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Determination of Energy Expenditure during Pregnancy and its Comparison to the Compendium of Physical Activity Values: A Pilot Study

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ABSTRACT

DAHMER, L. K., COE D. P., HATZEL B. Current exercises recommended during pregnancy are prescribed at the same intensity as the general adult population, 3-6 METs. It is unclear whether these MET values can be applied to the pregnant population.

Purpose: To determine energy expenditure of pregnant women while participating in three exercises, walking 3.5mph, stationary biking at 100watts, and prenatal aerobics during the second and third trimesters. And second, to determine whether the energy expenditure of the exercises would change from the second to third trimester. **Methods:** Participants were 3 women, ages 23-32, in their second trimester (weeks 14-26) of an uncomplicated pregnancy at commencement of the study. Subjects were cleared by their health care provider to participate in moderate physical activity during their pregnancy. Subjects reported to the Human Performance Lab twice, once during the second trimester and once during the third trimester, with at least 6 weeks between visits. During each visit, subjects participated in a resting state and were then randomly assigned the order of participation in stationary biking, walking, and prenatal aerobics. Resting metabolic rate and energy expenditure were assessed using the Viasys Oxycon Mobile unit. Resting metabolic rate was recorded in METs, absolute and relative oxygen consumption. Heart rate (using telemetry, Polar) and RPE (Omni, 0-10 scale) were also assessed during this time. Data was analyzed using a sample t-confidence interval test to compare the means of each activity during the second trimester to Compendium values (rest (1.0METs), biking (5.5METs), brisk walking (3.8METs), and aerobics (5.0METs)) and to compare the means of each activity during the third trimester to Compendium values. A paired t-test was used to compare values between the two trimesters. **Results:**

	Resting 2 nd	Resting 3 rd	Biking 2 nd	Biking 3 rd	Walk 2 nd	Walk 3 rd	Aerobics 2 nd	Aerobics 3 rd
Mean	1.03	1.05	5.41	5.50	4.52	4.53	3.71	3.43
Confidence Interval	(0.92, 1.13)	(0.72, 1.38)	(4.29, 6.51)	(4.37, 6.63)	(3.52, 5.52)	(4.08, 4.97)	(1.83, 5.58)	(2.19, 4.67)

The correlation coefficients for the exercises were: biking .931, walking .539, and aerobics .647. The p-values did not show evidence of a significant difference in any exercise between the 2nd and 3rd trimesters. **Discussion:** While correlation coefficients were high or moderate, the p-values were not significant due to the low sample size. The average METs for walking during both trimesters, while falling within the confidence interval were still above the recommended values from the Compendium. The average METs for aerobics declined from 2nd to 3rd trimester. This could be due to subjects learning from previous interaction with the prenatal aerobics video. More subjects are needed to be able to draw any conclusive evidence.

Keywords: Pregnancy, Pregnant, Exercise, Compendium, Compendium of Physical Activities, PARmed-X, PARmed-X for pregnancy, Stationary cycling, Walking, Prenatal aerobics, Women, Prenatal, Moderate intensity, Special population

Introduction

Regular exercise during pregnancy provides benefits to the mother and child (5, 6). Benefits include reduced risk of excessive weight gain and a decreased risk of development of conditions associated with pregnancy such as gestational diabetes mellitus and pregnancy induced hypertension (7). The recommended exercise prescription for pregnant women is generally consistent with recommendations for the general adult population. These recommendations include aerobic activity performed at least 3 days per week (preferably daily) at a moderate intensity (40-60% of VO_{2max}) for at least 15 minutes per day increasing to 30 minutes per day of accumulated activity (4). However, it is important to monitor and adjust exercise prescriptions according to the woman's symptoms, discomforts, and abilities during pregnancy.

Moderate intensity can be categorized as activity equivalent to 3-6 METs. Activities that meet these equivalents and are recommended during pregnancy include walking at a brisk pace, stationary cycling, and aerobic dance (1). According to the Compendium of Physical Activities, each of these activities falls within the 3-6 MET range (2, 3). However, it is unclear whether these MET values designed for non-pregnant adults can be applied to the pregnant population.

The purpose for this study was to determine energy expenditure of three exercises which are recommended for pregnant women during the second and third trimesters. A secondary purpose was to determine whether the energy expenditure of the three exercises will change from the second to the third trimester.

Methods

Participants were 3 women, ages 23-32, in their second trimester (weeks 14-26) of an uncomplicated pregnancy at commencement of the study. Subjects were cleared by their health care provider to participate in moderate physical activity during their pregnancy. Prior to participating in this study, subjects signed an informed consent form and filled out a PARmed-X for pregnancy (8) (including health care provider clearance) to ensure ability to engage in physical activity while pregnant. Subjects reported to the Human Performance Lab twice, once during the second trimester and once during the third trimester, with at least 6 weeks between visits.

The three exercises assessed were: walking briskly, stationary cycling, and low impact aerobics. All of these exercises are recommended for pregnant women at a moderate intensity. Intensity of each of these exercises was determined using the Compendium of Physical Activities and are listed as follows:

17200 3.8 METs Walking, 3.5 mph, level, brisk, firm surface, walking for exercise

02012 5.5 METs Bicycling, stationary, 100 Watts, light effort

03020 5.0 METs Aerobic Dance, low impact

Subjects walked on a treadmill at 3.5 miles per hour on a flat surface (0% grade).

Subjects cycled on a Corival Lode electronically-braked cycle ergometer at a pace that was comfortable. Resistance was automatically adjusted based on pedal speed to create a workload equivalent to 100 Watts. The prenatal aerobics video was a low impact

aerobics for pregnancy DVD that took the subjects through 10 minutes of low impact aerobic activity.

On both visits, resting metabolic rate was assessed using the Viasys Oxycon Mobile unit and recorded in METs, absolute and relative oxygen consumption. Heart rate (using telemetry, Polar) was also assessed during this time. Subjects lay in the left lateral position in a quiet environment for 30 minutes. No food or drink (except water) was to be consumed for at least two hours prior to testing.

After the resting state, subjects were randomly assigned the order of participation in stationary cycling, walking, and prenatal aerobics. Energy expenditure was assessed using the Viasys Oxycon Mobile unit. Heart rate (using telemetry, Polar) and RPE (Omni, 0-10 scale) were also assessed during this time. Target heart rates were adapted from the PARmed-X for Pregnancy:

Years of Age	Heart Rate
20-29	135-150bpm
30-39	130-145 bpm

On the Omni scale of RPE, moderate intensity for pregnant women is between 3 and 6. The researcher was instructed to stop activity if the subject's heart rate went above recommended levels for more than 1 minute or if RPE was reported above 6.

Table 1: Target HR from PARmed-X for Pregnancy

Data was analyzed using a sample t-confidence interval test to compare the means of each activity during the second trimester to Compendium values (rest (1.0METs), stationary cycling (5.5METs), brisk walking (3.8METs), and aerobics (5.0METs)) and to compare the means of each activity during the third trimester to the Compendium of Physical Activities values. A paired t-test was used to compare values between the two trimesters.

Results

	Resting 2 nd	Resting 3 rd	Biking 2 nd	Biking 3 rd	Walk 2 nd	Walk 3 rd	Aerobics 2 nd	Aerobics 3 rd
Mean	1.03	1.05	5.41	5.50	4.52	4.53	3.71	3.43
Confidence Interval	(0.92, 1.13)	(0.72, 1.38)	(4.29, 6.51)	(4.37, 6.63)	(3.52, 5.52)	(4.08, 4.97)	(1.83, 5.58)	(2.19, 4.67)

The correlation coefficients for the exercises were: biking .931, walking .539, and aerobics .647. The p-values did not show evidence of a significant difference in any exercise between the 2nd and 3rd trimesters.

Discussion

While correlation coefficients were high or moderate, the p-values were not significant due to the low sample size. The average METs for walking during both trimesters, while falling within the confidence interval, were still above the recommended values from the Compendium of Physical Activities. Due to the low sample size, the results cannot be said to be conclusive, however the higher than recommended average MET levels for walking suggest that further investigation needs to be done.

The average METs for aerobics declined from 2nd to 3rd trimester. This could be due to subjects learning from previous interaction with the prenatal aerobics video. More subjects are needed to be able to draw any conclusive evidence.

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