

## A comparative study of isometric handgrip test between pregnant and non – pregnant women

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### Abstract

**Background:** Pregnancy is associated with profound adaptive changes in maternal haemodynamics. The incidence of Pregnancy Induced Hypertension [PIH] is one of the three main causes of maternal – neonatal morbidity and mortality is 5-7% and prediction of this disorder is very important in maternal and neonatal health.

**Objective:** To study the effect of Isometric handgrip test among pregnant (women of first trimester) and non-pregnant women.

**Materials and Methods:** Healthy singleton pregnant women of first trimester and healthy non-pregnant women in the age group of 19 to 29 years were selected for the study.

The Isometric handgrip test was performed on singleton pregnant women attending the antenatal clinic of District Civil Hospital BIMS Belagavi. The control group consisted of Medical students and Patient's attenders of same age group.

Blood pressure was measured three times before the procedure and at 1 minute intervals during handgrip.

**Results:** The basal Diastolic blood pressure of first trimester subjects was significantly higher than compared to controls.

**Statistical Analysis:** Student's 't' test was used.

**Conclusion:** The study concludes that the increased basal DBP of first trimester subjects was due to the increased peripheral resistance in pregnancy.

**Keywords:** Diastolic blood pressure, Isometric Handgrip test, Pregnant women.

Access this article online	
Quick Response Code:	Website: www.innovativepublication.com
	DOI: 10.5958/2394-2126.2016.00057.8

### Introduction

Pregnancy is associated with profound changes in maternal haemodynamics. The Autonomic nervous system plays a central role in adaptation of cardiovascular system to various haemodynamic needs and is the principal system involved in short – term cardiovascular control.

Physiology of pregnancy is a virgin field; vast advances in knowledge have been made in the physiology of pregnant and non-pregnant women during the recent past. It is impossible to fathom and deliberate all the knowledge concerning cardiovascular system in pregnancy because reflexes associated with the autonomic nervous system are complex in nature. The earliest extensive survey of investigations related to the cardiovascular changes during pregnancy refers to monograph 'Physiology of human pregnancy' by Hytten and leitch (1971). Isometric exercise is a normal part of day to day activities and of many occupational tasks. Preventive services are important as they give

physicians an opportunity and responsibility to promote regular physical activity, reduce high blood pressure and help in weight control. Physical inactivity is recognized as a risk factor for coronary artery disease. Regular aerobic physical activity increases exercise capacity and plays a role in both primary and secondary prevention of cardiovascular diseases<sup>1</sup>. Autonomic nervous control can be studied non-invasively with cardiovascular reflex tests such as the Isometric handgrip test, Valsalva maneuver, Orthostatic test and by measuring the heart rate variability. A combination of tests is needed to elucidate overall autonomic nervous control<sup>2</sup>. Most of behavioral and hormonal changes occurring during reproductive life of women are exhibited through autonomic nervous system.

Higher sympathetic activity is noticed in first trimester<sup>3</sup> and also in second trimester<sup>4</sup>. This increased sympathetic activity leads to Hypertension in some women during pregnancy called as Pregnancy induced hypertension (PIH). Alteration in autonomic cardiovascular control during pregnancy has an important etiological role in certain conditions like Insufficient uteroplacental blood flow (PIH)<sup>5</sup>. Therefore the importance of cardiovascular monitoring during pregnancy especially in developing countries like India helps in early detection of cardiovascular abnormality. During antenatal visits it is immensely helpful in preventing complications.

**Objective**

To study the effect of Isometric handrip test among pregnant [women of first trimester] and non-pregnant women.

**Materials and Methods**

This is a cross-sectional study. Institutional ethical clearance from Ethical clearance committee and written informed consent from subjects was obtained. A total of 112 subjects were studied and the test was carried out in the antenatal-OPD of Department of Obstetrics and Gynaecology in the BIMS civil hospital and in the Department of Physiology BIMS College, Belagavi. The test was performed by randomized selection of 56 healthy normal women with singleton pregnancy attending the antenatal clinic of Department of Obstetrics and Gynaecology in the District civil hospital BIMS Belagavi in their 1-12 weeks of gestation. The control group comprised of equal number of subjects in reference to comparable age and accessibility, which includes medical students and patient’s attenders of same age group. The age group in control and cases were 19-29 years. 56 cases in each group were derived statistically by looking the prevalence in the referred article<sup>6</sup>.

**Inclusion criteria**

Subjects: 19 to 29 years healthy pregnant women of first trimester.

Controls: 19 to 29 years healthy non-pregnant women without any medical illness.

**Exclusion Criteria**

Pregnant women with history of Hypertension, Diabetes mellitus, Anaemia, Asthma, Heart and Thyroid diseases etc.

**Procedure**

The subjects were familiarized with the laboratory surroundings, equipments and explained the examination procedures to minimize the fluctuations in values caused by anxiety. The recordings were taken between 10am-12 noon. There was a minimum gap of two hours between breakfast and the recording of observations. The blood pressure was measured non-invasively by Omron Digital Blood Pressure and Pulse monitor.

**Isometric Handgrip test:** The subject’s maximal voluntary contraction force was first determined by using a Handgrip Dynamometer, by the dominant hand. The subjects were made to hold the handgrip dynamometer for as long as possible for a maximum duration of 3-5 minutes in the sitting posture, with 1/3<sup>rd</sup> or 30% of maximal voluntary contraction force. Blood Pressure and heart rate were measured three times before the procedure and at 1-minute intervals during the handgrip, by using the Omron Digital Blood Pressure monitor. Increase in systolic and diastolic blood pressures as well as in heart rate was measured<sup>7</sup>.

**Statistical analysis**

The data obtained was statistically analyzed by using student’s t- test.

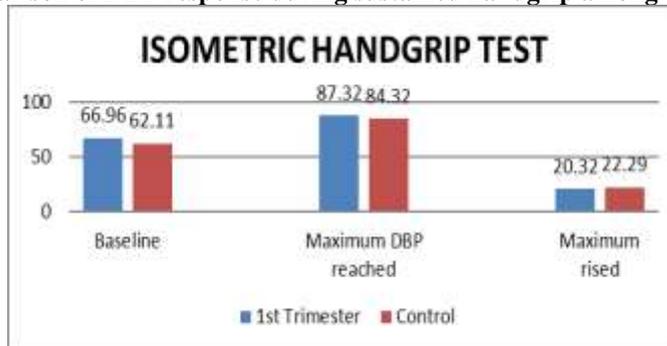
**Results**

By using student’s t- test the data was analyzed which shows that, the basal Diastolic blood pressure of first trimester subjects was significantly higher than compared to controls (P<0.001). Even though the maximum Diastolic blood pressure (DBP) was higher in first trimester subjects than compared to controls but it was not significant (P=0.31) (Table 1 and Graph 1).

**Table 1: Comparison of DBP response during sustained handgrip among cases and controls**

Category	n	Parameters	DBP values (Mean ±SD)	Significance		Confidence Interval
				t value	p value	
First Trimester	56	Baseline DBP	66.96±6.31	4.32	<0.001	65.27 to 68.65
Controls	56	Baseline DBP	62.11±5.56			60.62 to 63.59
First Trimester	56	Maximum DBP during handgrip	87.32±10.92	1.51	0.134	84.39 to 90.24
Controls	56	Maximum DBP during handgrip	84.32±10.10			81.62 to 87.03
First Trimester	56	Maximum rise in DBP	20.32±10.84	1.02	0.31	17.42 to 23.22
Controls	56	Maximum rise in DBP	22.29±9.55			19.73 to 24.84

**Graph 1: Comparison of DBP response during sustained handgrip among cases and controls**



## Discussion

In our study of isometric handgrip test, the basal Diastolic blood pressure of first trimester subjects was significantly higher than compared to controls ( $P < 0.001$ ). Even though the maximum DBP was higher in first trimester subjects than compared to controls but it was not significant ( $P = 0.31$ ).

Sympathetic stimulation mediates the cardiovascular responses to Isometric handgrip test<sup>8</sup>. An increase in the cardiac output and change in total sympathetic resistance achieve the pressure response caused by isometric handgrip. The significant increase in basal DBP of first trimester subjects than compared to controls could be due to increased peripheral resistance. Even though the maximum DBP was higher in first trimester subjects when compared to controls, it was not significant. In other words the maximum DBP in first trimester subjects after Isometric handgrip test was less compared to the controls. The response to the isometric handgrip test is conflicting in pregnancy. Longitudinal studies starting before pregnancy have shown that the heart rate response to isometric handgrip test is unaltered and the BP response has been reported to be diminished<sup>9</sup> corroborating with our studies. The blood pressure response has been reported to be unchanged by Ekholm et al in a longitudinal study in 1994, but cross sectional study conducted by the same author in 1993 reported as diminished response<sup>10</sup>.

A study showed both systolic and diastolic BP responses to isometric handgrip test were significantly smaller in pregnant women, which is attributed to antagonizing effects of products of uteroplacental unit such as progesterone or a diminished contractile response of blood vessels to adrenaline<sup>6</sup>, which again corroborates with our study.

Degani et al (1985) compared roll-over test and isometric exercise test to predict PIH and announced the preference of isometric exercise test<sup>11</sup>. Tomoda et al (1991-2) studied the validity of isometric exercise test and showed a sensitivity of 82% and specificity of 68% for it for prediction of PIH<sup>12</sup>. A study suggested that changes in sympathetic neural influences on total vascular resistance might act as a sufficient stimulus to produce a decline in BP after isometric training<sup>13</sup>.

Another study showed that there is marked decrease in BP [and HR] to the sustained isometric handgrip exercise training performed by subjects when compared to controls. Trained subjects had a significant lower BP [and HR] response to isometric handgrip exercise compared to untrained controls<sup>1</sup>. Hypertension in pregnancy is a cardiovascular complication, which is among the most common and critical pregnancy complications and despite notable advances in pregnancy period care, it is still one of the greatest causes of mortality and prenatal complications for the mother and fetus<sup>14</sup>. The main mother's mortality causes in the US is believed to be pulmonary emboli, pregnancy induced hypertension, bleeding and infections<sup>14</sup>. In the seventh global assembly of the World Health Organization (WHO) pregnancy induced hypertension was discussed to be one of the greatest global health threatening troubles and epidemiological studies of these disorders, especially in developing countries was emphasized<sup>15</sup>. Generally the incidence of pregnancy induced hypertension is reported to be between 5 to 17%<sup>16</sup>. Maternal mortality rate in developing countries is 100 to 200 times more than industrialized countries. From 2485 maternal mortality cases in Africa, 1610 cases and from 4022 cases in one year in Asia, 805 cases have been caused by pregnancy induced hypertension<sup>17</sup>. In Iran during 1992 to 1995, 14% of maternal mortalities were related to complications of pregnancy induced hypertension<sup>17</sup>. A study reported that, if the Isometric exercise test and Roll-over test are used together, sensitivity will be 85.7%, specificity will be 96.3% and positive and negative predictive values will be 66.6% and 98.8% respectively. Also reported that, the utilization of screening Isometric exercise test in prediction of pregnancy induced hypertension as a valid, simple, cost effective, reasonable and acceptable test for pregnant women and health care workers. Also it is possible to use a combination of Isometric exercise test and Roll over test to increase the predictive value for pregnancy induced hypertension<sup>18</sup>.

Therefore the importance of cardiovascular monitoring during pregnancy is very essential especially in developing countries like India which

helps in early detection of cardiovascular abnormalities. During antenatal visits it is of immensely helpful in preventing complications.

### **Conclusion**

The study concludes that the basal DBP of first trimester subjects was significantly higher than compared to controls, which could be due to the increased peripheral resistance in pregnancy. The non-significant increase in maximum DBP of subjects compared to controls could be due to the anatanizing effects of products of uteroplacental unit such as progesterone or a diminished contractile response of blood vessels to adrenaline.

Isometric forearm exercise can be performed quickly, easily and in any location. These attributes may increase patient compliance and thereby enhance the possibility of positive clinical outcomes.

### **Acknowledgements**

The authors are thankful to the Director, BIMS, Belagavi for giving us the permission & logistic support to conduct the Study. I am very much thankful to my guide and HOD department of physiology, for his kind support, help and for guidance in each and every aspect. We are grateful to all the participants [Subjects and Controls] for their kind cooperation and department of OBG in conducting the study. We also thank Mrs. Sunanda Halki, for her help in Statistical analysis and all the teaching and non-teaching staff for their help.

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