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Effect of Exercise and Physical Activity of Mothers on Birth Status of the Infants

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ABSTRACT

Objectives: Birth weight is very important factor regarding infant mortality and morbidity, childhood development, and adult health. At present, there are contradictory results regarding the role of physical activity on birth weight. Therefore, the purpose of this study was to examine the effect of self reported exercise on birth weight, gestational age at delivery. *Methodology:* A pre-tested and modified questionnaire was used for data collection, which was translated into Arabic for the ease of the mothers. Sedentary, pregnant women (N = 522), mean age 30.3 ± 6.3 years, pre-pregnancy BMI 26.86± 5.26 were analyzed for the present study. The study was carried to address the key issues related to the role of physical activity during pregnancy on chronic disease risk. *Results:* The mean birth weight of babies was found to be 3.16 kilograms (range 1.7 – 5.4 kg). The average BMI of the mothers before pregnancy was 26.86±5.3 which means that the average mothers were overweight before conception. There was no statistically significant difference between groups in mean birth weight, low birth weight (< 2500 g). Frequency of exercise was significantly correlated with age, weight and pre-pregnancy BMI of mothers, ($P<0.01$) and also with the weight of placenta, head circumference and weight of the baby. *Conclusion:* Reduced birth weight and less gain in mother's weight have been noted in women who continued physical activities during pregnancy. Other studies contradict these findings of low birth weight, which could be related to hyperthermia experienced during intense exercise in early pregnancy.

INTRODUCTION

The number of women who exercise regularly has been increasing since the mid-1970s. Women may run, cycle, perform aerobics or lift weights on a daily basis. Physically active women who become pregnant invariably ask their physicians about the safety of exercise and its impact on pregnancy. Should they continue to exercise at their current level or make modifications to their program? Physicians need to be able to answer these questions for their patients. Moreover, physicians and pregnant women need to be assured that the answers are supported by solid research [1,2].

During pregnancy, exercise can:

- Ease or prevent back pain and other discomforts
- Boost your mood and energy levels
- Help you sleep better
- Prevent excess weight gain
- Increase stamina and muscle strength

Exercise during pregnancy might also reduce the risk of gestational diabetes and pregnancy-related high blood pressure, as well as lessen the symptoms of postpartum depression. In addition, it might reduce the risk that your baby is born significantly larger than average (fetal macrosomia) [3,4].

For majority of women, at least 30 minutes of moderate exercise is recommended in pregnancy.

Walking is a great exercise for beginners. It provides moderate aerobic conditioning with minimal stress on your joints. Other good choices include swimming, low-impact aerobics and cycling on a stationary bike [2,5].

Provided that pregnancy is normal and healthy, the current American College of Obstetrics and Gynecology (ACOG) guidelines promote continuation of pre-pregnancy exercise activities and recommend that sedentary women start exercising during pregnancy [6,7]. According to the present guidelines, all pregnant women are encouraged to be physically active for at least 30 minutes on most days of the week, in the absence of medical or obstetrical contraindications [6,8].

Physical activity during pregnancy may reduce the occurrence of preeclampsia:

It has been estimated that women who are engaged in recreational physical activity during the first 20 weeks of pregnancy experienced a 43% decrease in risk of preeclampsia as compared women who are sedentary. Researchers also noted that the relative risk of preeclampsia is reduced as average time spent performing physical activities increased [9]. Sorensen *et al*. found that regular participation in recreational physical activity during the first 20 weeks of pregnancy was related to a 35% reduced risk of preeclampsia [10].

The role of maternal physical activity to treat or prevent gestational diabetes:

Researchers also noted that physical inactivity is a risk factor for obesity and type 2 diabetes, both of which are reaching epidemic proportions [11,12]. Obesity and gestational diabetes mellitus (GDM) are closely associated [13,14]. The prevalence of GDM in obese women is 17%, and overweight women have a 1.8–6.5 times higher risk of developing GDM than normal weight women [12]. Furthermore, women with GDM experience greater risk for type 2 diabetes later in life [12]. Sedentary lifestyle is also associated with developing GDM [15] and therefore, the common link between obesity and GDM is physical inactivity.

Keeping the above-mentioned facts in mind the present cross-sectional study was planned to investigate the Effect of exercise and physical activity of mothers on birth status of the infants in Hail city of Saudi Arabia.

MATERIALS AND METHODS

Demography of the Study area: The present cross-sectional study was conducted in the maternity wards of two hospitals - Hail General Hospital and Maternity and Children Hospital- in the center of Hail city of Saudi Arabia. Hail is located in the northern region of the country. It has an area of 103,887 km² and a population of 527,033 (2004 census) consisting 49.9% women [8]. According to the data of the ministry of health, the birth rate is 18.78 births/1,000 population and the fertility rate is 2.17 children born/woman [9]. Also, the percentage of Low Birth Weight deliveries is estimated to be 8%. [9]

Study population:

For the purpose of getting permission of data collection from patients, letters were given to the administrative and higher authorities of the hospitals from the Principal investigator and Head of the Department of Clinical Nutrition, University of Hail. The study was initiated after getting an informed consent from the Hospitals as well as the patient. Participants were assured that the information collected would be kept confidential. All those mothers who were willing to participate in the present study were interviewed.

The sample size was calculated on the basis of total prevalence rate of Low Birth Weight deliveries in previous studies. A total of 522 postpartum mothers (irrespective of the mode of delivery) aged 18 to 48 years, who delivered a single live baby through without any congenital malformation and completed gestational age of ≥37 weeks were enrolled for the present study. Sociodemographic data were obtained from hospital records file within 1 day of delivery. Mothers who had multiple births or gave birth to babies with congenital abnormalities were excluded.

Procedure:

Data collection: A pre-tested and modified questionnaire was used for the purpose of data collection, which was translated into Arabic for the ease of the mothers. Information was gathered from interviews with mothers of the newborn babies, from the medical files and biochemical examination of the mothers. Hospital records were checked to identify delivery cases for the particular day.

Information regarding age, education of both parents and other socio demographic characteristics were asked from the mother and crosschecked from the medical records for validation. Other variables included parity, total number of abortions, number of Antenatal visits (ANC) during pregnancy, nutritional status of mother, amount of physical activity including household work and hours of rest and sleep. The socioeconomic status was assessed from the employment of mother, total family income and the type of family (joint/nuclear). The interval between present and previous delivery was also recorded. The total number of antenatal checkups was recorded as 1, 2, 3, or ≤ 4 visits as according to WHO standards [10].

Nutritional status of mothers: Maternal nutritional status was checked with the help of pre-pregnancy weight and Body Mass Index (BMI), Hemoglobin level before and after delivery, Blood pressure, Blood sugar level and presence of any chronic illness (like cardiovascular disease (CVD), diabetes, asthma or thyroid problems).

Pre-pregnancy weight was asked from the mothers and crosschecked from the medical file of the patient. Height was measured up to the nearest centimeter.

Biochemical parameters: Maternal hemoglobin was checked both before and after the delivery by portable electronic hemoglobinometer with disposable strips using spectrophotometric technique. Random blood sugar was measured using electronic glucometer (One touch, ultra-Lifescan Johnson & Johnson, Milpitas, USA). One single prick was done to draw blood for both measurements. Blood pressure was measured using electronic wrist blood pressure machine (Beurer Medical - Germany). Medical records of the biochemical parameters were also checked and the average of all readings was considered for evaluation.

Information regarding the gestational age, parity, number of abortions was taken from the medical file. Weight gain during pregnancy was obtained by subtracting the final weight before delivery from the pre-pregnancy weight.

Use of iron and calcium tablets was considered as appropriate only if taken for ≥ 3 months during pregnancy. An account of the household works done, hours of midday rest and night sleep, and exercise frequency was taken with the help of questionnaire to judge the level of physical activity.

Anthropometry of the newborn: Sex of the Infant, birth weight, height, head circumference and weight of placenta were measured soon after the delivery and recorded in the file of the mother and neonate.

Statistical analysis: Data were entered and analyzed through the SPSS 17.0 Software. Mean, SD, Minimum and maximum values and ranges were calculated to explain the descriptive statistics of the study population. Odd's Ratios, Spearman's correlation, Bivariate analysis was done to find out the risk factors associated with poor pregnancy outcome.

RESULTS

This cross-sectional study included 522 mother-infant dyads. Descriptive statistics of the study population are represented in Table 1. Present study shows that the mean age of the mothers was 30.3 years (range 18 – 48 years). The mean birth weight of total deliveries was found to be 3.16 kilograms (range 1.7 – 5.4 kg). The average BMI of the mothers before pregnancy was 26.86±5.3 which means that the average mothers were overweight before conception.

Table 1 – Descriptive Statistics of the study population

Variables	N	Mean	Std. Deviation	Minimum	Maximum	Range
Age of the mother at the time of birth (yrs)	522	30.28	6.31	18	48	30
Height of the mother (cm)	522	157.97	5.44	85	175	90
Weight of mother before pregnancy (kg)	522	67.40	14.29	36	156	120
BMI before pregnancy (kg/m^2)	522	26.86	5.26	16.0	41.8	25.8
Total weight gain in pregnancy (kg)	522	8.24	3.19	2	18	16
Weight of placenta (mg)	522	636.07	138.85	330	1210	880
Head circumference of the baby (cm)	522	34.79	1.86	30.0	45.0	15.0
Height of the baby (cm)	522	49.98	2.83	43	58	15
Birth weight of the baby (kg)	522	3.16	0.61	1.7	5.4	3.7

Table 2 describes the background variables according to the frequency of exercise done during the entire pregnancy. Frequency of exercise was found to be significantly correlated with low birth weight, gestational age less than 37 weeks, occupation and type of family.

Table 2-Background variables according to the frequency of exercise

Variables	Exercise done				P value (χ^2)
	Never	1-2 days	3-4 days	Daily	
Low birth weight	63	24	13	2	0.000***
Gestational age < 37 weeks	28	3	1	2	0.000***
Primigravida	74	19	19	7	0.06
Anemia - present	114	27	24	18	0.184
- absent	191	40	60	48	
Occupation – house wife	250	63	70	40	0.000***
- working	55	4	14	26	
Family – Joint	298	66	72	62	0.032**
- Nuclear	2	1	7	4	

Table 3 -Newborn and mother's characteristics according to the frequency of exercise

Variables	Exercise frequency				ANOVA P value
	Never	1-2 days	3-4 days	Daily	
Age of mother (yrs)	30±6.5	28.6±6.5	29.5±5.6	32.1±5.2	0.006**
Height of mother (cm)	158.2±4.9	157.3±3.6	158.5±3.5	158.8±3.3	0.209
Weight of mother (kg)	67.6±13.9	70.1±14.8	65.6±11.1	63.2±12.8	0.005**
Pre-pregnancy BMI (kg/m^2)	27.05±5.4	27.8±5.5	26.01±4.2	25.67±5.5	0.004**
Weight gain in pregnancy (kg)	8.2±3.4	7.9±3.1	7.9±2.4	8.9±2.95	0.183
Weight of placenta after birth	640.9±138	594.9±170	623.9±97	670.6±142	0.011*
Head circumference of baby	34.7±1.9	34.6±1.4	34.4±1.5	35.7±2.3	0.000***
Height of baby	50.1±2.9	50.3±3.3	49.7±2.5	49.8±2.1	0.617
Weight of baby	3.14±0.62	3.01±0.63	3.18±0.53	3.43±0.58	0.000***

Table 3 depicts the newborn and mother's characteristics according to the frequency of exercise. The results show that frequency of exercise was significantly correlated with age, weight and pre-pregnancy BMI of mothers, ($P<0.01$) and also with the weight of placenta, head circumference and weight of the baby. When we look up at the pre-pregnancy weight and BMI, it was found that the values were significantly higher (70.1±14.8 kg and 27.8±5.5 kg/m^2 respectively) for the women who did exercise less frequently than those who did exercise on daily basis (63.2±12.8 and 25.67±5.5 respectively). Similarly, the weight of placenta was found significantly more (670.6±142) for the women who did exercise regularly during pregnancy. Also, the birth weight of infants was significantly higher (3.43±0.58) for these mothers as compared to that of inactive mothers (3.14±0.62).

Table 4 – Mother's health characteristics according to exercise frequency

Variables	Exercise frequency				ANOVA
	Never	1-2 days	3-4 days	Daily	P value
Systolic blood pressure	120.9±9.5	120.5±6.5	119.9±8.5	121.4±7.8	0.743
Diastolic blood pressure	73.9±8.7	75.6±8.7	74.6±5.9	73.1±5.7	0.015**
Hemoglobin level	11.7±1.1	11.7±1.2	11.8±0.9	12.2±1.8	0.004***
Random blood sugar	112±12.2	120±14.2	115±11.3	122±13.3	0.124
Hours of night sleep	6.2±1.5	6.4±1.4	6.1±0.9	5.4±1.1	0.000***

Mother's health characteristics according to exercise frequency are shown in table 4. It is clear from the table that as the as the frequency of exercise increased there was an increase in the hemoglobin level and decrease in the diastolic blood pressure ($P< 0.01$). Whereas the systolic blood pressure and Blood sugar showed no significant difference in the different levels of exercise. It was also found from table 4 that those having more physical activity had significantly fewer hours of night sleep.

Chi-square test was performed to find out the correlation between history of chronic illness and frequency of exercise. P-value was found to be $P>0.05$ (0.074) showing no statistical significance.

Table 5 – History of any chronic illness vs exercise

Problems	Exercise frequency				P value (χ^2)
	Never	1-2 days	3-4 days	Daily	
Hypertension	17(85%)	3(15%)	0	0	0.074
Diabetes	12(45%)	4(15%)	6(22%)	5(18%)	
Thyroid disorders	7(46%)	4(27%)	4(27%)	0	
Asthma	5 (50%)	2(20%)	3(30%)	0	
None	264(57%)	54 (12%)	71(16%)	61(14%)	

Analysis of the results from table 5 shows that almost 85% of the women having a known history of hypertension never did any exercise and are totally inactive. A very small number (15%) did exercise for 1-2 days in a week. On the other hand around 45-46% of the women with diabetes and thyroid disorders were found to physically inactive. A very small percentage (12.6%) of the total study population was found to be physically active (i.e. doing exercise on a daily basis).

DISCUSSION

Researchers have not been able to determine a cost effective, easily accessible evidence-based program with guidelines for frequency, intensity, duration of exercise and type of activity that will produce optimal outcomes for women who are at risk for, or who develop complications during pregnancy affecting birth outcomes. Regular exercise in pregnancy has been shown to provide medical and psychological benefits to both mother and child [16].

The relationship between exercise and birth weight is not firmly established. Similar to the present study results one research [17] studied 800 women categorized into groups of sedentary, mild, and moderate exercisers. The mild exercises delivered infants with a mean birth weight approximately 100 g (3.6 oz) higher than the birth weight among infants of sedentary women, while the infants born to the moderate exercisers had an even higher mean birth weight. However, as a contrast to the present study another researcher [18] found birth weight to be 400 g (14.3 oz) lower in the infants of women who exercised throughout their pregnancy, compared with the infants born to women who stopped exercising early in pregnancy.

Results of these studies, although seemingly contradictory, suggest that moderate levels of exercise during pregnancy may be beneficial whereas heavy exercise may have a detrimental effect on birth weight. This conclusion is supported by a study [19] in which a group of previously conditioned, moderate exercisers was compared with a group of non-exercisers. The study found that the mean birth weight of infants born to the exercises decreased as the amount of weekly exercise increased. Women who exercised three times a week delivered infants with higher mean birth weights than those of the women in the control group, whereas the infants of women exercising four to seven times a week had lower mean birth weights than the infants of women in the control group.

However, studies have not shown a consistent reduction in birth weight with exercise. Sternfeld and colleagues [20] looked at 388 women with levels of exercise classified as moderate, mild to moderate, mild, and sedentary. Neither mean birth weight nor gestational age was found to be related to the level of exercise. As a contrast, the present study shows that both mean birth weight and gestational age were affected by the level of physical activity. On the other hand, a meta-analysis [21] concluded the mean birth weight of infants born to exercisers was not significantly different from the birth weight of infants born to sedentary women.

Many types of maternal non–weight-bearing and weight-bearing exercise have been studied during pregnancy and none appear to increase the risk of an abnormal short-term outcome. Long-term follow-up data are quite limited, but it appears that beginning or continuing weight-bearing types of exercise during pregnancy has no adverse effects on postnatal growth, health or neurodevelopment. Beginning or continuing recreational weight-bearing exercise during pregnancy appears to have some positive short- and long-term effects on offspring outcome [22].

In a large population-based case-control study [23], the relationship of exercise, employment and other daily activities with pregnancy outcome were examined. Mothers of infants with very low or normal birth weight were surveyed on these issues. The major finding of this study was that mothers of very low-birth-weight infants were much less likely to exercise during pregnancy than the mothers with other pregnancy outcomes. No significant increased risks were found between employment during pregnancy, types of work activities and conditions, or other daily activities and adverse pregnancy outcome. An even more recent study showed that healthy and

well-conditioned women could participate in a moderate or high-intensity exercise program during pregnancy without experiencing adverse fetal or maternal outcomes [24].

CONCLUSION

Despite abundant experimental data on the effects of exercise on pregnancy, our knowledge of the subject is still insufficient. Research on physiologic adaptations and pregnancy outcomes does not adequately address the issue of more prolonged or strenuous exercise.

In the past few decades, research on the role of physical activity during pregnancy has come a long way. Research questions no longer focus on cautious concern for the health and well-being of mother and offspring, but rather, how maternal physical activity might affect future chronic disease risk. Although one must remember that each pregnancy is different, and a woman's physical activity experience should be considered in concert with guidance from her health care providers, positive results from studies examining exercise during pregnancy are very encouraging. Recent research on the Leading Health Indicators from Healthy People 2010 indicates that increasing physical activity and reducing obesity are the greatest priorities for enhancing women's health [25]. Future randomized clinical trials will help sort out the appropriate physical activity regimens that are optimal to help prevent chronic disease and obesity in women and be most beneficial for offspring growth and development. Results from this Scientific Roundtable have helped provide direction for these future research efforts. Once more information is known about the effects of physical conditioning on maternal-fetal adaptations and the effects of strenuous exercise on pregnancy outcome, guidelines can be revised to reflect these new understandings. Revised guidelines could include more specific information on the levels and types of exercise best suited for each trimester, better information on ways to avoid overheating, and nutritional guidelines before, during and after more prolonged bouts of exercise.

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