Effect of Physical Activity During Pregnancy on Birth Outcomes in Mothers Presenting at the Antenatal Clinic of De Soysa Maternity Hospital, Colombo 08

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Abstract - *According to national recommendations women should be physically active during pregnancy. The relation between physical activity during gestation and pregnancy outcomes in Sri Lankan women is poorly understood. The present study assessed whether, in a general obstetric population, prenatal physical activity affects birth outcomes. A cohort of 78 pregnant mothers was carried out from mean gestational age of 217 days, until the time of delivery. 18 to 35 age, singleton, primigravid pregnancies, were randomly assigned from the prenatal outpatient care at De Soysa Maternity Hospital, Colombo 08. Physical activity level was determined using an interviewer administrated questionnaire. Gestational age, infant birth weight, labor pain, mode of delivery and duration of labor were adopted as outcome criteria. Chi Square Test was performed using Statistical Package for Social Sciences (SPSS) 17.0 version. The occurrence of emergency caesarean delivery was significantly related to the prenatal physical activity level. (p = 0.015).Mildly active women were observed to have a greater risk.All other outcomes assessed were statistically unrelated to the level of physical activity in gestation. In light of the obtained results, physical activity during pregnancy does not appear to significantly influence the birth outcomes, except in terms of mode of delivery.*

Key words: *Low birth weight, Physical activity, Preterm births*

INTRODUCTION

During past decades effect of physical activity during pregnancy has been established as a research interest. This has created a move towards standardization of the prenatal physical activity level recommendations [1]. Accordingly, the most popular recommendation is, " In the absence of either medical or obstetric complications, 30 minutes or more of moderate exercise a day, on most, if not all days of the week is recommended for pregnant women" [2]. In spite of the recommendations, the prevalence of physical activity across gestation yet seems to be low among the obstetric population worldwide [1], [3]. In Sri Lanka, misbeliefs and fears based on cultural and social norms are the major reasons for this low prevalence. Given the large diversity of physical activity, most frequently researchers have made attempts to determine the effect of only one or two domains of physical activity. In earlier research, effect of occupational exposures have been the main focus. A great deal of studies has found unfavourable outcomes [4] - [6]. On the contrary, effect of leisure time physical activity appears to have a substantial positive effect on birth outcomes [7] - [9]. With the tendency towards aerobic exercise, research evaluating the effects of structured exercise programmes during pregnancy are on the rise [10], [11]. Either occupational or recreational, the general evidence base is not consistent. In addition to these, a considerable number of research has studied the effect of prenatal physical activity as a whole [12]-[14]. Since the conflictions of results interfered with the balance of evidence, the impact of prenatal physical activity on birth outcomes is still on debate. The objective of this study was to determine whether prenatal physical activity is effective in reducing the risk of prematurity and low birth weight, minimize the pain perceived at labor and the length of labor.

MATERIALS AND METHODS

2.1 Study Design and Population

A cohort study was done with a sample of 78 pregnant mothers. Study subjects were recruited from the population of women attending prenatal outpatient

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care at De Soysa Maternity Hospital, Colombo 08, between February and August 2013. Pregnant mothers of between 18 to 35 of age, first parity, singleton gestation with completed 30 weeks were randomly assigned to the study. Carrying multiple gestations, multi gravidity, pre-existing, ongoing medical conditions or any obstetrical complication and elective caesarean section were used as exclusion criteria.Simple randomization approach was implemented. Of mothers who matched with inclusion criteria a hundred was drawn using a shuffled deck of cards. Among the enrolees, one reported a neonatal death, four were withdrawn. In addition, final analysis subsequently excluded 17 participants due to repeated failure to follow up, inability to refer to De Soysa Maternity Hospital for delivery as their pregnancy outcomes were unknown. The analytical sample therefore reduced to 78 women.

2.2 Assessment of Physical Activity

To determine the level of physical activity a stranded questionnaire and a dairy card (PIN3 physical activity questionnaire) were used. Apart from the initial recruitment, two pregnancy interviews were carried out at two different times during gestation to assess gestational age specific physical activity level. A brief post-partum interview was done in order to collect data on labor pain. The first pregnancy interview was done around mean gestational age of 224 days. Participants were questioned with regard to the physical activity they performed at home, at occupation as well as transport. They were asked about the types of physical activity they often engaged in. In depth queries were made, only on activities that caused at least some increase in breathing or heart rate. Therefore data on sedentary activities, such as watching television, reading or sewing, were not collected. Questions were correlated to predefined categories of physical activity as recreational, outdoor, indoor, child and adult care, transportation, work and other activities[15]. Mothers were further questioned about lifting and carrying weights, standing for a long period and stair climbing, either at occupation or at home. Frequency and duration for each activity were noted down. The questionnaire was designed to recall activity during the week prior to the interview. The participants were questioned on how many times in the past week and on average for how many minutes or hours usually they engaged in that particular activity. Women were interviewed again around the mean gestational age of the 252 days.A small percent (7%) of these interviews were done over telephones. At each session the diary cards were collected back from the participants. At the postpartum interview, which was carried out on the following day after delivery, perceived intensity of pain at child birth was recorded. Patients were taught about the pain visual analogue scale by the time of second pregnancy interview to avoid difficulty in understanding in postpartum.

2.2.1 PIN3 physical activity questionnaire:

This interviewer administrated questionnaire has been developed to recall physical activity which has been performed during the week prior to the interview. The questionnaire has been developed to capture moderate and vigorous physical activity done in predefined categories of physical activity. Recreational, indoor household activity, outdoor household activity, adult and child care, transportation, work & school activity and other activity were the categories included. For each activity, in these categories, participants were questioned on the sessions per week and duration of one session. Moreover the respondents were asked to report the perceived level of intensity at each activity corresponding to the modified Burg scale. Upon completion, total hours per week spent for each activity was calculated and added together [15].

2.2.2 PIN3 dairy card:

"The structured diary card was developed as a way of assessing the evidence for concurrent related validity of the PIN3 physical activity questionnaire" [15]. For the present study it was translated in to Sinhala and Tamil and back translated into English. The aim of this card was to collect all levels of physical activity performed during one week. Activity, the frequency, duration and intensity had to be filled out according to instructions given in the back of the card. Participants were requested to return the card at the end of the week when they were interviewed. Scoring was similar to the PIN 3 physical activity questionnaire [15].

2.4 Delivery Assessment.

This was assessed using Pain visual analogue scale (PVAS) and patients' medical charts.

2.4.1 Pain visual analogue scale (PVAS).

PVAS is a 100 mm horizontal line, labelled at the extremes as "no pain" and "worst imaginable pain". Participants were requested to mark the pain intensity they felt. Measurements were done from zero to the

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patients 'mark with a centimetre scale. (The National Initiative on Pain Control[Tm])

2.4.2 Patients' medical charts.

Patients' medical charts complied by medical personnel at the labor, were used to collect data on mode of delivery and length of labor. When unavailable, self-report was used.

2.5 Statistical Analysis.

The collected data were analysed using SPSS statistical software programme, version 17. Two sets of analyses were done. The main analysis was to distinguish any existing relation between prenatal physical activity and the dependent variables, which were preterm birth, birth weight, labor pain, mode of delivery and the length of delivery. Associations were evaluated by Chi Square Test. P value of less than 0.05 was considered significant. In another separate analysis, Chi Square test was repeated to examine a possible effects arising from certain physical activity that are considered as strenuous in pregnancy. Stair climbing, frequent lifting, walking for a purpose were the activities considered. In addition, odds ratios and 95% confidence interval were also estimated.

2.6 Ethical clearance

Ethical clearance was obtained from the Ethics Review Committee of the Faculty of Medicine, University of Colombo, Sri Lanka and the Director, De Soysa maternity hospital, Colombo 08.

RESULTS

Descriptive characteristics and distribution of pregnancy outcome among the study population: The study population consisted of seventy eight primi gravid mothers with singleton pregnancies. Of them the majority, 85 percent, were Sinhala speaking mothers. Average maternal age among the seventy eight women was 28.36. Almost one half of them were within age of 28 and 32. More than a fifth engaged in an occupation, even in late pregnancy. In general this study sample had more education. More than 80 percent had completed their secondary education. There was one reported neonatal death. Almost all the participants received a good antenatal care. Approximately one third of women in the sample had emergency caesarean delivery.

Table 1 follows the results from Chi Square Test and the Odds Ratio. **A significant relation was found between maternal physical activity during pregnancy and the mode of delivery.**Women who failed to engage in physical activity to meet the recommendations were more likely to have emergency caesarean deliveries compared with their moderately active counterparts. (p = 0.015).Except for the mode of delivery, no significant difference was seen between maternal physical activity level and any of the other variables assessed. The incidence of preterm birth was 8.9%. The average gestational age difference is 0.27. The birth weight averaged at 3.01606 kg and 2.24989 kg in moderate and mild groups respectively. Prenatal physical activity level did not appear to be significantly associated with the pain at labor. (P= 0.732). However tests for Odds indicated, women who were mildly active across pregnancy had a higher risk of experiencing a severe pain at child birth, compared with moderately active women.Average length of labor was 1.47 hours lesser among less active women compared with moderately active women (p=0.563).

Table 1. Relationship between maternal prenatal physical activity level and the outcomes.

	Maternal Physical Activity Level		P value	OR	95% CI
Variable	Mild N= 47	Moderate N=31			
Gestational age (%) (<37 weeks)	3.2	12.7	0.149	4.39	0.503-38.403
Low birth weight (%) (2500 kgs)	16.1	14.5	0.882	0.91	0.261-3.174
Mode of delivery (%) (Emergency Cessareans)	**41.93**	**17.02**	**0.015***	0.284	0.100-0.806
Labor pain (%) (>7 in PVAS)	16.1	20.5	0.732	1.29	0.229-5.573

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Table 2: Association between strenuous physical activity and the outcomes.

Variable	%	Preterm births		LBW births		Emergency Cesareans	
		%	p	%	p	%	p
Climbing Stairs							
Yes	18	35.71	0.000	53.3	0.000	7.1	0.055
No	82	3.1		6		31.25	
Walking (For purpose) (4<day/wk)							
Yes	46	11.11	0.541	22.8	0.099	11.11	0.004
No	54	7.7		9.3		40.47	
Lifting objects							
Yes	44	20	0.002	27.77	0.005	11.42	0.005
No	56	-		4.76		39.53	
Occupation							
Yes	23	27.7	0.001	38.8	0.002	11.76	0.111
No	77	3.39		8.33		31.14	

An additional analysis was done to determine whether certain physical activities, which are considered as strenuous in pregnancy, are correlated with the birth outcomes. Climbing stairs, walking for transportation more than 4 days per week and lifting weights more than six kilograms either at home or at employment were the activity domains tested. In addition, the relation of occupation was also assessed. These activities were found to be associated with unfavourable birth outcomes in terms of gestational age, infant birth weight and labor pain.

DISCUSSION

The aim of this study was to identify the association between maternal physical activity during pregnancy and birth outcomes in Sri Lankan women. Gestational age and infant birth weight were the main outcomes of focus. Influence of prenatal physical activity on labor pain, length of labor and mode of delivery were also studied. All the participants were reckoned either into moderately or mildly active groups according to the MET values used in measuring physical activity level. Of them 60% (n=47) were moderately active by the time of the first pregnancy interview. Generally, almost all participants engaged in similar activities in housekeeping activity domain, with varying durations and frequencies. Engaging in exercises was rare. Walking was the most preferred recreational activity, yet infrequent (11%, n=9). Some women reported stair climbing, frequent lifting, walking for transportation and activities related to child care. Sixteen percent (n=13) of women continued their occupation late into gestation. By the time of the second pregnancy interview the figure was practically identical, with an inconsiderable diminution in outdoor activities and walking.

Incidence of preterm birth was 9% corresponding to a total number of seven. There appeared no significant relation(p=0. 149), between preterm births and the maternal physical activity characteristics considered. This finding is generally consistent with a considerable number of studies in literature [16]-[21]. The findings of the present study further agree with a systematic analysis of 3,313 articles, in which the overall findings have indicated no apparent association between maternal physical activity and gestational age of their offspring [22]. These results are inconsistent with the findings of some studies where either a protective or an adverse relationship between vigorous physical activity and preterm births has been found. Yet, these studies have addressed solely one type of physical activity instead of assessing physical activity as a whole [15], [23]-[25]. The Odds on gestational age showed two folds greater risk, which was not scientifically significant, in the moderate group. It is assumed that the relatively small number of preterm births in both groups might have resulted in these excess odds. More importantly, it is worth to note a considerable proportion of women gave birth to premature infants around completed 224

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days of gestation. Since the current study particularly focused on physical activities during last trimester, this proportion could not be adequately interviewed and had to be excluded from the final analysis. The additional analysis showed significant influences of stair climbing, lifting weights and employment late into gestation on the gestational age.

Infant birth weight and labor pain also did not indicate a scientific relation with the physical activity level during pregnancy. Both of these outcomes were seemed to have in higher odds among the mildly active group. Low birth weight incidence was moderately low (15.4%) in the current study population as it was seen with preterm births. Birth weight averaged at 2.98 kg. The highest mean birth weight was observed to be in the infants of moderately active women. The findings of the present study extends the findings of a number of studies [17], [19]-[22], [26]-[29] yet identifies controversies and conflicting findings with a handful of earlier studies [5], [16], [30], [31]. Three types of physical activities in particular seemed to pose a negative effect on the birth weight. Likewise, stair climbing, lifting heavy weights and occupation in late pregnancy were observed as hazardous. Of these, impact of stair climbing was seen to be almost identical to its effect on the duration of gestation. Effects of repetitive lifting of heavy weights and employment were comparatively lesser on neonatal weight at birth than their effects on gestational age.

The Pain Analogue Visual Scale score in the majority (80%, n=46) was more than seven. As for the Odds the highest possibility of experiencing a severe pain was observed among mildly active women ($p=0.732$, OR = 1.29). Nevertheless, there appeared no significant relation between physical activity level and the perceived pain at delivery which averaged at 8.321 in this study population. **Prenatal physical activity level was significantly related to the mode of delivery** ($p = 0.015$). Mothers who were mildly active were discovered to have three folds greater odds compared with the moderately active women. Twenty seven percent of women had emergency caesarean deliveries. Of them nearly two thirds (n=13, 62%) were mildly active during gestation. This is in agreement with the findings of several studies [24], [29], [32].

In the current study population, the duration of labor did not exhibit a significant difference with respect to the maternal physical activity level during pregnancy. This is equivalent to the findings of some earlier studies [17], [20], [33] where no convincing effect of last trimester physical activity on the length of delivery was found. Mean length of labor was, 4.66 hours and it was observed that moderately active women had relatively longer deliveries.

CONCLUSION AND RECOMMENDATIONS

The purpose of this study was to identify associations between maternal physical activity performed in pregnancy and birth outcomes. Considering the observations, this research strongly suggests a relation between maternal physical activity level during pregnancy and mode of delivery. According to data, it is possible to conclude the incidence of emergency caesarean births is significantly increased among less active women. Prematurity or infant birth weight do not seem to be significantly influenced by prenatal physical activity level. However it was observed certain types of activities, in particular, were shown to increase the risk of incidence. Stair climbing, frequent lifting, occupation in late pregnancy were the activities which have been found to create unfavourable outcomes. Overall, the present data suggest an inverse relation between prenatal physical activity level and perceived pain at delivery, lesser the physical activity level greater the pain perceived at labor. Yet this association is not significant. Further, the length of labor also did not reach a scientifically significant association in the present study group.

It is acknowledged that the major limitation in the present study was the small sample size employed. Some of the outcome variables were therefore distributed in limited ranges within the study population. This sometimes hampered the identification of a true association. Physical activity levels of the participants were determined by the total MET hours per week. Code for each MET value was abstracted from the published metabolic tables (MET) in Compendium of Physical Activities [34]. It should be noted these MET values are meant for healthy non pregnant adults. A residual uncertainty related misclassification in exposure is therefore impossible to underestimate. Diary card and the responses for the questionnaire were self-reported and the questionnaire was designed to capture physical activities performed in the week prior to the pregnancy interviews. It was sometimes problematic to recall the number of hours or exact numbers of sessions. Thus a recall bias was most likely to occur. Measurement of the labor pain was also self-reported. Some of the participants were not able to accurately recall the intensity of pain which might have resulted in over or under reporting.

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Due to methodological flaws, it was difficult to obtain a true relation between physical activities during pregnancy on birth outcomes. Hence, it is necessary for the future studies to implement large prospective studies with high quality data collecting approaches. In the meantime women should be encouraged to remain active in pregnancy despite of all cultural and social norms.

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