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TO EVALUATE THE EFFECT OF DEEP BREATHING IN NON DIABETIC OFFSPRINGS OF TYPE 2 DIABETIC PATIENTS

Physiology

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ABSTRACT

INTRODUCTION: Diabetes Mellitus is polygenic and multifactorial disease , since in addition to genetic susceptibility, environmental factors such as obesity, nutrition, and physical activity modulate the phenotype. Type 2 Diabetes Mellitus has a strong genetic component and autonomic nervous system dysregulation is implicated in the pathogenesis of obesity and type 2 Diabetes Mellitus. The present study determines the changes in cardiac autonomic functions by evaluating the effect of deep breathing on heart rate in healthy nondiabetic offsprings of type 2 diabetes patients and to compare it with age and sex matched controls. METHODOLOGY: This study of Cardiovascular Autonomic Functions was carried out in 50 healthy offsprings of Type 2 Diabetic Parents (Case group) and 50 healthy offsprings of Nondiabetic Parents (Control group) in the age range of 18 - 25 years randomly selected among MBBS students of J.L.N. Medical College Ajmer. Statistical Analysis is done by student t-test. Probability P value <0.05 was considered statistically significant. RESULT: : In offsprings of type 2 diabetic patients significantly higher basal heart rate (beats/min) (P< 0.001) and significantly lower deep breathing E/I ratio (P <0.001) were observed as compared to control group. CONCLUSION: The study reveals shift in sympathovagal balance was due to vagal withdrawal in offspring of type 2 Diabetes Mellitus patients. Risk of future diabetes is associated with this autonomic dysfunction .Early detection can be utilized to prevent future cardiovascular risk in subjects by non pharmacological means as exercise and yoga.

KEYWORDS:

Autonomic Function Test, Diabetes Mellitus, Sympathovagal balance

INTRODUCTION: Diabetes Mellitus is polygenic and multifactorial disease , since in addition to genetic susceptibility, environmental factors such as obesity, nutrition, and physical activity modulate the phenotype. Type 2 DM is characterized by hyperinsulinemia and hyperglycaemia due to insulin resistance and relative insulin deficiency, and a slow, progressive loss of beta-cell function. Type 2 DM has a strong genetic component. The autonomic nervous system (ANS) has a role in the regulation of long- and short-term energy balance, and ANS dysregulation is implicated in the pathogenesis of obesity and T2DM (Schwartz MW et al 2004).

The function of the ANS can indirectly be examined by cardiovascular reflex tests ("Ewing tests"), as proposed by Ewing and Clarke in 1982, are still considered the gold standard for clinical autonomic testing. The basis for performing a cardiovascular reflex test is to induce a disturbance in the system and to monitor the cardiovascular response. Heart rate variation during deep breathing is a conventional autonomic function test (CAFT). It assesses the parasympathetic activity and is one of the best parasympathetic reactivity test (Pal GK and Pal P 2010). It is abnormal in multisystem atrophy, progressive autonomic failure, diabetes mellitus , autonomic neuropathy and central nervous system depression. The aim of our study is to evaluate the parasympathetic activity after deep breathing in offsprings of type 2 diabetes mellitus parents and to compare it with age and sex matched controls.

2. MATERIAL AND METHODS

The study was performed in department of Physiology, J.L.N. Medical College, Ajmer. In this comparativen study, 100 healthy subjects including both males and females, in the age group of 18-25 years were recruited from M.B.B.S. students of J.L.N. Medical College , Ajmer. The study group consisted of 50 volunteers with parental history of Type 2 DM and control group included 50 volunteers without parental history of diabetes. Known case of diabetes, hypertension and congenital heart disease and with any history of smoking, alcohol or substance abuse and on long term medication that may influence cardiovascular and respiratory system were excluded from the study . Ethical clearance was obtained from Ethics committee of J.L.N. Medical College,Ajmer. The study protocol was explained and informed written consent was taken from the volunteers. Detailed personal, medical and family history including history of parental DM was taken. Anthropometrical parameters like height, weight, BMI were taken. The study was carried out between 9.30 am-12.30 pm after emptying bladder, consuming a light breakfast 1-2 hr before arrival. Subjects were asked to abstain from use of caffeine and other stimulants 12 hrs before the study and strenuous exercise 24 hr before study. The random blood sugar level [Using Dr Morepen GlucoOne blood glucose monitoring system] was measured to rule out diabetes. Blood Pressure and Autonomic function of subjects by HRV analysis was recorded after making them comfortable by resting in supine posture for 15 minutes. Blood Pressure and Heart Rate were recorded by RMS Polyrite D Version 2.4. Resting ECG and baseline HR were recorded. Subject was asked to breathe deeply at the rate of 6 breaths per minute, allowing 5 seconds each of inspiration and expiration. The maximum and minimum heart rates during each breathing cycle were measured and the ratio of longest R-R interval in expiration to shortest R-R interval in inspiration is calculated which is called Expiration /Inspiration ratio (E/I ratio). Statistical analysis was performed with the SPSS, Trial version 23 for Windows statistical software package (SPSS inc., Chicago, IL, USA) and Primer. The Groups were compared for quantitative data were presented as mean and standard deviation (Mean ± SD) and were compared using by student t-test. Probability P value <0.05 was considered statistically significant.

3. RESULT

The Groups were compared for anthropometric measures. Table 1 shows Subject characteristics and anthropometric measures of study population in two groups. It was shown that age, height, weight, BMI, Systolic and Diastolic blood pressure were comparable and there were no significant differences between cases and controls in subject characteristics and anthropometric measures.

Table 1 shows Subject characteristics and anthropometric measures of study population in two groups

Variables	Cases(N=50)	Control (N=50)	P value
Age (yrs)	19.42±1.727	19.88±1.923	0.21 NS
Height (meters)	1.67±8.22	1.69±7.97	0.25 NS

Weight (kg)	62.38±14.20	61.32±8.77	0.65 NS
Body Mass Index (kg/m2)	22.04±4.15	21.44±2.32	0.36 NS
Systolic BP (mm of Hg)	112.86±8.29	113.60±6.77	0.62 NS
Diastolic BP (mm of Hg)	70.4±9.65	68.66±8.08	0.62 NS

Data expressed as Mean ±SD
Cases = healthy subjects with parental history of type 2 DM
Controls = healthy subjects without parental history of Diabetes
S = statistically significant
NS= statistically non significant

Table 2 provides analysis of basal heart rate and heart rate response to deep breathing (E/I ratio) between study groups. The results of present study showed that basal heart rate was significantly higher and deep breathing E/I Ratio was significantly lower among the cases as compared to healthy control subjects.

Table 2 : Analysis of basal heart rate and heart rate response to deep breathing (E/I ratio)

Parameters	Cases	Controls	P value
Basal Heart Rate (beats/minute)	88.82 ± 12.70	80.38 ± 10.08	<0.001S
Deep Breathing E/I Ratio	1.27 ± 0.23	1.76 ± 0.29	<0.001S

Data expressed as Mean ±SD
Cases = healthy subjects with parental history of type 2 DM
Controls = healthy subjects without parental history of Diabetes
S = statistically significant
NS= statistically non significant

4. DISCUSSION

Autonomic dysfunction as primary pathological factor has been associated as a risk factor for developing diabetes in future. The present study attempted to assess the changes in cardiac autonomic activity in healthy offspring's of normal parents and healthy offsprings of Type 2 diabetic parents by analysing the basal heart rate and heart rate response to deep breathing. In present study, physiological factors like Age, Gender, BMI, SBP and DBP in two study groups were not significantly different .The basal heart rate among the cases was significantly higher as compared to controls. Basal heart rate is an index of parasympathetic tone, and increased BHR has been reported to be associated with increased CV risks.(Jensen MT et al 2007). This finding was in accordance with previous studies of Barkai L and Madacsy L (1995) and Pal GK et al (2014). In comparison of Deep Breathing E/I Ratio statistics among the cases and controls, significantly lower mean Deep Breathing E/I Ratio was observed among the cases as compared to controls. Decrease in E: I ratio in the study group subjects represent decreased parasympathetic reactivity as this ratio reflect modulation of vagal reactivity in response to Deep breathing. These results were in accordance with Das, Piyali et al (2013) and Pal GK et al (2014). Das, Piyali et al (2013) concluded that deep breathing E/I Ratio is altered in diabetic patients and Pal GK et al (2014) concluded that the E: I ratio was significantly decreased in the first degree relatives of type 2 diabetic patients.

The present study reveals that there is a shift in sympathovagal balance due to vagal withdrawl as evidenced by higher basal heart rate and decreased E/I ratio. Though the cause of sympathovagal imbalance can not be elucidated from the present study but it could be attributed to raised insulin levels as various studies have shown that subjects with family history of diabetes have raised insulin level (Rodriguez-Moran M and Guerrero-Romero F 2001 , . Ferrannini E et al 1997) and hyperinsulinaemia is known to enhance sympathetic outflow(Scherrer U and Sartori C 1997) via effects in the hypothalamus (Philippe Van De Borne et al 1999) and also contribute to decrease in vagal tone. The limitation of present study is that, we have not estimated the plasma insulin, and not assessed insulin resistance, that could contribute to SVI in ofsprings of diabetics patients. Future studies should assess if sympathovagal homeostasis can be attained by exercise and other non-pharmacological means such as yoga-relaxation that would reduce the CV risks in the offsprings of type 2 diabetes patients.

5.CONCLUSION

Present study reveals that nondiabetic offspring of Type 2 Diabetic patients have Sympathovagal imbalance with decreased Parasympathetic activity. This can be utilized to prevent future cardiovascular risk in subjects by non pharmacological means as exercise and yoga.

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