PHYSICAL ACTIVITY AND PREGNANCY OUTCOME AMONG INDIAN WOMEN BELONGING TO HIGH SOCIOECONOMIC FAMILIES

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ABSTRACT

Objective: *This study was carried out to describe the relationship of the mother's physical activity to the pregnancy outcome.*

Material and Methods: *A total of 500 healthy women with uncomplicated singleton pregnancies were studied. Subjects belonging to high socio economic families from Mysore city, India participated in the study. An activity questionnaire according to WHO was used. Activity score were derived based on Basal Metabolic Rate (BMR) per unit body weight using published data. It was then administered to assess physical activity at initial time, 14±2, 28±2 and 38±2 weeks of gestation. Women were classified into very light, light, moderate and heavy activity categories based on their activity pattern.*

Results: *Mean energy intake of women at initial time was 1765 Kcal. This increased by 25% by the end of pregnancy (38±2 week) period, however energy expenditure was increased by 10%. Correlation computation revealed that higher maternal activity in first as well as second trimester was associated with lower mean birth weight and birth length, while no such effects occurred for third trimester after adjusting for the major confounding factors ($P<0.05$).*

Conclusion: *It can be concluded that excessive maternal activity during first and second trimesters leads to smaller fetal size in urban affordable families of higher socioeconomic status.*

Key words: *Activity Pattern, Pregnancy, Energy Intake, Pregnancy Outcome.*

INTRODUCTION

Economic development in recent years has led to changes in dietary consumption patterns accompanied by decline in levels of physical activity resulting in sedentary life styles.[1,2] Extent of these changes are proportional to industrialization and urbanization, however, the rural population continue to lead an active life. Life style and activity pattern during pregnancy has an important bearing on the health and well being of both the mother and growing fetus. Extensive physical activity while pregnant, in combination with poor nutrition, fatigue or harmful body posture adversely affect the pregnancy outcome.[3]

Low-income women living in urban areas in developing countries are often as active as those women living in rural areas, but the activities may not be as energy intensive.[4] This high degree of physical activity performed by women in developing countries is not offset by increase in energy intake. The resulting imbalance in energy supply is reflected in low weight gain, impaired fetal growth, and a decreased ability to sustain milk production.[5]

The data from French national survey documented that birth weight was not associated with maternal employment including standing work in the last trimester.[6] Rabin et al[7] also reported marginal increase in birth weight in British women doing full time employment and those having longer hours of sleep. However, the effect of energy expenditure, work and physical activity on intrauterine growth is uncertain as revealed by a systematic review of the available data in developing countries by Gopalan et al.[8] Nevertheless, such an effect would be consistent with biological principles, at least for work involving high-energy expenditure.[9] The present report analyses the activity pattern of women during the course of pregnancy and its impact on pregnancy outcome in affordable urban families in India.

MATERIAL AND METHODS

The subjects for this study were recruited from pregnant women attending the out patient prenatal clinics in private hospitals and nursing homes in urban Mysore city. A total of 500 women who conceived within 15-20 days at the time of investigation, volunteered in the study (written consent to participate in the study was obtained from each subject). They were followed up till one-week post delivery period. In this study, women from families with a monthly income more than Rs.10,000 were considered. All births were singleton without any congenital malformation. No study women had any illness likely to affect physical activity or pregnancy outcome during the course of study.

Time-disposition studies were done to map the physical activity patterns of pregnant women. Time spent on related activities was pooled and classified as very light, light, moderate, and heavy work on the basis of the FAO/WHO/UNU. Information thus generated was used for computing energy expenditures according to FAO/WHO/UNU.[10] [Table-1].

Maternal height was measured with a stadiometer accurate to 0.1 cm. Weight was measured with a spring balance accurate to 0.1 kg (calibrated after every 10 measurements). Birth weight was recorded on a Beam scale. Infant length was measured on an infantometer. Abdominal girth was measured by fiberglass tape at the level of umbilicus by cross over technique. Fundal height was measured as the distance between symphysis pubis and highest point of the uterine fundal, defined with a gentle pressure on a plane at right angle abdominal wall and was marked.

Hemoglobin was estimated by Cyanmethemoglobin method. Dietary survey was done by 24 h recall using standardized utensils. All estimations were undertaken in 500 pregnant women at four points i.e., initial time (15-20 days after conception), 14±2, 28±2 and 38±2 weeks of gestation and comparisons were made.

Data processing and statistical analysis were performed by using the SPSS 10.0. They were expressed as mean and standard deviation. Mean differences were evaluated by repeated-measures analysis of variance (ANOVA). Multiple regression and correlation analysis were used for comparisons.

GENERAL CHARACTERISTICS OF THE SUBJECTS (N=500)*

Characteristic	Value
Age (yr)	24.0 ± 4.2 (19-38)
Education (%)	
Elementary	11.8
College	38.0
Graduate	43.8
Post Graduate	6.4
Occupation (%)	
Housewife	91.2
Employed	8.8
Family size	4.2 ± 1.7 (2-6)
Parity	1.6 ± 0.7 (1-4)

*Mean ± SD, range in parentheses.

Table 2

RESULTS

General information about the selected subjects is presented in [Table-2], the mean age of women was 24.0 ± 4.2 years with a range of 19 to 38 years. Majority of women (43.8%) were graduates. Only small percentage of women were economically active (8.8%), more than 90% of the subjects were housewives. Mean parity status was 1.6, wherein 51.2% women were primi para.

Majority of women were found to be engaged in household work. The time allocation for physical activity indicated a significant difference in work pattern among pregnant women in three trimesters. An increase in time spent in

ENERGY COST OF ACTIVITY ACCORDING TO WHO CLASSIFICATION [MULTIPLES OF BASAL METABOLIC RATE (BMR) IN PARENTHESES].

Very light (<1.7 BMR)	Light (1.7-2.2BMR)	Moderate (2.2-2.8BMR)	Heavy (>2.8 BMR)
Sleeping (1.0) Sitting (1.1) Breastfeeding (1.5) Standing holding the child (1.6)	Cooking (2.0) Tailoring (2.1)	Scouring vessels (2.5) Bathing the child (2.7) Walking (2.8)	Arranging things and folding beds (3.1) Walking holding the child (3.2) Sweeping (3.2) Washing clothes(3.5)

Table 1

TOTAL TIME SPENT BY SELECTED WOMEN FOR DIFFERENT ACTIVITIES DURING PREGNANCY.

Variables	During pregnancy				F Value
	Initial	I tri. (14±2 week)	II tri. (28±2 week)	III tri. (38±2 week)	
Physical activity (hour)					
Very light (<1.7 BMR)	11.9±1.3	12.0±1.3	13.1±1.5	13.7±1.6	15.9**
Light (1.7-2.2 BMR)	5.7±0.7	5.9±0.7	6.1±0.9	6.9±1.0	634.5**
Moderate (2.2-2.8 BMR)	4.2±0.7	4.0±0.6	3.6±0.8	3.6±0.8	667.3**
Heavy activity (>2.8 BMR)	2.10±0.62	2.05±0.61	1.30±0.68	0.44±0.63	1976.7**
Energy intake (Kcal/d)	1765.0±217.5	1932.0±149.5	2052.0±183.4	2264.0±251.8	56.6**
Energy expenditure (Kcal/d)	1749.0±116.5	1824.0±114.5	1825.0±113.8	1928.0±119.8	4606.0**

The values represent Mean±SD; ** Significant at 1% level.

Table 3

very light and light activities, and decrease in moderate and heavy activities with advancing pregnancy was noticed (P<0.01). A mean increase of 3 hours per day in very light and light activities (11.9±1.3 to 13.7±1.6 and 5.7±0.7 to 6.9±1.0 hours) was observed whereas heavy activity decreased by 1.3 hours (2.10±0.62 and 0.44±0.63 hours) between the initial time to end of pregnancy (38±2 week). Energy intake significantly increased during pregnancy and was higher in third trimester as compared to initial time (P<0.01). A similar trend was noticed with regard to energy expenditure [Table-3].

A correlation test were performed to understand the effect of maternal activity on birth weight. The relationship between the level of physical activity in third trimester and birth weight is shown in [Table-4]. Correlation computation revealed that these parameters were negatively correlated except very light activity that had positive correlation (P<0.01). An inverse relationship was found to exist between the intensity of maternal physical activity and birth weight.

The results of multiple regression analysis done to study the impact of physical activity and various factors on weight and length of infant at birth is given in [Table-5]. As evident from the table, heavy activity in first and second trimesters exerted a significant effect on birth weight and length. However heavy activity performed in the third trimester did not exhibit any influence in both the parameters. Mother's weight in the initial time, fundal height and abdominal girth at second and third trimesters significantly influenced the birth weight. Among the other factors family monthly income and total weight gain of mother were found to be associated significantly with infant's weight and length. Weight gain in pregnancy significantly decreased when women undertook heavy physical activity in the first and second trimesters (correlation coefficients being r=0.312, P<0.01 and r=-0.302, P<0.01, respectively). Rest for longer duration in third trimester was found to be advantageous for weight gain (correlation coefficients being r=0.185, P<0.01) and birth weight.

DISCUSSION

Pregnancy increases cost of activities by virtue of increase in body weight. It is assumed that the increased costs of physical activity are offset by a decrease in the amount of time spent in weight-bearing activities and by the relaxed and economical fashion in which pregnant women move.[11] Our results indicate that energy intake increased during pregnancy with advancing pregnancy. These results confirm previous

CORRELATION BETWEEN MATERNAL PHYSICAL ACTIVITY AND BIRTH WEIGHT AT THIRD TRIMESTER.

Parameters (n=500)	r
Very light activity vs birth weight	0.705**
Light activity vs birth weight	- 0.335**
Moderate activity vs birth weight	- 0.487**
Heavy activity vs birth weight	- 0.403**

* Significant at 1% level

Table 4

FINAL REGRESSION MODELS OF EFFECT OF HEAVY ACTIVITY ON BIRTH WEIGHT AND LENGTH [1].

Variables	Birth Weight			Birth Length		
	ß	SE	P	ß	SE	P
Constant	23.981	546.575	.965	48.500	.647	0.000
Initial mother's height (m)	35.339	196.646	.857	6.298	.233	0.787
Initial mother's weight (kg)	-3.959	1.494	.008	-2.651	.002	0.134
Haemoglobin-III tri. (g/dl)	15.620	11.609	.179	1.484	.014	0.281
Energy intake-III tri. (Kcal/d)	6.305	0.053	0.05	2.625	0.12	0.673
Protein intake-lll tri. (g)	-3.226	1.944	0.098	2.195	.002	0.924
Parity	1.493	23.234	0.949	-3.709	.028	0.178
Monthly income (Rs.)	-92.597	31.917	0.004	-0.201	.038	0.000
Fundal height- II tri. (cm)	-33.087	8.317	0.000	1.751	.010	0.986
Fundal height- III tri. (cm)	29.916	7.024	0.000	6.614	.008	0.427
Abdomen girth- II tri. (cm)	-6.793	2.555	0.008	-2.221	.003	0.463
Abdomen girth- III tri. (cm)	41.020	3.469	0.000	2.972	.004	0.470
Total weight gain (kg)	0.391	4.527	0.031	-5.135	.005	0.028
Heavy activity (h)						
I trimester	205.121	31.790	0.000	-0.192	.038	0.000
II trimester	162.754	28.843	0.000	8.324	.034	0.015
III trimester	-16.113	21.515	0.454	-1.192	.025	0.640

[1] For birth weight model F= 123.94, P= 0.000, and R^2= 0.804; For birth length, model F= 9.75, P= 0.000, and R^2= 0.244.

Table 5

reports.[12] Literature provides information that are contradictory specially from developing countries where women may not have been able to eat to appetite. Results from rural India and Thailand showed moderate increase in energy intakes,[13,14] while those from Europe and Australia have not shown increase to expected level.[15,16]

Energy expenditure is known to increase during pregnancy, this is understandable that movement with higher body weight demands more energy.[12,13] Hence our observations exhibited a mean increase of 10% in energy expenditure in third trimester.

An inverse relationship was found to exist between the intensity of maternal physical activity and birth weight. Available studies support the hypothesis that women involved in heavy physical activity have lower weight gain, fundal height , abdomen girth increments during later pregnancy.[13,17]

Time allocation is a measure of behavioral choices with respect to physical activity. We found that pregnant women spent more time in very light and light activities during third trimester than that in first trimester, but otherwise did not change the time devoted to the activities measured. These differences were evident in first trimester (14±2 wk gestation), suggesting that changes in activity may occur very early in pregnancy. Furthermore pregnant women spent less time in moderate and heavy activities. This finding agrees with others studies.[12,18]

CONCLUSION

In summary, pregnant women from affordable families in India who were assessed at initial time, 14±2, 28±2 and 38±2 weeks of gestation, indicated higher energy intake and energy expenditure in third trimester as compared to initial time. At first and second trimesters heavy activity significantly influenced birth weight and length, while at third trimester did not exhibited any influence. Initial mother's weight, fundal height, abdomen girth, monthly income and total weight gain significantly influenced the birth weight and length. There were significant differences in time spent for different activities during the early and late pregnancy and these women allocated more time to energy saving activities and less time to energy demanding activities. This differences support the suggestion that changes in physical activity are an important way pregnant women meet the energy demands of pregnancy.

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