Original Article

Impact of Physical Exercise on Leptin and Adiponectin Levels in Reducing the Risk of Gestational Hypertension

Gul Muhammad,[1] Sobia Azim Siddiqui,[2] Qurat Ul Ain,[3] Zubia Shah[4], Filza Salim,[5] Maham Khalid[6]

Abstract

Objective: To investigate the effect of exercise on the blood pressure of new-onset hypertension and non-hypertensive pregnant women and to determine the serum leptin and adiponectin levels and their response to exercise.

Methodology: This quasi-experimental cross-over study was conducted at the Department of Gynaecology and Obstetrics, Hayatabad Medical Complex Peshawar. Samples were processed and analyzed at Khyber Girls Medical College Peshawar from January 2022 to April 2022. A total of 140 pregnant females were recruited for this study through convenience sampling. Out of this total, 70 were normotensive for the control group and 70 were hypertensive (gestational hypertensive). All participants were included after taking an informed consent.

Results: In normotensive pregnant women, mean systolic and diastolic blood pressure remained normal, and no hypertension developed. In gestational hypertensive women, 70% responded significantly to physical exercise. Post-exercise, Group A saw decreases in systolic BP, diastolic BP, and leptin levels, with an increase in adiponectin. Group B exhibited more pronounced changes by decreased systolic BP, diastolic BP, leptin, and increased adiponectin.

Conclusions: We observed that recommended physical exercise during pregnancy is safe and beneficial for maternal health in pregnancy. Physical exercise significantly reduced the progression of GH and brought the serum leptin and adiponectin levels toward normal range. Therefore, physical activity should be encouraged in every healthy woman after addressing potential barriers to exercise during pregnancy.

Keywords: Gestational hypertension, Exercise, Leptin, Adiponectin

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1, 2,3,5,6 : Rehman Medical College, Peshawar
4: Khyber Girls Medical College, Peshawar

Correspondence:
Dr. Zubia Shah, *Associate Professor, Department of Physiology, Khyber Girls Medical College, Peshawar. E-mail: zubiashah1971@gmail.com*

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Introduction

Hypertensive disorders of pregnancy (HDP) are the main causes of maternal and neonatal health complications and mortality. Gestational Hypertension (GH) is the first alarming sign of these disorders.[1] GH complicates about 10 to 12% of pregnancies worldwide.[2] In Pakistan, the ratio is about 3 times higher than the developed countries, and further

complications of GH may lead to serious outcomes of pregnancy.[3]

Physical activity improves cardiovascular (CV) health of both the mother and fetus and may lower the risk of GH.[4] Literature search revealed that most of the pregnant women with GH usually had less or no physical activity.[5] In addition, they had an inverse ratio of leptin and adiponectin levels in their blood.[6,7] Normal leptin and adiponectin levels are not only useful for metabolic regulation in pregnant ladies but also help in angiogenesis and endothelial functions to improve the cardiovascular status of both mother and fetus.[8] A resistance to leptin and suppression of adiponectin is developed in these women who are prone to develop GH. The increased leptin can cause hyperstimulation of the sympathetic nervous system that in turn puts stress over the cardiovascular system (CVS) so GH may develop in these women.[9]

Latest guidelines globally recommend physical exercise for 60 to 120 minutes during pregnancy.[10,11] Those pregnant women who follow these exercise protocols during their pregnancies, have 30% less chance of GH. Initial studies have proved that those women who were involved in recommended physical exercise had lifelong protection from GH and cardiovascular (CV) problems in subsequent pregnancies.[12] Physical exercise of a pregnant woman is also beneficial for the baby's health and wellbeing.[13]

Both Leptin and Adiponectin are the types of cytokines that are released by adipose tissue in the body, so they are collectively called Adipokines. Excessive Leptin is considered to be the major causative factor of many CV diseases associated with obesity and Adiponectin is thought to be a useful Adipokine and very helpful for CV diseases.[14]

Generally, pregnancy is considered a stress test for a woman where new changes occur in CVS and the body has to adjust to a new physiological environment. Recommended regular physical exercise will facilitate these new changes through endothelial functions. Failure of these vascular adaptations increases the risk of GH and other cardiovascular diseases which may persist beyond pregnancy.[15]

In this study, we observe new changes in the CVS of all pregnant women, both in normotensive and hypertensive i.e. with GH. Based on this evidence, advising a pregnant lady to follow a recommended physical exercise even before pregnancy and during pregnancy may be a very beneficial therapy to reduce the risk of GH.

Methodology

This quasi-experimental study employed exercise as an intervention to assess its impact on blood pressure and adipokines in pregnant women. The research was carried out over six months, from January 2022 to June 2022.

The main study was conducted in the Obstetrics & Gynaecology Outpatient Department (OPD) of Hayatabad Medical Complex, Peshawar, with sample analysis performed in the Physiology Laboratory of Khyber Girls Medical College, Peshawar. The sample size of 140 participants was calculated using the WHO sample size calculator, based on previous studies. The confidence level was set at 1.96, with a standard deviation (δ) of 24 and a margin of error (E) of 4. This calculation yielded a required sample size of 139, which was rounded to 140 for convenience. Participants were recruited through convenience sampling, with 70 normotensive and 70 hypertensive pregnant women included in the study.

Pregnant women attending the antenatal checkup between 20 and 30 weeks of gestation were considered for inclusion. Exclusion criteria included chronic hypertension, diabetes mellitus, twin pregnancy, history of pre-eclampsia or eclampsia, BMI greater than 27, severe anaemia, and any heart or lung diseases. Informed consent was obtained from all participants meeting the inclusion criteria.

The exercise program, following WHO 2020 guidelines, was explained to each participant. Group A consisted of normotensive pregnant women, while

Group B included those with gestational hypertension. Participants were advised to start exercising gradually, beginning with 5 to 10 minutes per day and increasing to 30 minutes daily. If unable to perform 30 minutes at once, they were instructed to split the exercise into two 15-minute sessions.

Each participant was provided with a pedometer linked to a smartphone application to accurately track their physical activity. They also maintained a diary to record their exercise routines. Blood samples were collected at baseline and during subsequent monthly visits. Samples were centrifuged on the same day and stored at -70°C in the physiology lab for later assessment of leptin and adiponectin levels using kits from RANDOX, a UK-based company. Other investigations, including full blood count, urine R/E, abdominal ultrasound, random blood glucose, renal function tests, and liver function tests, were performed on the same day and recorded on a proforma.

Statistical analysis was conducted using SPSS version 23. Variables were categorized according to gestational age and presented as Mean ± SD. An independent sample t-test was applied to continuous variables, while discrete variables were analyzed using the chi-square test, with a p-value of ≤ 0.05 considered statistically significant.

Ethical Approval: After being reviewed and approved by the graduate study committee (GSC), a research proposal for this study was approved by the Advanced Study and Research Board (ASRB) of Khyber Medical University, Peshawar, under (Ref no. DIR/KMU-AS&RB/EE/001166), dated: 6/08/2020.

Results

In the normotensive group, systolic blood pressure and diastolic blood pressure decreased significantly post-exercise. Serum leptin levels dropped, while serum adiponectin levels increased (p-values < 0.001, Table I). In the hypertensive group, systolic blood pressure was reduced, and diastolic blood pressure was reduced. Serum leptin levels decreased, and serum adiponectin levels rose (p-values < 0.001, Table I). For subsequent visits, in normotensive women (Table II), the systolic blood pressure decrea-sed from the first pre-exercise visit in the second and third post-exercise visits, respectively (p < 0.020). The diastolic blood pressure dropped on the second and third visits (p < 0.021). Serum leptin levels dec-reased significantly in subsequent visits (p < 0.001). Serum adiponectin levels increased across the visits (p < 0.001).

In hypertensive women (Table III), systolic blood pressure decreased significantly from the first pre-exercise visit in subsequent post-exercise visits (p < 0.001). Diastolic blood pressure dropped on the second and third visits (p < 0.011). Serum leptin levels significantly decreased in subsequent visits (p < 0.001). Serum adiponectin levels were increased across the visits (p < 0.001). The relationship between

Table I: *Comparison of Blood Pressure, Leptin, and Adiponectin Levels with Exercise in Both Groups*

Variables	Normotensive Women Group A		Gestational Hypertension Women Group B		P-Value
	Pre-Exercise	Post-Exercise	Pre-Exercise	Post-Exercise	
Systolic BP (mmHg)	122.6±10	110±10	150 ± 10	120 ± 10	< 0.001
Diastolic BP (mmHg)	75±5	71 ± 5	90 ± 10	80 ± 5	< 0.001
Serum Leptin (µg/L)	20.3±5	12 ± 5	50 ± 5	25 ± 5	< 0.001
Serum Adiponectin (ng/ml)	18±5	28.4 ± 5	12.7 ± 5	30.5 ± 5	< 0.001

BMI and blood pressure demonstrated that women with a BMI greater than 25 had higher systolic and diastolic blood pressure in both normotensive and hypertensive groups (p < 0.001, Table IV). Maternal age also influenced blood pressure, with women over 28 years showing higher systolic blood pressure compared to those under 28 years (p < 0.001,

Table V). Additionally, BMI had a significant impact on leptin and adiponectin levels in both normotensive and hypertensive women ($p < 0.001$, Table VI).

Discussion

Our study provides an overview of the current understanding of how physical exercise contributes to reducing the risk of gestational hypertension. Studies have shown leptin to be a known potential contributor to many CVS diseases that are linked with obesity.[16] A study by Awad MA has observed that when leptin level is decreased or resistance is developed to leptin then it causes hypertension, CVS remodelling, ROS, atherosclerosis, and sympathetic nervous system stimulation.[17] Poetsch MS et al., have explained that in leptin resistance, a high level of leptin hormone can predict myocardial infarction and hypertension independently of any other known risk factors.[18] On the other hand, in a normal healthy life, leptin has protective actions on CVS, renal, and gastrointestinal systems during low blood perfusion when it works normally and has no resistance. Blaming leptin, as the only harmful hormone may not be fair.[19] Previously a study by Shibata has proved that adiponectin takes care of normal physiology of the heart. It prevents CVS from inflammatory and oxidative stress which are the major causes of atherosclerosis. Further studies have explained the beneficial role of adiponectin as a potentially effective the treatment of many CVS diseases. [20]

According to de Knegt VE., GH is more pre-valent in obese pregnant women, and the increased leptin level was identified as a risk factor in those women.[21] Piotrowska K et al., succeeded in fin-ding a positive response of exercise on PE, but they linked the cause with inflammatory markers that

Table II: *Relation of Blood Pressure with Adipokine Values in Normotensive Group A*

Variables	1st Visit Pre-Exercise (mean ± SD)	2nd Visit Post-Exercise (mean ± SD)	3rd Visit Post-Exercise (mean ± SD)	P-Value
Systolic BP (mmHg)	115 ± 10	112 ± 10	110 ± 10	< 0.020
Diastolic BP (mmHg)	75 ± 10	70 ± 10	70 ± 10	< 0.021
Serum Leptin (ng/ml)	15 ± 5	12.5 ± 5	7.5 ± 5	< 0.001
Serum Adiponectin (µg/ml)	10 ± 8	15 ± 8	18 ± 10	< 0.001

Table III: *Relation of Blood Pressure with Adipokine Levels in Hypertensive Group B*

Variables	1st Visit Pre-Exercise (mean ± SD)	2nd Visit Post-Exercise (mean ± SD)	3rd Visit Post-Exercise (mean ± SD)	P-Value
Systolic BP (mmHg)	140 ± 10	130 ± 10	120 ± 10	< 0.001
Diastolic BP (mmHg)	90 ± 10	70 ± 10	70 ± 10	< 0.011
Serum Leptin (ng/ml)	45.7 ± 10	35.5 ± 5	15.5 ± 5	< 0.001
Serum Adiponectin (µg/ml)	8.5 ± 4	15.4 ± 6	25.5 ± 5	< 0.001

Table IV: *Relation of Blood Pressure with BMI in Both Normotensive and Hypertensive Groups*

BMI	Normotensive BP	Hypertensive BP	P-Value
	Systolic	Diastolic	Systolic
< 25	110 ± 5	75 ± 5	140 ± 5
> 25	120 ± 5	80 ± 5	150 ± 5

TableV: *Relation of Blood Pressure with Maternal Age*

Age Group	Systolic BP (mmHg)	Diastolic BP (mmHg)	P-Value
< 28 years	140 ± 5	95 ± 10	< 0.001
> 28 years	150 ± 5	95 ± 10	< 0.001

Table VI: *Effect of BMI on Leptin and Adiponectin Levels in Normotensive and Hypertensive Women*

BMI	Leptin (ng/ml) in Normotensive Women	Adiponectin (µg/ml) in Normotensive Women	Leptin (ng/ml) in Hypertensive Women	Adiponectin (µg/ml) in Hypertensive Women	P-Value
< 25	10.5 ± 5	5.5 ± 3	7.5 ± 5	12.5 ± 5	< 0.001
> 25	35 ± 5	12.5 ± 5	15 ± 5	5.5 ± 3	< 0.001

decreased after long-term exercise, especially in women who do exercise even before pregnancy.[22] Recently White et al., were impressed by the beneficial effect of exercise during pregnancy and motivated pregnant women to exercise.[23] Thirty four percent of pregnant women were found to benefit from physical exercise. Aburezq M et al., also found a particularly good response to physical activities in 45% of pregnant women with GH.[24]

Conclusion

Regular physical exercise significantly reduces the risk of gestational hypertension (GH) and helps normalize leptin and adiponectin levels. In normotensive pregnant women, consistent exercise maintained normal blood pressure and improved adipokine levels. In women with GH, regular exercise brought blood pressure and adipokine levels closer to normal, with 70% showing significant improvement.

Conflict of Interest: *None*

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Authors Contribution

Following authors have made substantial contributions to the manuscript under:

GM, SAS: Concept and study design, acquisition, analysis interpretation of data, drafting the manuscript, approval of the final version to be published

QUA, ZS: Acquisition of data, drafting the manuscript, approval of the final version to be published

FS, MK: Concept and study design, analysis and interpretation of data, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.