

# Hemodynamic Response Of Hand-Grip Contraction In Hypertensive Patients

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## *Abstract:*

**Background:** Throughout the day, your blood pressure changes depending on your everyday activities. Regularly elevated blood pressure readings could be an indication of high blood pressure. We examined the variations in the hemodynamic response to handgrip contraction between age groups and hypertension exercise stages.

**Objective:** The objective of my study is to access the hemodynamic response of hand grip contraction in hypertensive patients.

**Method:** A systematic experiment using repeated measurements. The patients were told to contract the grasp of their dominant hand to the maximum voluntary force. Prior to the removal of hand pressure, blood pressure (SBP and DBP) and heart rate (HR) responses were assessed. Additionally, it should be noted that the HR and BP responses were assessed 1, 3, and 5 minutes after the pre-value was recorded.

**Result:** Patients with pre-HT and stage 1 HT observed a significant enhancement in their systolic and diastolic blood pressure and heart rate following a handgrip contraction training session ( $p < 0.05$  for all comparisons); however, stage 2 HT patients did not improve ( $p > 0.05$  for all comparisons). HT stage 2 did not significantly improve despite variable response analysis results and some sessions demonstrating blood pressure rises.

**Conclusion:** After conducting handgrip contraction exercises with a dynamometer, patients with pre-HT and stage 1 HT have decreased blood pressure. The BP and HR responses are still inconsistent in stage 2 of HT and intermittently rise.

**KEYWORDS:** Portable dynamometer, Hemodynamic response, Hypertension, Hangrip exercise.

## 1. INTRODUCTION

Hypertension, one of the main risk factors, affects more than 1 billion people worldwide. Exercise with an isometric handgrip (IHG) helps hypertensive people lower their blood pressure. IHG training has been

approved by the American Heart Association as a therapeutic option for these patients, and the current study examined blood pressure changes in hypertensive people following IHG protocols with different volumes and intensities.<sup>1</sup>

Static exercise is defined as changing the muscle's tension largely without significantly changing the muscle's length, whereas isotonic or dynamic exercise modifies the muscle's length while maintaining the same tension. Heart rate, stroke volume, systemic vascular resistance, and mean arterial pressure are all affected by changes in sympathetic and parasympathetic activity during exercise (MAP).<sup>2</sup> The hypertension of each patient is not being properly treated. Currently, the recommended exercise programme for blood pressure regulation is dynamic endurance.<sup>3</sup>

Isometric handgrip exercises could be used as a non-pharmacological therapeutic alternative for persons who are already hypertensive as well as a preventative intervention for those who are at high risk of developing the condition.<sup>3</sup> We investigated the effects of isometric handgrip exercise on vascular hemodynamics in individuals of different ages. It is generally known that other vascular hemodynamics, such as arterial stiffness, respond to activity during isometric exercise.<sup>4</sup>

The goal of this study was to determine whether IRT is effective at lowering blood pressure and whether a working control group that performed low-intensity exercise was appropriate.<sup>5</sup> Increased blood pressure response to tilting or standing has been seen in borderline hypertensive individuals who have not yet received treatment for their hypertension.<sup>6</sup>

Increased contraction frequency and intensity during isometric exercise may cause greater post-exercise blood pressure decreases. Determine the hemodynamic reactions was the aim of the current experiment. All IHG procedures were performed using a computerised hand dynamometer. With their elbows bent 90 degrees and their forearms resting on the table to protect them, participants did five IHG procedures while seated.<sup>7</sup> The impact of IHT on these parameters has been hotly contested, and it is still important to pinpoint the precise mechanism that changed as a result of IHT. To determine how IHT affected vascular measurements, stress oxidative biomarkers, and inflammatory biomarkers in hypertension patients who responded to the treatment.<sup>8</sup>

Although the benefits of IHG exercise on this acute BP response are yet unknown, resistance training seems to be beneficial for persons with HT. It is yet unknown how training affects this acute BP response in HT patients as well as how an IHG session affects blood pressure. For people with HT, recurrent BP drops may be produced by IHG sessions spread out throughout the day. This easy surgery may therefore offer an essential and timely augmentation to current HT treatments.<sup>9</sup>

## 2. METHODOLOGY

An experimental study with repeated measures design. A sample size of 54 patients was included. The setting of this study was district Gujrat (city and Ikram) hospitals. The patients had been selected according to inclusion and exclusion criteria. Data were collected using demographic data, a digital BP apparatus, a stopwatch, and a

handheld dynamometer. Hand-held dynamometer: reliability ( $r > 0.90$ )<sup>62</sup>, validity ( $r = .74-.77$ ). All data were taken from diagnosed hypertensive patients. Using a digital blood pressure and heart rate monitor, the baseline blood pressure and heart rate of each subject were collected with a suitably sized cuff placed on the arm. By pushing the handles of the portable dynamometer, the individuals were told to contract their hand grasp as much as their voluntary control would allow. Values were measured 1, 3, and 5 minutes after the previously mentioned treatment schedule. After collecting the data, it was entered into the statistical software SPSS version 24, IBM Corp., released in 2016. To calculate the normality of the data, the Shapiro-Wilk test was applied. For descriptive analysis, mean and standard deviation were calculated for quantitative variables, whereas frequency and percentages were used for qualitative variables<sup>10</sup>. For the inferential statistics to find significance, an appropriate statistical test had been applied. All results will be calculated at a 95% confidence interval, and a p-value 0.05 will be considered a significant value.<sup>11</sup>

### 3. RESULTS

The majority of the patients involved in this study were pre-HT, which falls into the percentage of 42.59%. Stage 1 hypertension affects 27.78% of patients, while stage 2 hypertension affects 29.63%. The mean age of the patient pre-HT is  $33.52 \pm 8.28$ , HT Stage1  $39.86 \pm 6.32$  and HT Stage2  $46 \pm 3.67$ , respectively. Out of 54 include 61.11% of female which were in highest percentage and 38.89% of males which were in lowest percentage<sup>12</sup>. Stages of HT patients in pre-HT. 15(27.8) % stages of HT patients in HT stage1. 16(29.6) % stages of HT patients in HT stage2 in Table 1.

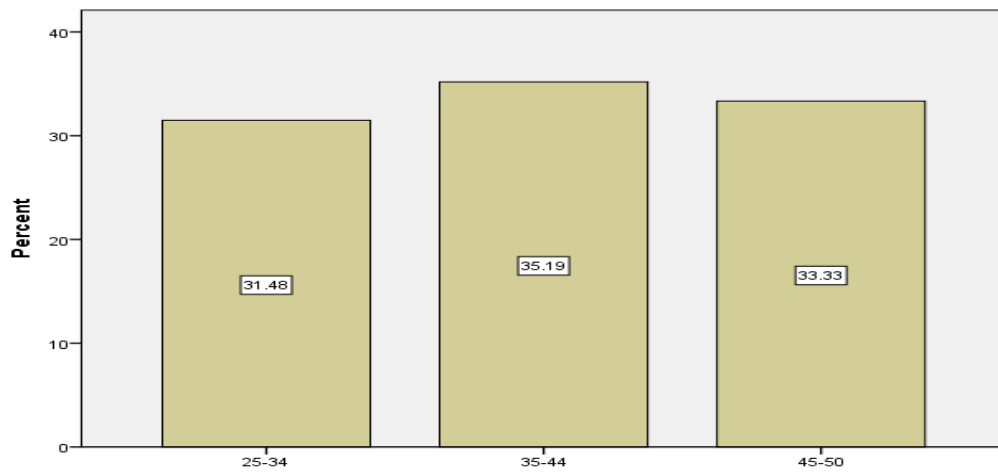
Table 1: Hypertension Types Classified

		n%
Stages of HT patients	Pre HT	23(42.6)
	HT stage1	15(27.8)
	HT stage2	16(29.6)
	Total	54(100)

Table 2 - Comparisons of the hemodynamic response of hypertension stages with time among experimental sessions.

Pairwise comparison	1min	3min	5min	P value
SBP Pre-HT	124.21±9.06	122.82±9.11	122.21±7.36	0.02
DBP Pre-HT	81±8.01	80.17±5.50	79.21 ±6.98	0.51
HR Pre-HT	82.21±7.06	80.53±9.15	87.87±28.58	0.34
SBP HT stage1	145.6±7.22	143.86±8.78	143.33±8.78	0.51
DBP HT stage1	91.73±6.22	91.26±6.67	91.20 ±6.50	0.14
HR HT stage1	81.65±5.60	79.8±8.04	90±27.66	1.00
SBP HT stage 2	173.31±12.42	164.68±20.66	175.93±11.75	0.481
DBP HT stage 2	96.62±11.84	96.37±11.45	97.31 ±9.45	0.536
HR HT stage 2	83.73±7.29	80.6±7.82	82.43±8.38	0.481

Table 2 compares the blood pressure, heart rate, and stages of hypertension during various experimental sessions. Pre-HT & HT stage 1 had a significant reason in any of the metrics ( $p < 0.05$ ), whereas HT stage 2 had none ( $p > 0.05$ ).

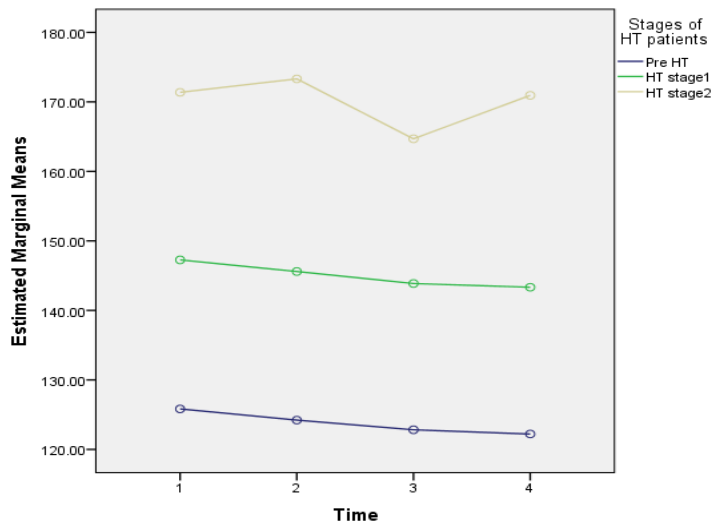


In this fig(1) shows that out of 54 patients 31.48% of a patient belong to age group of 25-35 years and at lowest percentage. 35.19% were of age 35 -44 years and at highest rate. While 33.33% are of age group of 45-50years.

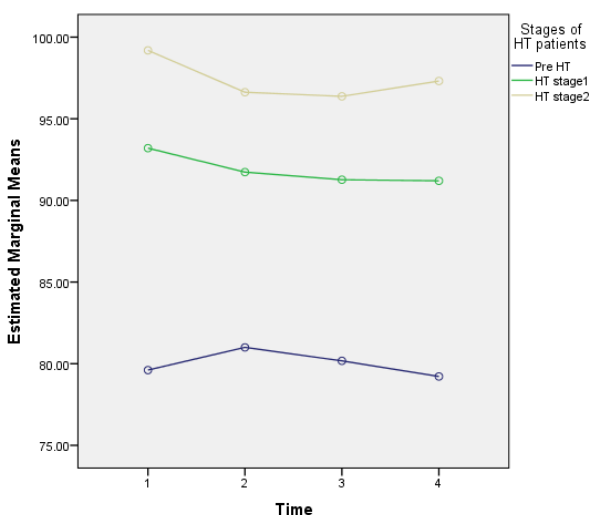
Table-3 Multivariate Tests of HT stage in Between Subjects and Within Subjects

Multivariate Tests			Value	F	Sig.
Between Subjects	Intercept	Wilks' Lambda	0.003	5141.642 <sup>b</sup>	0
	Hypertensionstages	Wilks' Lambda	0.14	27.321 <sup>b</sup>	0
Within Subjects	Time	Wilks' Lambda	0.481	5.159 <sup>b</sup>	0.51
	Time * Hypertensionstages	Wilks' Lambda	0.529	1.789 <sup>b</sup>	0.542

In Table 3 shows that the Between Subjects of Wilks' Lambda to Intercept , Value 0.003, F 5141.642<sup>b</sup> ,sig 0 and hypertensionstages of Wilks' Lambda Value 0.14, F 27.321<sup>b</sup>,sig 0 . Within Subjects Effect of Wilks' Lambda respect to Time , Value 0.481, F5.159<sup>b</sup>,sig 0.51 and Time hypertensionstages of Wilks' Lambda Value 0.529, F 1.789<sup>b</sup>,sig 0.529



In the case of pre-HT, the estimated marginal mean of SBP is between 120 and 130 mmHg, as shown in Fig. 2. It was between 140 and 150 mmHg for HT stage 1 and between 160 and 173 mmHg for HT stage 2.



According to Fig. 3, the estimated marginal mean of DBP in the case of pre-HT is between 79 and 83 mmHg. It is between 90 and 93 mmHg for HT stage 1 and between 95 and 100 mmHg for HT stage 2.

Comparisons of the hemodynamic response of hypertension stages with time among experimental sessions compare the blood pressure, heart rate, and stages of hypertension during various experimental sessions. Pre-HT and HT stage 1 had a significant reason in any of the metrics ( $p < 0.05$ ), whereas HT stage 2 had none ( $p > 0.05$ )<sup>13</sup>. This figure shows that 31.48% of the 54 patients are between the ages of 25 and 35, with the lowest percentage. The highest rate was 35.19% among those of working age (35 to 44 years). while 33.33% are between the ages of 45 and 50. In the case of pre-HT, the estimated marginal mean of SBP is between 120 and 130 mmHg, as shown in Fig. 2. It was between 140 and 150 mmHg for HT stage 1 and between 160 and 173 mmHg for HT stage 2. According to Fig. 3, the estimated marginal mean of DBP in the case of pre-HT is between 79 and 83 mmHg.<sup>14</sup> It is between 90 and 93 mmHg for HT stage 1 and between 95 and 100 mmHg for HT stage 2. The estimated

marginal mean of HR in the case of pre-HT is between 78 and 82 bpm. It was between 82 and 84 bpm for HT stage 1 and between 80 and 90 bpm for HT stage 2.

#### 4. DISCUSSION

The study's main finding is that different IHG protocols may reduce the BP response in pre-HT and HT stage 1. The results of the present study indicated that IHG exercise altered the systolic or diastolic blood pressure and heart rate of hypertensive patients. There were no appreciable improvements in HT stage 2 despite inconsistent results from the response analysis, with some sessions showing increases in blood pressure. The setting of this study was district Gujrat (city and Ikram) hospitals. The patients had been selected according to inclusion and exclusion criteria.<sup>15</sup> Data were collected using demographic data, a digital BP apparatus, a stopwatch, and a handheld dynamometer.<sup>16</sup>

According to Tim Van Assche, this study shows that just one episode of IHG can lower blood pressure throughout the day. These results need to be confirmed, and more study is required to clarify any potential mechanisms underlying the observed changes.<sup>17</sup> After an isometric challenge, blood pressure levels rose, and there was a significant correlation between handgrip strength and changes in blood pressure and aortic stiffness in aged patients. These results may be explained by the ageing arterial system failing under stress and vascular resistance rising with age.<sup>18</sup>

The majority of the patients involved in this study were pre-HT, which falls into the percentage of 42.59%. Stage 1 hypertension affects 27.78% of patients, while stage 2 hypertension affects 29.63%<sup>19</sup>. The mean age of the patient pre-HT is  $33.52 \pm 8.28$ , HT Stage1  $39.86 \pm 6.32$  and HT Stage2  $46 \pm 3.67$ , respectively<sup>20</sup>. Out of 54 include 61.11% of female which were in highest percentage and 38.89% of males which were in lowest percentage. The Stages of HT patients with respect to time in SBP pre-HT  $p < 0.05$ , HT stage  $p < 0.05$  and HT stage2  $p > 0.05$  therefore, stages of HT patients with respect to time in DBP pre-HT  $p < 0.05$ , HT stage1  $p < 0.05$  and HT stage2  $p > 0.05$ . Stages of HT patients with respect to time in HR pre-HT  $p < 0.05$ , HT stage1  $p > 0.05$  and HT stage2  $p > 0.05$ .

Isometric exercise may be a potent non-pharmacological intervention for the management of hypertension. isometric forearm exercise has the advantages of being quick, simple, and location-independent.<sup>16</sup> Out of 54 include 61.11% of female which were in highest percentage and 38.89% of males which were in lowest percentage. According to Philip J. Millar's article, the IHG data that are now available indicate that 8 weeks of training are sufficient to reduce resting ABP without the need for medication. Both normotensive and hypertensive groups show these effects. The autonomic nervous system's regulation is most likely the underlying process causing these training effects.

In the case of pre-HT, the estimated marginal mean of SBP is between 120 and 130 mmHg, as shown in Fig. 2. It was between 140 and 150 mmHg for HT stage 1 and between 160 and 173 mmHg for HT stage 2. According to Fig. 3, the estimated marginal mean of DBP in the case of pre-HT is between 79 and 83 mmHg.<sup>21</sup> It is between 90 and 93 mmHg for HT stage 1 and between 95 and 100 mmHg for HT stage 2. The estimated marginal mean of HR in the case of pre-HT is between 78 and 82 bpm. It was between 82 and 84 bpm for HT stage 1 and between 80 and 90 bpm for HT stage 2.

## 5. CONCLUSION

As a result of this study, it is possible to draw the conclusion that individuals with pre-HT and HT stage 1 hypertension have a reduction in blood pressure after engaging in dynamometer-assisted handgrip contraction exercises. The BP and HR responses are still erratic in stage 2 of HT and sporadically rise.

### Abbreviations

**HHD:** Hand Held Dynamometer, **IHG:** Isometric Hand Grip,

**SBP:** Systolic Blood Pressure, **DBP:** Diastolic Blood Pressure, **HR:**Heart Rate

### Conflict of interest

There was no conflict of interest.

### Financial statement

No funding was given by authorities. It was a project thesis of Doctor of Physical Therapy.

### Data availability

Data will be provided on demand by corresponding author. [Khushboo.gulzar@uipt.uol.edu.pk](mailto:Khushboo.gulzar@uipt.uol.edu.pk)

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