [33].

The present study suggests that orientation for the practice of physical activities during pregnancy should be more widespread available and reinforced, so that PW could enjoy the physical and psychological benefits of regular and moderate-intensity PA. PW can follow the same ACSM recommendations as non-pregnant women.

SYNOPSIS: assessing physical activity in pregnant women, especially in developing countries is a way to identify if PW follow PA recommendations.

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References


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**Authors’ contribution**

A – Study Design

B – Data Collection

C – Statistical Analysis

D – Data Interpretation

E – Manuscript Preparation

F – Literature Search

G – Funds Collection