

Significance of Aerobic Fitness in Early Detection and Primordial Prevention of Hypertension

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Abstract: Hypertension is quantitatively the major cardiovascular risk factor and responsible for ~50% of cardiovascular morbidity and mortality. It is known to have a genetic factor and has various structural changes in heart and the blood vessels, which could lead to difference in aerobic fitness of apparently normotensive females having family history of HTN and those without family history of HTN. This is an observational cross sectional study including 67 apparent, normotensive, young females with and without family history of hypertension. Their vO_2max was calculated as per the equation given by McArdle et al which was found to be decreased (44.26 ± 2.73) in normotensive females with family history of HTN than those without any family history of HTN (45.55 ± 2.36). Our study findings emphasize the importance of aerobic fitness in early detection of hypertensive changes, which could be helpful in implementing early interventions to improve aerobic fitness for primordial prevention of hypertension.

Keywords: aerobic fitness, hypertension, normotensives, family history

1. Introduction

Hypertension (HTN) is among the major risk factors for premature disability and death in both Western [1], [2] and Asian [3] populations. India is one of the highly populated countries and is now leading with other Western countries in having increased number of people suffering from non-communicable diseases, such as cardiovascular disorders, which are the major determinants of morbidity and mortality. Family history, male gender, salt intake, obesity, diabetes mellitus, etc have been reported as the risk factors for hypertension. The increased risk of cardiovascular events in Indian population has been attributed to genetic predisposition [4].

Aerobic fitness or aerobic exercise capacity of an individual is considered as an independent prognostic factor for cardiovascular diseases and mortality. The aerobic fitness is usually measured as vO_2max for general aerobic fitness level. Previous studies show that there is an inverse relationship between physical activity and hence between aerobic fitness and hypertension. In a study done by Steven Blair et al [5], it was found that persons with low levels of physical fitness had a relative risk of 1.52 for the development of hypertension when compared with highly fit persons. Our study further looks for any difference between aerobic fitness of young normotensive with and without family history of HTN, which would depict the risk of future development of HTN in these subjects.

2. Literature Survey

William F. Graettinger et al [6] in their study found that in young normotensive men with a family history of hypertension, LV diastolic filling, while still normal, shifted toward the pattern of LV filling observed in hypertensive patients.

James F. Sallis et al [7] in their concluded that fitness was strongly and significantly correlated with virtually all risk factors such as blood pressure, high density lipoprotein

(HDL) cholesterol, the ratio of high density lipoproteins to low density lipoproteins (LDL), and body mass index.

Jack H. Wilmore et al [8] in their study concluded that there is a significant relationship between changes in markers of aerobic fitness and changes in several risk factors for CVD and NIDDM. However, the magnitude of these relationships is small.

3. Problem Definition

Pathological changes due to family history of HTN may start without any apparent symptoms. This study looks for any difference in aerobic fitness of otherwise apparently healthy young females having family history of HTN and those without the family history of HTN.

4. Material and Methods

This is an observational cross sectional study done at the out-patient department of physiotherapy, People's college of Paramedical Sciences, Bhopal. The inclusion criteria were apparently healthy, normotensive (SBP 100-119mm Hg, DBP 60-69mmHg), 18-25 years old females with and without family history of hypertension. Exclusion criteria were any apparent cardiovascular morbidity, respiratory diseases compromising the aerobic capacity, any orthopedic condition that interferes with performing test, neurological diseases and muscle weakness, unable to comprehend and cooperate with commands.

Subjects were taken for the study after having their consent and approval from the ethical committee, and were divided in two groups; Group A (having family history of hypertension), and Group B (without family history of hypertension). Subjects were asked to rest in a chair for at least 15 minutes. Baseline HR and BP was measured. Subjects performed Queen's College Step Test [9]. Subjects stepped using a 4-step cadence (up up-down down) for 3 minutes. Subjects were instructed to stop immediately after completion of 3 minutes. HR was again measured

immediately after the test. $\dot{V}O_2\text{max}$ was calculated as per the equation given by McArdle et al, $\dot{V}O_2\text{max}$ (ml/kg/min) = $65.81 - 0.1847 * \text{post test HR}$.

5. Results and Discussion

A total number of 67 female subjects were included and assigned into two groups, viz Group A having family history of HTN (n=32) and Group B without family history of HTN (n=35). The details of both the groups in respect to various parameters are given in table 1.

Table 1: Baseline Parameters in both the groups

AGE	GROUP A (n=32)	GROUP B (n=35)
MEAN	20.03	20.17
SD	1.31	1.34
BMI		
MEAN	20.98	21.95
SD	1.63	1.85
SBP		
MEAN	116.94	116.51
SD	4.16	4.88
DBP		
MEAN	70.75	68.35
SD	4.62	4.16

An unpaired t-test was used to examine changes in the $\dot{V}O_2\text{max}$ of both the groups. The significance level set for this study was $p < 0.05$. The details are given in table 2.

Table 2: Statistical analysis of $\dot{V}O_2\text{max}$ of both the groups

Para meter	Group A (n=32)	Group B (n=35)
Mean	44.2647	45.5520
Standard Deviation	2.7309	2.3616
SEM	0.4828	0.3992
„t“ Value	2.0685	
„p“ Value	0.0426	
Significant/Non Significant	Significant	

The difference in $\dot{V}O_2\text{max}$ of both the groups was found to be significant with the decreased $\dot{V}O_2\text{max}$ found in the Group A (with family history of HTN) than the $\dot{V}O_2\text{max}$ of Group B (no family history of HTN). The comparison of $\dot{V}O_2\text{max}$ of both the groups is depicted graphically in figure 1.

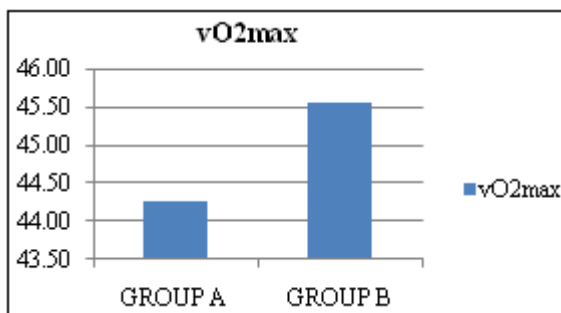


Figure 1: Graphical representation of means of $\dot{V}O_2\text{max}$ in both the groups

Aerobic capacity is generally considered the best indicator of cardio respiratory endurance. It is affected by three factors-

functioning of cardiovascular and respiratory system as well as ability of skeletal muscles to extract the oxygen from blood. Considering the normal functioning of the other two systems, the abnormality in CVS would lead to decreased aerobic fitness. Scientific literature says that higher physical conditioning status, indexed by $\dot{V}O_2\text{max}$, is associated with reduced arterial stiffness, which in turn is associated with low or normal blood pressure, thus emphasizing the importance of higher aerobic fitness in managing HTN.

Blood pressure is a classical complex genetic trait with heritability estimates of 30-50%. Unbiased genome-wide analyses of BP genomics have identified 43 genetic variants associated with systolic, diastolic BP, and HTN (Ehret GB et al) [10]

Hypertension is associated with structural changes in the vascular system and in the heart- a thickening of the intima-media of the carotid artery and an increase in left ventricular mass (Hughes AD et al) [11]. Changes in the extracellular matrix predisposes to fibrosis which cause functional and structural abnormalities like increased myocardial stiffness, especially during diastole. (Bradford C. Berk et al) [12].

Our study hypothesized if such changes are present in otherwise normotensive population with family history of HTN, and then there could be a difference in aerobic fitness of these people and people without family history of HTN. The results of this study show that there is decreased $\dot{V}O_2\text{max}$ (44.26 ± 2.73) in normotensive females with family history of HTN than those without any family history of HTN (45.55 ± 2.36). Although the calculated $\dot{V}O_2\text{max}$ in both the groups is of superior rank, there is still a statistical difference in both of them, which could be attributed to the latent changes caused due to family history of HTN. Our study emphasizes the importance of aerobic fitness in early detection of hypertensive changes, which could be later helpful in implementing early interventions to improve aerobic fitness for primordial prevention of hypertension.

6. Conclusion

In conclusion, there is a decreased $\dot{V}O_2\text{max}$ (aerobic fitness) found in normotensives having family history of HTN than those without the family history of HTN.

7. Future Scope

More prospective studies should be done with larger sample sizes to confirm the relationship between aerobic fitness and family history of HTN.

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Author Profile



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