

## EFFECT OF PHYSICAL ACTIVITY ON BORDERLINE HYPERTENSION

ALI H.,<sup>1</sup> MALIK O.,<sup>2</sup> IQBAL H.,<sup>3</sup> SALEEM S.,<sup>4</sup> ABBAS A.<sup>5</sup> AND AHSEN N.<sup>6</sup>

<sup>1,2</sup>Services Institute of Medical Sciences

<sup>3,4,5</sup>FMH College of Medicine and Dentistry and <sup>6</sup>University of Health Sciences, Lahore

### ABSTRACT

**Background and Objectives:** Hypertension is key contributor to the current pandemic of cardiovascular diseases. This randomized control trial compared decrease in systolic and diastolic blood pressures in the study and control groups in response to a lifestyle intervention in borderline hypertensives. The intervention was carried out for the period of three months.

**Methodology:** A total of 102 adult participants were included with borderline hypertension (B.P between 120/80 to 139/89 mmHg) in Lahore, Pakistan. Participants were randomized into study and control groups. The study group was provided with 30 minutes daily exercise advice (both written and verbal) with regular monthly follow-ups from May to December 2013. Data were collected using a structured questionnaire. Blood pressures were recorded by Sphygmomanometer. Data were analysed using SPSS v.17. Chi-square test of significance was applied for comparison of proportions and t test for comparison of means. Relative Risks and Confidence Intervals were generated.

**Results:** Out of 51 participants in study group, a total of 25 (49.0%) showed a reduction in their systolic blood pressure ( $P = 0.0002$ ) and 23 (45.0%) showed a reduction in their diastolic blood pressures ( $P = 0.0001$ ) after a three months physical activity intervention, as compared to only 08 (15.6%) and 06 (11.7%) out of 51 in the control group. Reduction in systolic and diastolic blood pressures was found to be significant in study group at  $P < 0.05$ . Reduction in post intervention mean systolic and diastolic blood pressures was found to be statistically significant in study group (t-test) that is  $> 5$  mmHg at  $P < 0.01$ . Where as no such reduction in mean systolic and diastolic blood pressures was seen in control group at the start and end of three month period.

**Conclusions:** Physical activity can lower borderline hypertension. Reducing blood pressure can prevent the excess risk of cardiovascular diseases associated with borderline hypertension. However a study on a large sample size is required to generalize results for wider community. Also a three month period for physical activity is not predictive of change in lifestyle behaviors. The effect of intervention should have been evaluated after six months and one year intervals to measure long term outcomes.

**Keywords:** Borderline hypertension, physical activity, sedentary life style, cardiovascular disease, non-communicable diseases (NCDs), randomized control field trial (RCFT), blood pressure.

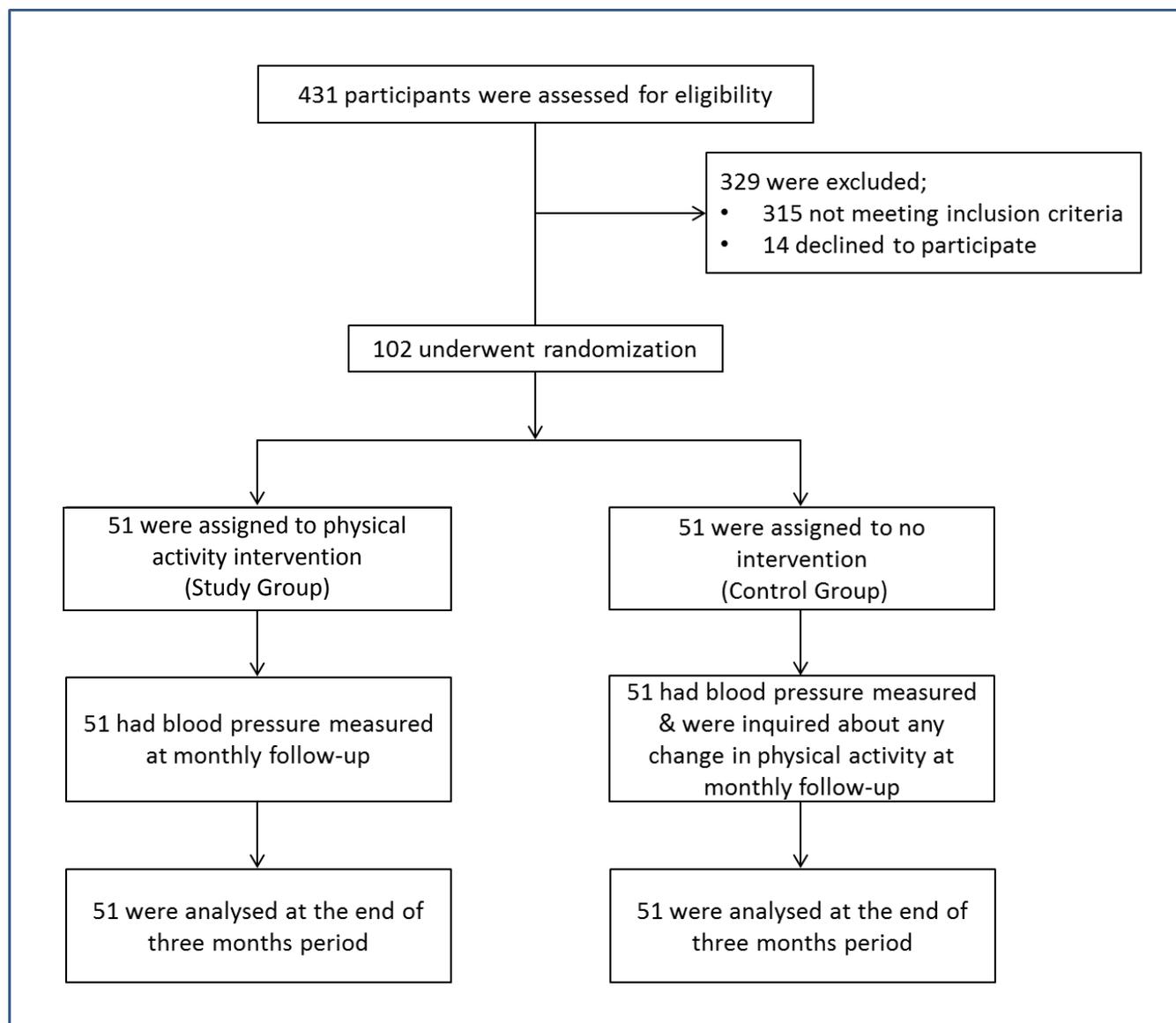
### INTRODUCTION

According to the JNC-Seven Classification of hypertension, borderline hypertension lies between 120 / 80 mmHg and 139/89 mmHg. It is not a disease category, instead it is a designation chosen to identify individuals at high risk of developing hypertension.<sup>1</sup> There are at least 600 million hypertension sufferers worldwide, which is 4.4 percent of the total global disease burden.<sup>2</sup> Non-communicable diseases (NCDs) contribute significantly to adult mortality and morbidity and impose a heavy economic burden on individuals, society and health systems within Pakistan.<sup>3</sup>

A study done in the provinces of Punjab and Sindh in Pakistan showed Hypertension prevalence of 05% and 17% respectively.<sup>4</sup> In Pakistan it is estimated that

more than 50% of the population over the age of 50 is hypertensive.<sup>2</sup> Similarly the prevalence of Hypertension over the age of 45 years was reported at 33%, implying that one in three Pakistani Nationals over the age of 45 years suffers from high blood pressure.<sup>5</sup> Another survey conducted in Boston in US population showed similar trends, with prevalence estimates of 31.5%.<sup>6</sup>

In both men and women, studies have shown a strong association between elevated systolic and diastolic blood pressure, and the risk of cardiovascular disease and stroke.<sup>7,8</sup> According to the World Heart Federation Fact Sheet 2002, physical inactivity increases the risk of hypertension by 20 – 30%.<sup>9</sup> A regular exercise program may help lower blood pressure over the long term. Activities such as jogging, cycling, or swimming



**Figure 1:** Screening, randomization, follow-up and analysis of the study participants.

for 30 to 45 minutes daily may ultimately lower blood pressure by as much as 5 to 15 mmHg.<sup>10</sup>

This study was designed to identify the inverse association between physical activity and borderline hypertension. The aim was to promote a life style change in our community if an association is found.

### SUBJECTS AND METHODS

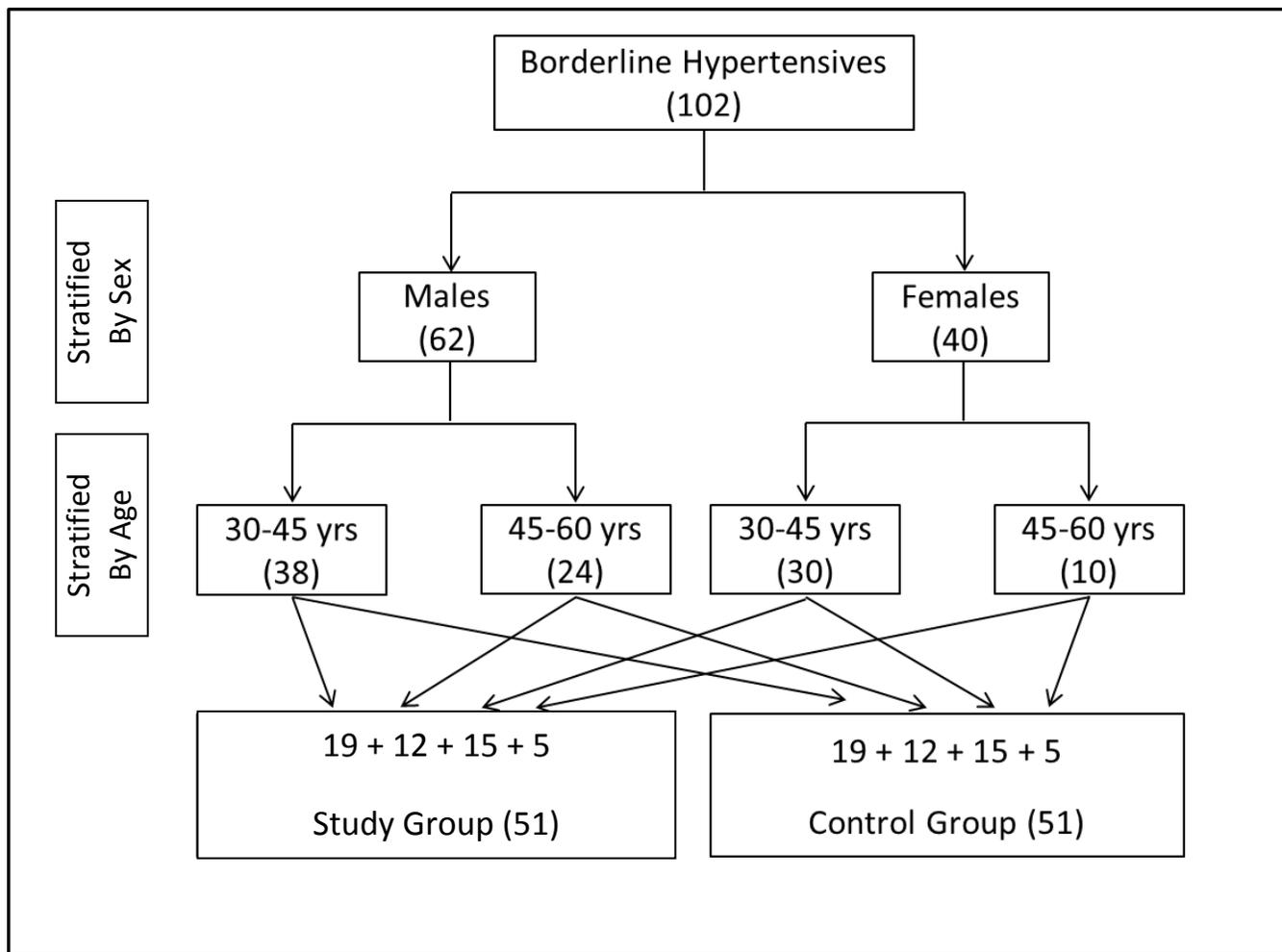
The study design selected was randomized control field trial (RCFT) in the setting of the University of Punjab, Lahore, Pakistan, from May to December 2013. The study population was faculty members of the University of Punjab Lahore Pakistan. The faculty from all departments was listed and those with borderline hypertension fulfilling the inclusion criteria were

included in the sample.

One Hundred and Two (102) participants with borderline hypertension were identified. Inclusion criteria were male and female faculty members of Punjab University, aged 30 – 60 years with borderline hypertension. Individuals with known history of co-morbid conditions such as diabetes mellitus, heart diseases, renal diseases, endocrine disorders and pulmonary diseases, those on steroids therapy or other medications and known hypertensives were excluded from the study.

From above, all those who fulfilled the inclusion criteria, were stratified by age and sex (Figure 1).

Data Collection Instrument was a validated Questionnaire. Sphygmomanometer was used to record blo-



**Figure 2:** Stratified randomization of the study participants to account for the confounding variables of age and sex.

od pressure. The data were entered into the computer software program using SPSS 17.0 version. Data analysis was done using the same software. Chi-square test of significance ( $\chi^2$ ) was applied. Relative Risk (RR) and Confidence Intervals (CI) were calculated. Pre- and post-intervention mean systolic and diastolic blood pressures were recorded in both study and control groups. T-test was used to determine the difference between the means. P value < .05 was taken as statistically significant for both statistical tests. Stratified randomization was done to account for gender and age (Figure 1).

Baseline blood pressures of participants were measured. The lowest reading of blood pressure was taken as final reading. The data was collected using a structured questionnaire including the variable of interest. The investigators conducted examinations and interviews which included measurement of blood pressure of the study participants. The experimental group was provided with exercise advice both written and verbal (intervention) with regular monthly follow-ups. They were asked to do moderate regular physical exercise

for three months e.g. daily brisk walk for 30 minutes. They were allowed to re-divide 30 minute exercise by three bouts of 10 minute each per day. The blood pressure at the end of the stipulated period of three months was recorded to see the effect of intervention. During the follow-up period on every visit, the participants in the control group were regularly inquired about any change in their physical activity.

**RESULTS**

A Randomized Control Field Trial was conducted to see the effect of physical activity on borderline hypertension. A total of 102 borderline hypertensives were identified for the study and were randomized into study and control groups. Stratified randomization was done to control the confounding effect of age and gender.

The proportion of participants with reduction in both systolic and diastolic blood pressures in study group is highly statistically significant as compared to the proportion of subjects in the control group (i.e.  $P = 0.0002$  and  $P = 0.0001$ ) (Table 1, 2). This shows that

the intervention (increased physical activity) does play a role in reduction of both systolic and diastolic blood pressures in borderline hypertensives.

**Table 1:** *Systolic Blood Pressure.*

	<i>At Least 5 mmHg Reduction in Systolic B.P.</i>	<i>No or &lt; 5 mmHg Reduction in Systolic B.P.</i>	<i>Total</i>
Study Group	25	26	51
Control Group	08	43	51
Grand Total	33	69	102

X<sup>2</sup> 13.51 (p = 0.0002)  
 RR 3.43  
 95% CL 1.63 – 7.22

**Table 2:** *Diastolic Blood Pressure.*

	<i>At Least 5 mmHg Reduction in Diastolic B.P.</i>	<i>No or &lt; 5 mmHg Reduction in Diastolic B.P.</i>	<i>Total</i>
Study Group	23	28	51
Control Group	06	45	51
Grand Total	29	73	102

X<sup>2</sup> 14.66 (p = 0.0001)  
 RR 3.40  
 95% CL 1.81 – 10.70

Reduction in post intervention mean systolic and diastolic blood pressures was found to be statistically significant in study group (t-test) that is > 5 mmHg at  $P < 0.01$ . Whereas no such reduction in mean systolic and diastolic blood pressures were seen in control group at the start and end of three-month stipulated period.

## DISCUSSION

This particular study was conducted with the primary objective of assessing the effect of enhanced physical activity on decrease in systolic and diastolic blood pressures in borderline hypertensives.

In our study, out of 51 subjects in study group, a total of 25 (49.0%) showed a reduction in systolic blood pressure and 23 (45.0%) showed a reduction in their diastolic blood pressures, as compared to only 08 (15.6%) and 06 (11.7%) out of 51 in the control group (Table 1, 2).

A study conducted at the University of Minnesota in USA showed that physical activity should be considered in the prevention of hypertension in young adults. It was found that young adults who exercised an average of five times a week and burnt 300 calories per exercise session experienced a 17% reduction in the risk of developing hypertension. In addition, study participants who maintained or increased their total time participating in physical activity from the start of the study to the finish, decreased their risk of high blood pressure by 11% for every 1,500 calories they burned weekly.<sup>11</sup>

Our study was conducted in an urban setting among faculty of the University of Punjab, Lahore. Another study conducted among children in year 2001 showed that increasing rates of urbanization and associated behavioral changes have led to a higher prevalence of a sedentary lifestyle and less exercise. It is estimated that children today spend 600 kcal / day less on physical activity than their counterparts 50 years ago.<sup>12</sup>

If only population exercise levels can be improved and sustained, the cardiovascular risk burden will decrease. Effect of exercise shown in a meta-analysis in year 2002 (including 15 studies with 770 participants) concluded that for hypertensive patients, aerobic exercise with at least one 40-minute session of moderate intensity per week was associated with a drop in systolic blood pressure of about 5 mmHg and a drop in diastolic blood pressure of about 4 mmHg.<sup>13</sup>

In our study, mean baseline systolic and diastolic blood pressures of the study and control groups were also measured. After the three-month intervention in the experimental group, mean systolic and diastolic blood pressures of experimental and control groups were again recorded. Reduction in post intervention mean systolic and diastolic blood pressures was found to be statistically significant in experimental group (t-test) that is > 5 mmHg at  $P < 0.01$ . Whereas no such reduction in mean systolic and diastolic blood pressures were seen in control group at the commencement and end of the stipulated period.

It is **concluded** that on the basis of the results of this study it is seen that physical activity can lower borderline hypertension. Reducing blood pressure can prevent the excess risk of cardiovascular diseases associated with borderline hypertension. Persuading patients to make lasting changes in their physical activity patterns is however challenging.

## Limitations of the Study

Borderline hypertension is a highly prevalent condition. It is therefore necessary that research must be carried out with large sample size so as to generalize the results to the wider community.

A three month period for physical activity is not predictive of change in lifestyle behavior. The effect of

intervention should have been evaluated after six months and one – year intervals to measure long – term outcomes.

### ACKNOWLEDGEMENTS

The authors express their sincere thanks to the members of the faculty of University of the Punjab who participated in this study.

### REFERENCES

1. Guyton, Hall. Textbook of Medical Physiology. 7th ed. USA. Elsevier – Saunders publishers, 2005: 220 p.
2. Abbas S, Kitchlew AR, Shazia A. Disease burden of ischemic heart disease in Pakistan and its risk factors. *Ann Pak Inst Med Sci.* 2009; 5 (3): 145-50.
3. Nishtar S. The National Action Plan for the prevention and control of non-communicable diseases and health promotion in Pakistan: Prelude and finale. *J Pak Med Assoc.* 2004 Dec; 54 (12 Suppl. 3): S1-8.
4. Siddiqui H, Qudsia A, Omair A, Usman J, Rizvi R, Ashfaq T. Risk factors assessment for hypertension in a squatter settlement of Karachi. *J Pak Med Asso.* 2005; 55: 390.
5. Pakistan Medical Research Council. National Health Survey of Pakistan 1990 – 94. Islamabad, Pakistan: Pakistan Medical Research Council, Network Publication Service, 1998.
6. Jaffar TH, Levey AS, Jafary FH, White F, Gul A, Rahbar MH, et al. Ethnic subgroup differences in hypertension in Pakistan. *J Hypertens.* 2003; 21: 905-12.
7. The Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *ArchIntern Med.* 1997; 157: 2413–2446.
8. Guidelines Subcommittee, World Health Organization-International Society of Hypertension Guidelines for the management of hypertension *Hypertens.* 1999; 17: 151–183.
9. Mendis S, Puska P, Norrving B. Global Atlas on Cardiovascular Disease Prevention and Control. Geneva: World Health Organization, 2011.
10. Health-Cares.net [Internet]. Your fitness guide. 2005 [updated 2005 July 18; cited 2014 Aug 12], <http://mens-health.health-cares.net/hypertension-lifestyle.php>
11. Parker ED, Schmitz KH, Jacobs, Dengel DR, Schreiner PJ. Physical activity in young adults and incident of hypertension over 15 years of follow up: the CARDIA study. *Am J Public Health,* 2007; 97: 703–709.
12. Boreham C, Riddoch C. The physical activity, fitness and health of children. *J Sports Sci.* 2001; 19: 915–929.
13. Whelton SP, Chin A, Xin X, He J. Effect of aerobic exercise on blood pressure: a meta-analysis of randomized controlled trials. *Ann Intern Med.* 2002; 136 (7): 493–503.