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A STUDY OF CARDIOVASCULAR AUTONOMIC FUNCTIONS AND VO_2 MAX IN YOUNG OFFSPRINGS OF TYPE 2 DIABETIC PARENTS

Physiology

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ABSTRACT

Background: Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia,which affects multiple organ systems. If both parents have type 2 DM, the risk approaches 40%. Decreased VO_2max is among the earliest indicators of insulin resistance and T2DM therefore, an important risk factor for disease progression. **Objectives:** This study compares the cardiac autonomic function and VO2 max of offsprings of diabetic parents with offsprings of non-diabetic parents. **Material And Methods:** This study was done in 30 healthy offsprings of diabetic parents and 30 offsprings of non-diabetic parents, of age group 18- 25 years. Selections of participants were based on the inclusion and exclusion criteria. A detailed history was taken along with the clinical examination after obtaining consent from the participants. Autonomic function parameters of the subjects were assessed by heart rate variability and VO_2max of the subjects were measured by Harvard step test. **Results:** This study shows a higher LF, lower HF and higher LF:HF ratio in diabetic group comparing with the non-diabetic group. Our study also shows that the VO_2max was lower in the diabetic group as compared to the non-diabetic group, though statistically insignificant. **Conclusion:** The study identifies cardiovascular autonomic dysfunction, in young non diabetic offsprings of diabetic parents. A lower VO_2max also signifies a decreased cardiorespiratory fitness in these young non diabetic offsprings. It underlines the importance of early intervention in the form of regular physical activity in this risk group.

KEYWORDS

Diabetes mellitus, VO2max, sympathovagal imbalance

INTRODUCTION

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. The metabolic dysregulation associated with DM causes secondary pathophysiological changes in multiple organ systems. With an increasing incidence worldwide, DM is likely to continue to be a leading cause of morbidity and mortality in future.(1) Type 2 DM has a strong genetic component. If both parents have type 2 DM, the risk approaches 40%. Decreased VO_2max is among the earliest indicators of insulin resistance and T2DM therefore, an important risk factor for disease progression (2). This study has been designed with the aim of assessing any changes in autonomic regulation of cardiovascular system and VO2max in non-diabetic offsprings of type 2 diabetic parents by comparing it with non-diabetic offsprings of non-diabetic parents.

OBJECTIVES

1. To assess the heart rate variability and VO_2 max parameters in young offsprings of type 2 diabetic parents (study group)
2. To assess the heart rate variability and VO_2 max parameters in young offsprings of non-diabetic parents (control group)
3. To compare the results of study group and control group.

Methodology

A cross sectional study was conducted among the students of our institution in the age group 18 to 25 years. Sample size was calculated to be 60. Based on parental history of Type 2 diabetes mellitus, students were separated into two groups . Group 1 was students with parental history of Type 2 diabetes mellitus and Group 2 was students with no parental history of type 2 diabetes mellitus. From these two groups, study group (diabetic) and control group (non- diabetic) were selected by simple random sampling with 30 in each group.

Autonomic function parameters were assessed by heart rate variability using Physiopac PC -2004 version. After instrumentation, subjects were given 15 minutes mandatory rest period. Following which ECG recording was performed during which subjects were in supine position, awake and normally breathing. The data so gathered subjected to spectral analysis of HRV using Physiopac PC 2004 version software. The spectral components like high frequency (HF), low frequency (LF) in absolute and normalized power were considered for analysis along with LF/HF ratio.

VO_2max was measured by Harvard step test. The participants performed 20 step cycle at a normal pace. The VO_2 max was calculated from the data obtained from this procedure.

Inclusion Criteria:

Only healthy subjects of Indian origin were included in the study. The apparent health status of subject was determined through clinical examination and history taking

Exclusion Criteria:

1. Evidence of hypertension (SBP>150 and DBP>90)
2. Subjects with diabetes mellitus, bronchial asthma, giddiness on standing, syncopal spells.
3. Subjects receiving drugs that can interfere with cardiac function or respiratory functions eg: beta blockers.
4. Subjects with history of alcohol intake.
5. Subjects with tobacoo use.
6. Any disease or conditions affecting autonomic functions like polio, tuberculosis, Guillian barre syndrome.
7. Subjects performing regular athletics, yoga training and body building exercises were excluded from the study.

Data Analysis

The data obtained was coded, entered in Microsoft Excel sheet and analysed using the statistical software, Statistical Package for Social Sciences (SPSS Version- 23). The difference of means in two groups were assessed by students 'T' test. **p value <0.05 is taken as significant.**

Institutional Research Committee and Ethical committee clearance was obtained prior to starting the study (No: AIMSIEC/25/2018 dated 06.10.2018.)

Table 1. Comparison Of LF In Normalized Units Between Diabetic And Non Diabetic Groups

Variable	Group		P value (independent t test)
	Diabetic	Non diabetic	
LF nu	83.79±8.11	70.26±13.9245	0.0001

Values expressed as mean ± SD, p value <0.05 –significant, p value < 0.01 - highly significant , p value < 0.001 - very highly significant

Table 2. Comparison Of HF In Normalized Units Between Diabetic And Non Diabetic Groups

Variable	Group		P value (independent t test)
	Diabetic	Non diabetic	
HF nu	14.10±4.97	28.88±10.98	0.0001

Values expressed as mean ± SD, p value <0.05 –significant, p value < 0.01 - highly significant, p value < 0.001 - very highly significant

Table 3. Comparison Of LF nu :HFnu Ratio Between Diabetic

And Non Diabetic Groups

Variable	Group		P value
	Diabetic	Non diabetic	(independent t test)
LFnu : HFnu ratio	6.57±1.95	2.75±.927	0.0001

Values expressed as mean ± SD, p value <0.05 –significant, p value < 0.01 - highly significant, p value < 0.001 - very highly significant

Table 4. Comparison Of VO_2 Max Between Diabetic And Non Diabetic Groups

Variables	Group		P value
	Diabetic	Non-diabetic	(independent t test)
HR15	32.800±3.3672	32.467±3.7484	0.718
HR_{max}	198.400±1.886	198.267±1.552	0.766
VO_2max in litres/min	65.219±6.573	66.075±8.009	0.652

Values expressed as mean ± SD, p value <0.05 –significant, p value < 0.01 - highly significant, p value < 0.001 - very highly significant

RESULTS

This study reveals LF nu was significantly higher in the diabetic group as compared to non diabetic group, HF nu was significantly lower in the diabetic group as compared to non diabetic group and LF nu : HF nu ratio was significantly higher in the diabetic group as compared to non diabetic group. Our study also shows that the VO_2max was lower in the diabetic group as compared to the non diabetic group, but this difference was not statistically significant.

DISCUSSION

In the present study, the spectral analysis of HRV revealed that theLFnu was higher, HF nu was lower and LFnu : HFnu ratio higher in the diabetic group as compared to the control group. These differences were statistically significant. A statistically significant increase in the sympathetic components and decrease in parasympathetic components in the non-diabetic offsprings of diabetic parents, when compared to the non-diabetic offsprings of non-diabetic parents, were also observed by Kuppuswamy et al(3). Similar to the present study, they observed that the non-diabetic offsprings of diabetic parents have enhanced sympathetic activity and attenuated vagal activity even in their non-diabetic state, thus inferring an early onset of sympathovagal imbalance that could predispose them to hypertension and its sequel. A shift in sympathovagal balance due to vagal withdrawal was also observed in offsprings of diabetic parents by Pathak et al (4). Sympathetic overactivity was also observed by Fiorentini et al in their study as well, with spectral analysis showing a higher LF power in offsprings of diabetic parents.(5).Similar findings were observed by Iellamo et al.(6) and G K Pal et al(7). Goit et al also concluded that, parental type 2 diabetes has an impact on the cardiac autonomic function in non-diabetic young adults (8). In their study, LF, HF and HFnu were significantly less in the diabetic group, whereas LFnu and LF:HF ratio were comparable between the two groups.

The study by Durai raj et al showed that, there was no significant difference in HF and LF when expressed in both absolute and normalized units. The ratio of LF: HF, surrogate marker of sympathovagal balance was higher among subjects with parental history diabetes, however, statistically not significant. (10). F J Naeves et al observed findings contrary to the present study (11). They found that family history of type 2 diabetes, in the absence of concomitant metabolic derangements, does not impair heart rate variability in first degree relatives.

The study also observed a lower VO_2max in the study group as compared to the control group. Researchers had identified decreased VO_2max as an early indicator of insulin resistance and it is correlated to impaired insulin sensitivity.(9) Decreased VO_2max as an early marker for insulin resistance syndrome / type 2 DM underlines the need for offsprings of diabetic parents to participate in regular physical activity and improve cardiorespiratory fitness in order to prevent insulin resistance, type 2 diabetes and atherosclerosis acceleration.

CONCLUSION

The study identifies cardiovascular autonomic dysfunction, in young non diabetic offsprings of diabetic parents. The presence of this abnormality even in the non diabetic state underlines the importance of early intervention in the form of regular physical activity in this risk group who are prone to develop diabetes mellitus and its complications in future.

A lower VO_2max also signifies a decreased cardiorespiratory fitness in these young non diabetic offsprings. Though, these findings were not statistically significant, they are significant pointers towards future research in young offsprings of diabetic parents.

The study identifies the need for early intervention and follow up in this risk group with regular physical activity and deep breathing exercises to improve cardiorespiratory fitness in order to prevent insulin resistance, development of type 2 diabetes and atherosclerosis acceleration.

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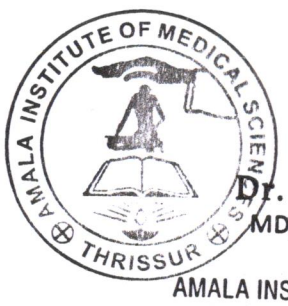

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