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A Study of Heart Rate Recovery Following Exercise in Healthy Young Adult Male

Dr.Jagnyaseni Panda[1], Dr.Snigdha Prava Mishra[2], Dr.Bipin Bihari Pradhan[3]
[1]*Tutor, Department of physiology, M.K.C.G Medical College, Berhampur, Odisha.*
[2]*Associate Professor, Department of physiology, M.K.C.G Medical College, Berhampur, Odisha.*
[3]*Professor and Head of the department, Department of physiology, M.K.C.G Medical College,Berhampur, Odisha.*

Abstract: *Exercise has positive chronotropic effect on heart rate and on cessation heart rate returns to pre-exercise level. A delay in heart rate recovery (HRR) (≤12beats in first minute) is considered abnormal and reflects autonomic dysfunction.The present study was taken up to find out the presence of abnormal HRR in normal subjects (Male) and to establish HRR as an independent autonomic marker. For the study 106 healthy young adults (male) were subjected to exercise by Bicycle ergometer till targeted Heart Rate (85%Maximum Heart Rate(MHR)) was achieved. HRR at the end of 1 minutefollowingcessation of exercise were tabulated. In our study 23(21.7%) subjects showed Abnormal HRR indicating HRR could be an independent autonomic marker. Keyword-HRR, MHR*

I. Introduction:

Exercise is a common physiological stress used to elicit cardiovascular abnormalities not present at rest and to determine the adequacy of cardiac function[1]. Physiologically it has positive chronotropic effect on heart rate due to sympathetic stimulation and parasympathetic (Vagal) withdrawal (Kluess etal 2000)[2]. On cessation of exercise parasympathetic reactivation and withdrawal of sympathetic activity ultimately leads to return of heart rate towards pre exercise level (Arai etal 1989)[3].Heart Rate Recovery (HRR) is defined as the change in heart rate from peak exercise to 1minute following cessation of exercise. Fall in heart rate ≤12beats after first minute following peak exercise is considered abnormal (Coleetal)[4].A delay in HRR reflects autonomic dysfunction. Role of Autonomic nervous system in regulation of cardio vascularfunction is well documented.

So the present study was taken up with the objective to find out the presence of abnormal HRR following exercise in healthy young adults (male) and in such cases whether HRR by itself can be an independent autonomic marker.

II. Materials and Methods

This prospective study was conducted in the P.G Research Laboratory of Department of Physiology, M.K.C.G Medical College, Berhampur during the period from 2009-11 after due approval from the institutional ethics committee.

For the study healthy young male adults between 17-24 years were included. Cardiac monitor was connected to each subject and Blood Pressure (BP), HeartRate (HR) and Oxygen saturation at rest were recorded. They were subjected to exercise by Bicycle Ergometer with digital display till targeted Heart Rate (85%MHR) was achieved or appearance of limiting symptoms like(chest discomfort,shortness of breath, dizziness) whichever was earlier. During exercise continuous recording of heart rate, blood pressure and oxygen saturation were done by cardiac monitor.

At cessation of exercise therecording of HR, BP and oxygen saturation were noted. HRR at the end of 1minute after cessation of exercise were tabulated and analyzed.

III. Observation and Analysis

Total number of 106 healthy young male adults were includes in the study. Their mean BMI was within normal range.

Table 1Anthropometric Parameters of The Study Group

Parameters	No. of subject (n=106) (Mean ±S.D)
Age(yrs)	19.00±1.24
Height (mtr)	1.66±0.07
Weight(Kg)	62.6±12.22
B.M.I(kg/m^2)	22.75±4.04

Table 2 Pre Exercise Parameters

Parameters	No. of Subject (n=106) (Mean ±S.D)
Heart Rate (beats/min)	77±3.86
Blood Pressure(mmHg) Systolic	119±6.34
Diastolic	81±3.86
Oxygen Saturation (%)	98±1.25

Mean heart rate, Blood Pressure both systolic, diastolic and oxygen saturation are within normal range.

Table 3 Exercise Parameters Of The Subjects (N=106)

Parameters	Pre-Exercise (Mean ± S.D)	End of Exercise (Mean ± S.D)	1 min after cessation of exercise (Mean ± S.D)
Heart Rate(Beats/Min)	77±6.34	163±9.13	140±13.58
Blood Pressure(mmHg)			
Systolic	119±6.34	142±10.54	136±8.63
Diastolic	81±3.86	89±6.32	87±5.15
Oxygen Saturation (%)	98±1.25	98±1.14	99±0.81

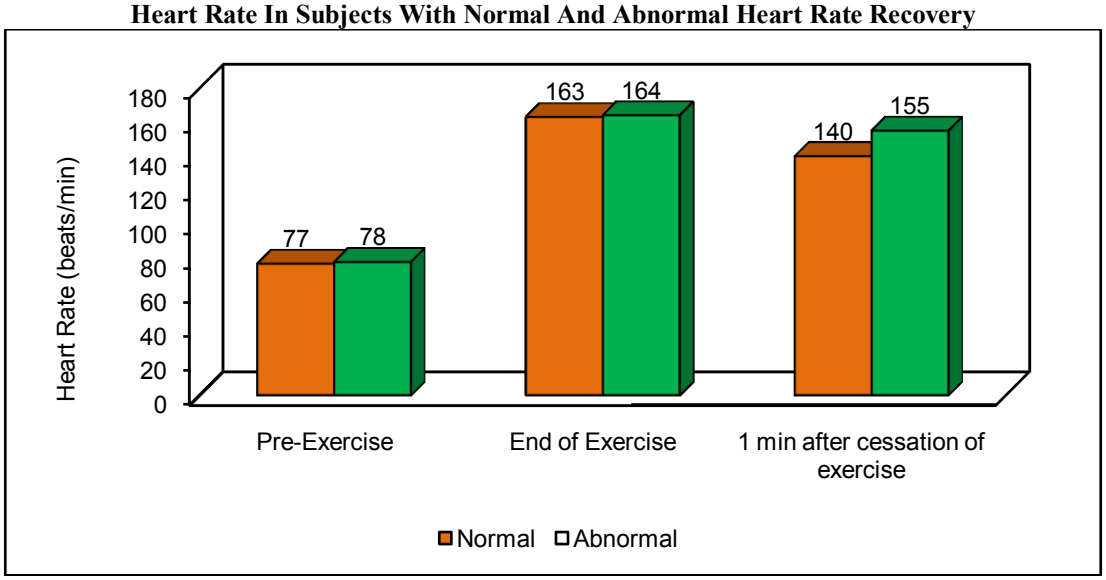
After exercise mean heart rate increased to 163 ± 9.13 and came down to 140 ± 13.58, 1 minute following cessation of exercise.

Table 4
Exercise Parameters Of Subjects With Abnormal Heart Rate Recovery (N=23)

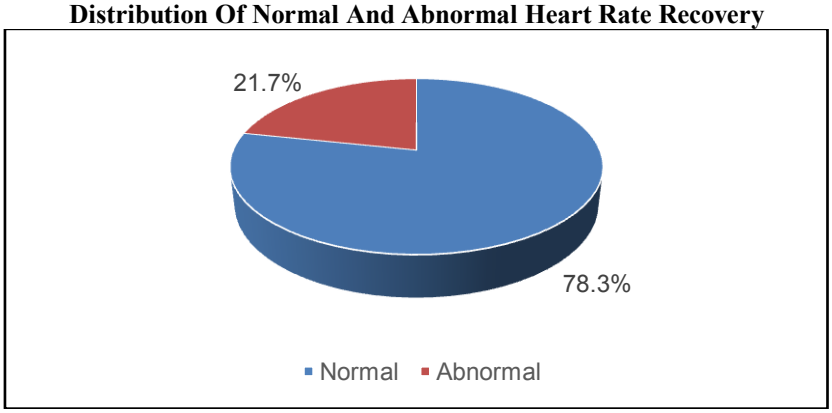
Parameters	Pre-Exercise (Mean ±S.D)	End of Exercise (Mean ± S.D)	1 min after cessation of exercise(Mean ± S.D)
Heart Rate(Beats/Min)	78±5.75	164±6.46	155±5.79
Blood Pressure(mmHg)			
Systolic	119±8.15	144±10.45	136±9.43
Diastolic	82±4.05	92±4.80	89±3.11
Oxygen Saturation (%)	98±1.56	98±0.79	98±0.65

23 male subjects showed abnormal HRR following 1 minute after cessation of exercise, the mean heart rate came down to 155±5.79 following 1 minute after cessation of exercise from 164±6.46 at end of exercise.

Heart Rate In Subjects With Normal And Abnormal Heart Rate Recovery



Distribution Of Normal And Abnormal Heart Rate Recovery



IV. Discussion

Out of the total 106 healthy male subjects in our study, only 23 showed abnormal HRR[4] . Heart Rate (HR) during dynamic exercise is regulated by a combination of neural, hormonal and intrinsic mechanism. At the onset of exercise the rise in heart rate is thought to be mediated by withdrawal of inhibitory vagal tone. Central command from higher brain centre and input from mechanoreceptors in muscle contribute to this early response.[5,6] At higher heart rate, increase sympathetic out flow to the heart, increased level of circulatory catecholamine and temperature of pacemaker tissue also play a role [7,8,9]. Immediately after exercise acceleratory influence from higher brain centre and peripheral nerve reflexesdiminish and heart rate is thought to be primarily regulated by restoration of vagal inhibitory tone[10-13]

HRR following exercise correlates with vagal tone and a decrease of HRR in the first minute of the exercise is associated with increased mortality. Our study therefore is suggestive of possibility that the HRR following exercise is highly sensitive enough to reflect the autonomic dysfunction due to decreased vagal tone. So, it can be an independent autonomic marker, which is easy to obtain in any clinical set up. Few studies have found out that delay in HRR following exercise, which may be an influence of decrease vagal activity is a powerful predictor of overall mortality, independent of work load, the presence or absence of myocardial perfusion defects[14]. This marker is simple to calculate from data that are already contained in the results of standard exercise tests and may be valuable for the assessment of risk in routine clinical practice.

V. Summary and Conclusion

Our study consisting of 106 healthy young male, within age group 17-24 years, was carried out to assess the presence of abnormal HRR following dynamic exercise. Also we aimed at using HRR as an independent autonomic marker. From our study we found out that, 21.70% of total subjects showed abnormal HRR. Therefore we can conclude that HRR could be an independent variable as a prognostic marker.

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