ORIGINAL RESEARCH

Effect of physical activity on heart rate variability of first year MBBS students of Government Medical College, Patiala (Punjab, INDIA)

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ABSTRACT

Background: Sedentary living is responsible for about one-third of deaths due to coronary heart disease, hypertension and diabetes for which physical inactivity is an established causal factor. **Aims & objectives**: To study the effect of high, moderate and low intensity exercises on heart rate variability. **Material and methods** : The study comprised of randomly selected 65 1st year students (boys), aged 17-21 years. BMI of students was in range of 17-34.The students weredivided into 3 groups byusing W.H.O. Standard criteria for grading of physical activity. GROUP I(n=36)- Students who played sportslike cricket, badminton, soccer,basketball, swimming and jogging for >5 hrs/week for 8 weeks were categorised as performing vigorous activity/ grade-1. GROUP II(n=22) – Students who did brisk walking, cycling, played volleyball and table tennis for 3-5 hrs/week for 8 weeks were categorised as performing moderate activity or grade-2. GROUP III(n=7) - Students who did weight lifting, situps , pushups and walking for <3 hrs/week for 8 weeks were categorised as performing low activityor grade-3.**Results**:Heart rate variability has proved to be more sensitive tool for the detection ofautonomic balance than meanheart rate (HR). The Studyshowed significant correlationofmoderate and vigorous activity with heart rate variability.Due to this physical activity there was predominace of parasympathetic activity over the sympathetic activity resulting in decrease heart rate. **Conclusion**: Vigorous andmoderate physicalactivityare considered better than low physical activityto remain fit and healthy. It plays a vitalrole in reducing risk of coronaryarterydisease,diabetes and hypertensionin coming years.

Keywords: Effect,Physicalactivity,Heartrate variability

INTRODUCTION

The prevalence of physical inactivity has risen over the last decade(1,2). Its association with coronary heart disease incidence is ofgrowing importance(3).Physical inactivity may lead to coronary heart disease via increased adiposity, reduced lean body mass, reduced cardiovascular fitness(4) and raised blood pressure(5). Low resting heart rate variability is a marker of autonomic function has been related to increase risk of mortality(6).Disturbances in autonomic function are associated with each of these potential mechanism linking physical inactivity to coronary disease and may be an additionalway in which physicalactivityreduces coronaryheart disease morbidity. Heart rate variability is an indicator of interaction between cardiac sympathetic and parasympathetic activity which causes changes in thebeat to beat intervals and changesin frequency component of heart rate. HRV is often measured and monitored through electrocardiography (ECG) in individual Siecinski et al;2020(7), during exercise Cuzzolin et al; 2021(8) or during rest after physical training workload Valenzano et al;2016 (9). Higher HRV has beenreportedinathletes(10). Afew studies have beendone in the developing countries including India.Hence present study has made an attempt to examine the effect of physical activity on heart rate variability(11).

AIM AND OBJECTIVE

- To study the effect of high, moderate and low intensity exercises on heart rate variability

MATERIALANDMETHODS

- The study comprised ofrandomly selected 65 First MBBS year students (boys), aged 17- 21 years. BMI of students was inrange of17-34.The students were divided into 3 groups by using W.H.O. Standard criteria for grading of physical activity. GROUP I(n=36)- Students who played sports like cricket, badminton, soccer, basketball, swimming and jogging for >5 hrs/week for 8 weeks were categorised as performing vigorous activity/ grade-1. GROUP II(n=22) – Students who did brisk walking, cycling, played volleyball and table tennis for 3-5 hrs/week for 8 weeks were categorised as performing moderate activity or grade-2. GROUP III(n=7) - Students who did weight lifting, situps , pushups and walking for <3 hrs/week for 8 weeks were categorised as performing low activity or grade-3.

EXCLUSIVE CRITERIA

Students with any cardio-vascular or cardio-respiratory disease were not included in the study.

PREREQUISITES

Boys were interviewed in accordance with enclosed performas and written informed consents were taken. Correct procedure of the test was explained to them. Students were made to lie in the supine position in front of the recording machine. Anthropometric parametersmeasured were- name, age, height, weight and BMI.

PROCEDURE

Heart rate of each student was recorded by taking 5 min E.C.G. in supine position by using Physiopac hardware by Mediaid. E.C.G. electrodes were placed on right arm, right leg, left arm, left leg.Time domain and frequency-domain indices of HRV were obtained using HRV analysis software Kubios HRV standard version 3.3.1. Time-domain measures included the mean of all the RR intervals (mean RR) in millisec (ms), mean HR in beats per min (bpm),standard deviation of the normal to normal RR interval standard deviation of NN intervals (SDNN) in ms, percentage of number of RR intervals with differences >50ms. (PNN50), and root mean square of successive differences between adjacent intervals root mean square of the successive differences (RMSSD)in ms. Frequency-domain measures give information regarding how power /variance is distributed as a function of frequency.It was measured bypower spectralanalysis by fast Fourier transformation. It included the very LF(VLF) band of 0.003-0.04Hz, LF band of 0.04-0.15Hz, HF band of 0.15-0.4Hz and the total power in all the bands together.Powers are calculated as the magnitude square of the spectrum(ms^2).Thenormalized units(nu) ofLFand HFpower andtheLF/HFratio werealso obtained. The time-domain indices cannot discriminate between sympathetic and parasympathetic modulations to HRV.The time-domain methods are usually best for long term recordings.SDNN is an estimator of overall HRV.RMSSD denotes vagal drive on HR.And so RMSSD is used as an indicator of the parasympathetic drive.LF range(0.04- 0.15Hz) is marker for sympathetic activity,while the higher frequency range (0.15-0.4Hz) of the RR is associated with vagal activity.TheLF-HF ratio is a good index of sympathovagal balance. Data were entered in MS Exel worksheetandanalyzedusing SPSSsoftware version 22. The comparison of HRV values between three groups was done using ANOVA. P<0.05 was considered statistically significant(12).

RESULTS

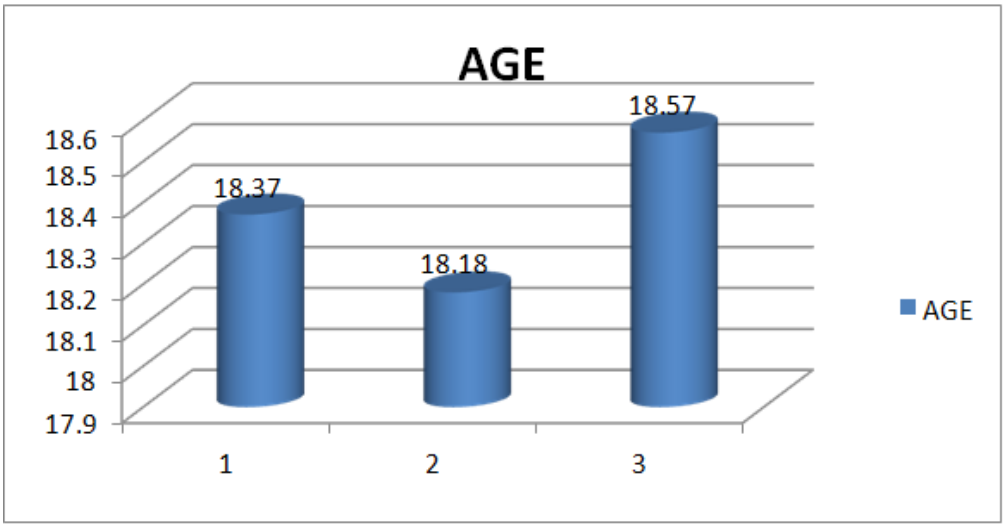


Fig-1: Distribution of age among the three groups.

The Mean age of group I,II, III was 18.37± 0.794 SD, 18.18 ± 0.906 SD, 18.57 ±1.13 SD respectively. So age

factor does not play any role in physical activity and it is statistically insignificant.p=0.528(p>0.05)

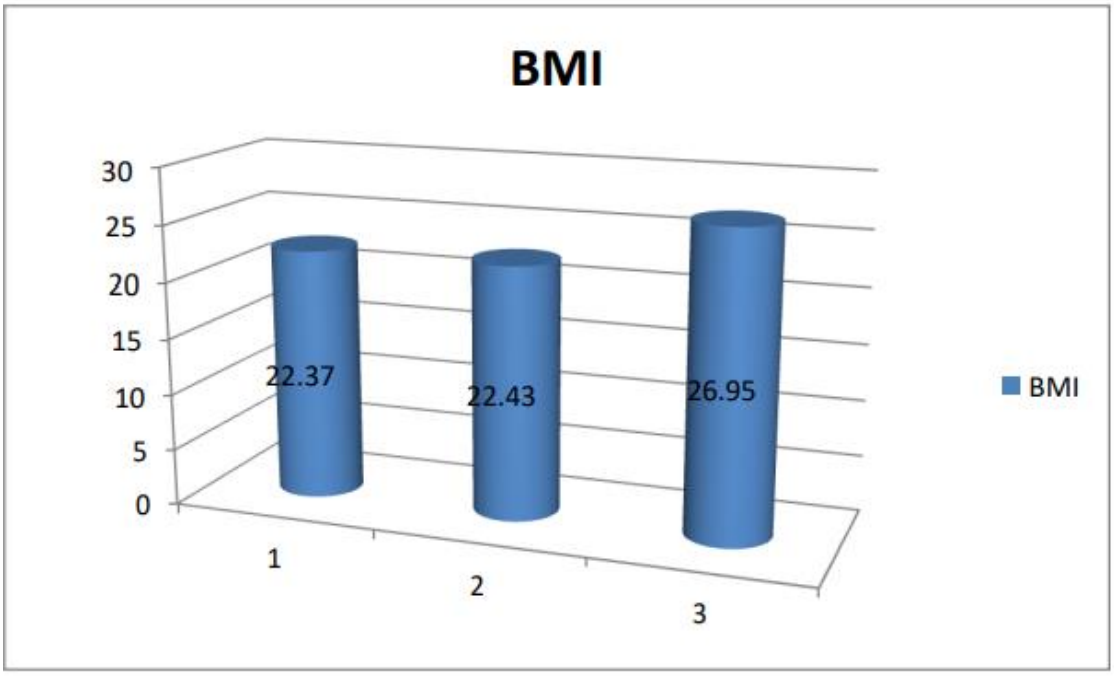


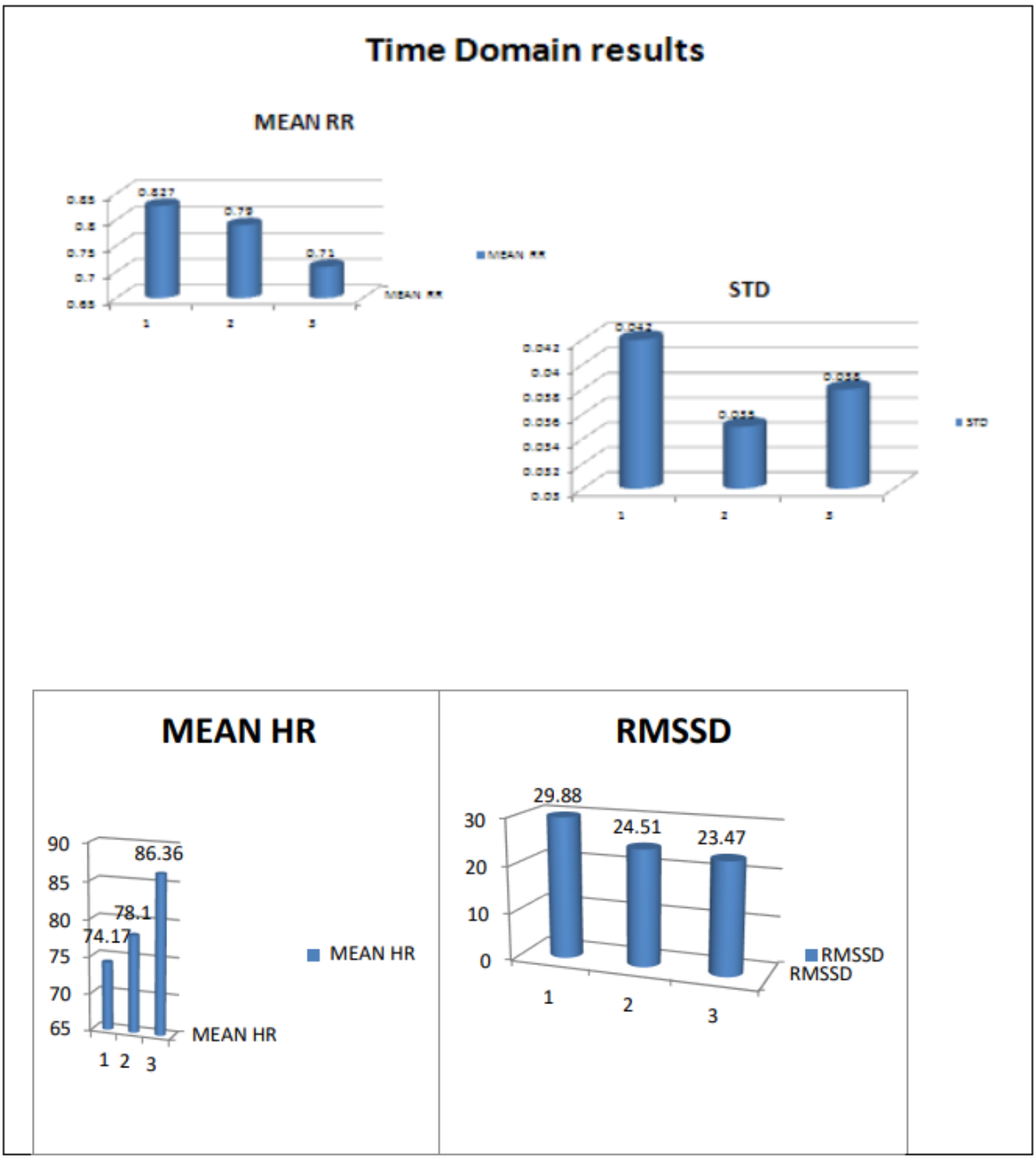
Fig-2: Distribution of BMI among the three groups.

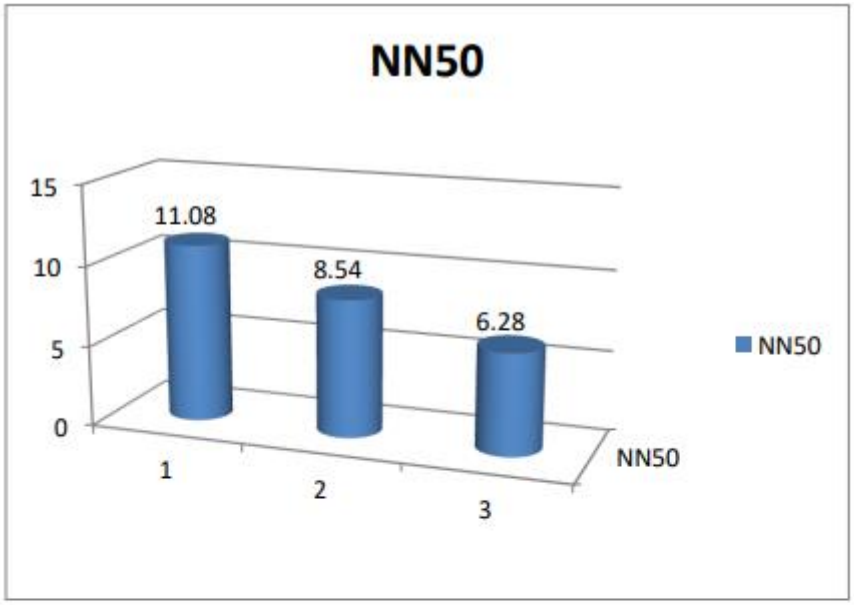
It was found in our study that mean BMI of Group I, II, III was22.37±3.76SD, 22.43±3.55SD & 26.95 ± 4.56 SD respectively And when these three groups were compared they were found statistically significant. P=0.041 (p<0.05)

Table -1: Comparison of Time Domain Analysis of Heart Rate Variability among Group I, II,III

Parameters	Group I	Group II	Group III	P value	Significant
MeanRR	0.827±0.117	0.79±0.126	0.71± 0.099	0.019	S
STD(SDNN)	0.042±0.024	0.035±0.013	0.038±0.022	0.475	NS
MeanHR	74.17±10.49	78.1±11.60	86.36±11.93	0.013	S
RMSSD	29.88±17.21	24.51±11.67	23.47±16.84	0.347	NS
NN50	11.08±7.56	8.54±6.19	6.28±6.34	0.167	NS
PNN50	7.67±5.12	5.94±4.32	4.28±4.26	0.156	NS

Non-Significant(p>0.05),Significant(p<0.05)HighlySignificant(p<0.01)





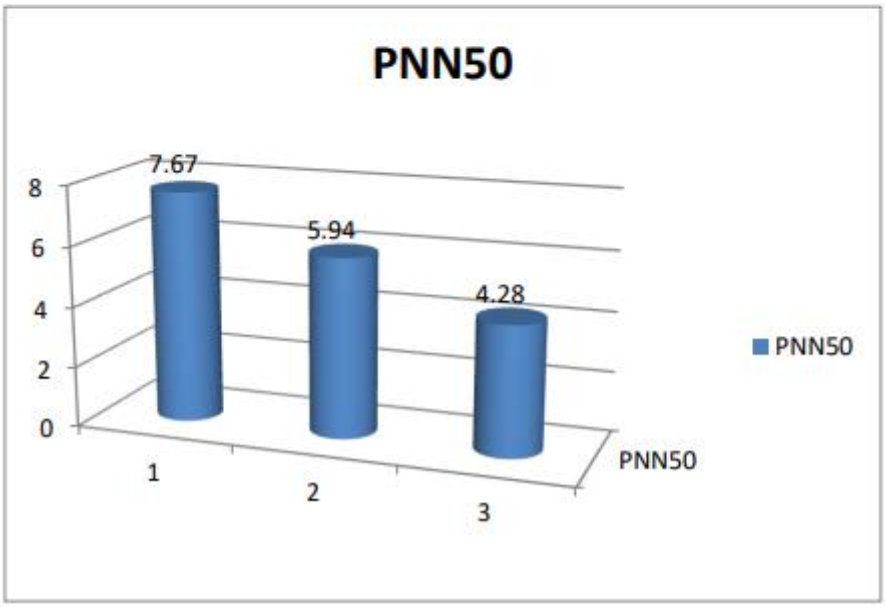
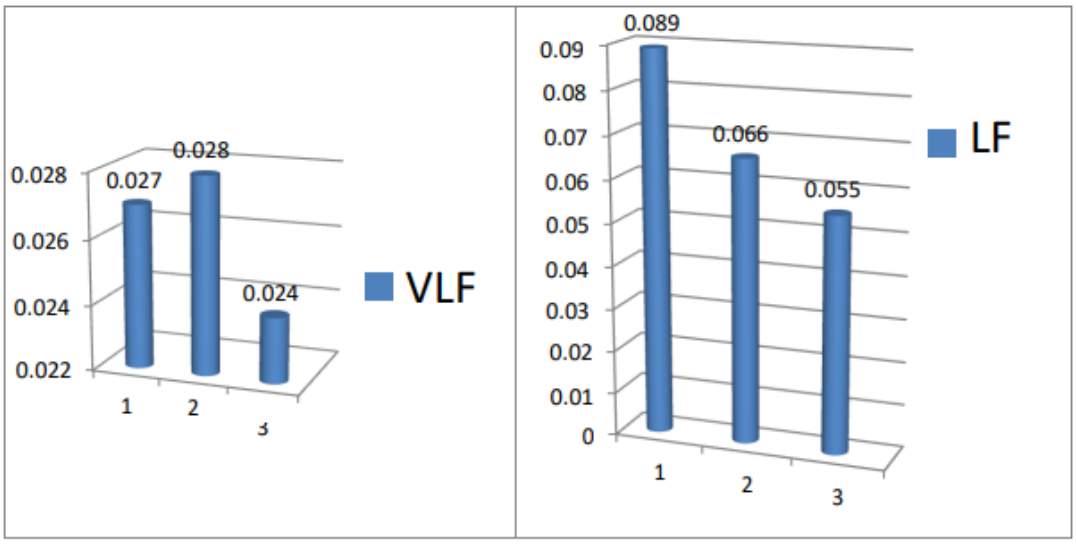


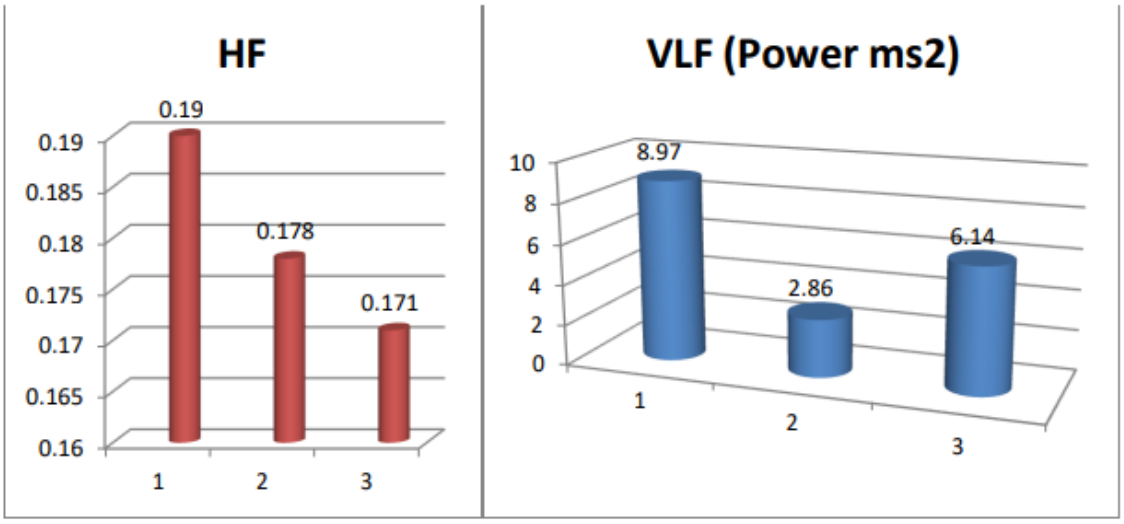
Table-2: Comparison of Frequency Domain Analysis of Heart Rate Variability among groups I,II,III

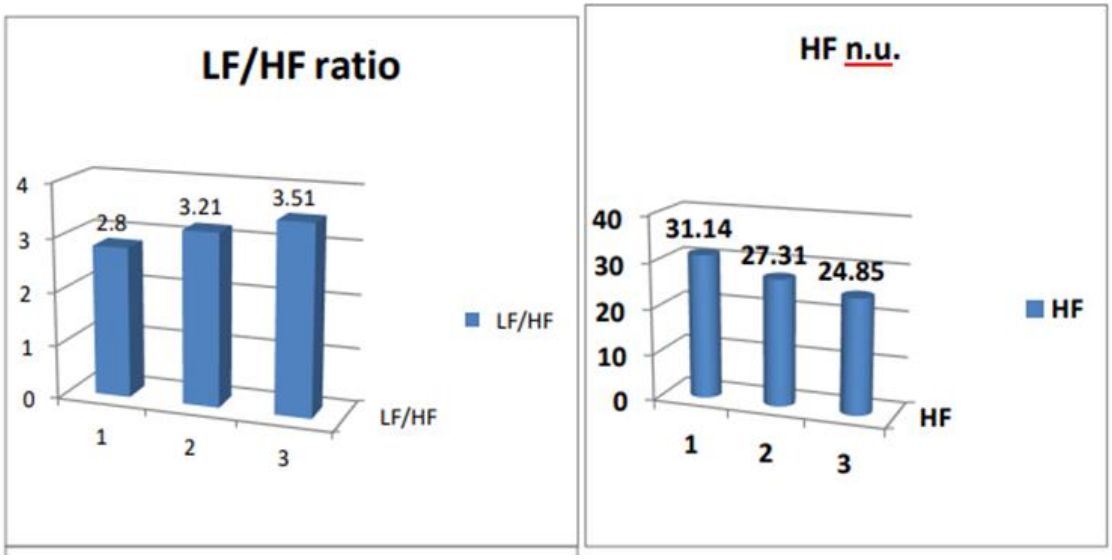
Parameters	Group I	Group II	Group III	P value	Significant
VLF(Peak)	0.027± 0.008	0.028±0.006	0.024±0.009	0.496	NS
LF	0.055±0.018	0.066±0.029	0.089±0.036	0.008	HS
HF	0.178±0.034	0.171±0.019	0.19±0.32	0.326	NS
VLF(Powerms^2)	8.97±18.71	2.86±3.10	6.14±4.29	0.291	NS
LF	19.13±31.54	7.81±10.85	11±15.69	0.236	NS
HF	8.81±20.94	2.4±3.17	4.57±7.34	0.329	NS
VLFPower(%)	22.67±11.44	24.38±16.33	38.71±17.57	0.026	S
LF	52.93±11.39	54.40±12.46	46.21±14.73	0.299	NS
HF	24.37±11.60	21.2±10.31	15.07±6.56	0.103	NS
LF/HF Ratio (Power nu)	2.8±1.59	3.21±1.54	3.51±1.68	0.433	NS
LF (nu)	68.65±13.2	72.68±10.98	75.14±8.76	0.311	NS
HF	31.14±13.2	27.31±10.98	24.85±8.76	0.312	NS
Non-Significant(p>0.05),Significant(p<0.05)HighlySignificant(p<0.01)					

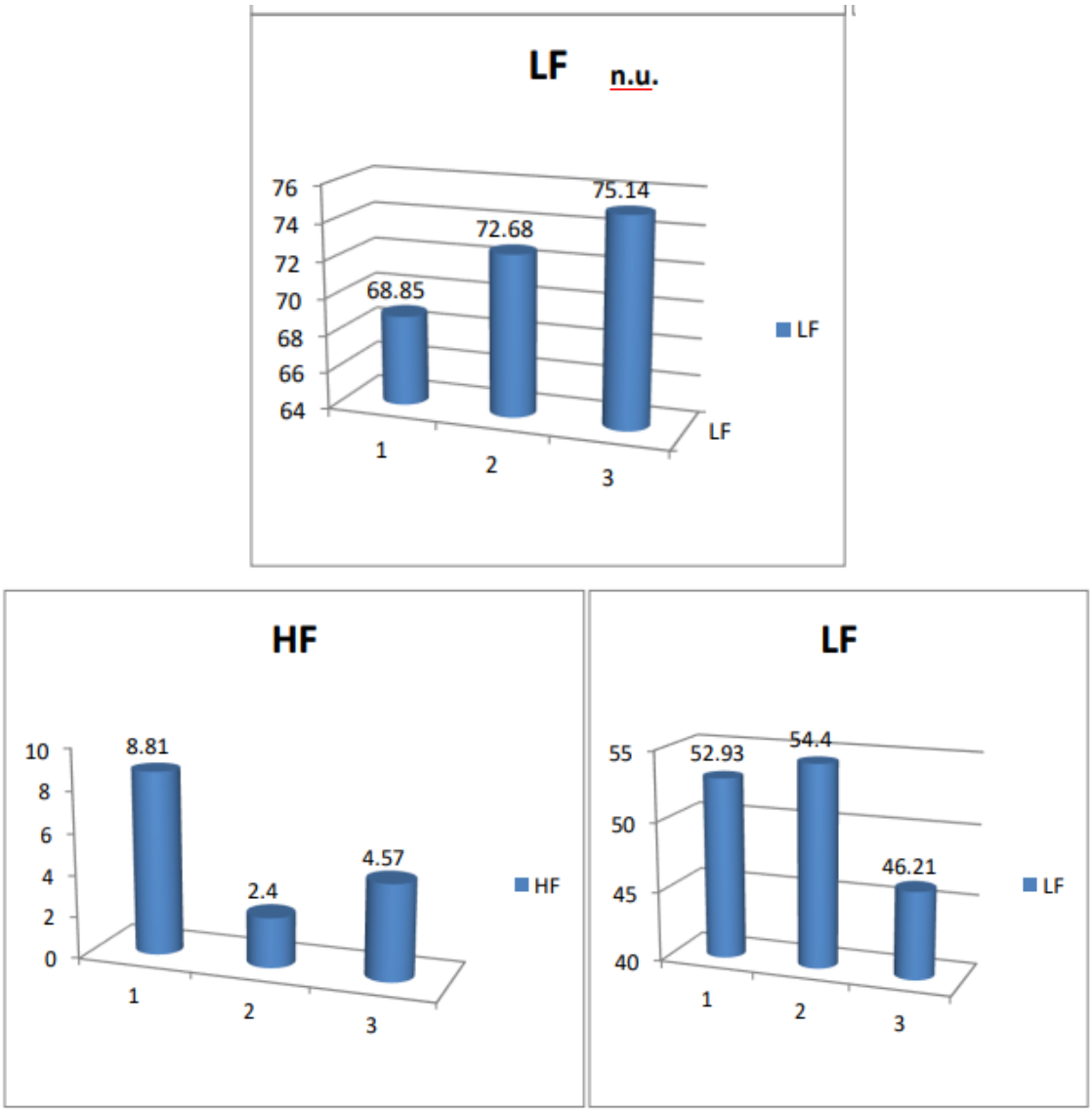
Comparison of Mean LF (peak Hz) in group I, II, III was found to be highly significant P=0.008(p<0.01) and comparison of meanHFand VLF (peak Hz) in group I, II, III were found to be insignificant P=0.326 and 0.496 respectively (P>0.05) The comparison of mean VLF (Power %) in group I, II, III was found to

be significant P=0.026(P<0.05) and comparison of mean LF and HF (power%) in group I, II, III was found to be insignificant P=0.299 and 0.103 respectively (p>0.05) The comparison of mean of LF (Peak Hz) in group I and II shows sympathetic activity over the para sympathetic activityas compare to group III









DISCUSSION

In our study students with total leisure-time physical activity and both moderate and vigorous-intensityactivitywere associated with higher HRV independent ofage. Heart rate variabilityhas proved to be more sensitive tool for the detection of autonomic balance than mean heart rate(HR)..Due to physical activity there was predominance of parasympathetic activity over the sympathetic activityresulting indecrease heart rate. Inour studytime-domain indices analysis of heart rate variability, the mean RR and mean HR were statistically significant when compared among the groups. Inferences from meta-analysis were recorded (2004) by Gravin R.H.Sandercock. et al (13).Similar studies showed that heart rate variability is increased due to chronic exercise; especially in endurance trained athletes Aubert et al;2001(14). The RR interval decreases as a result of increased sympathetic nervous activity, and increases as a result of increased parasympathetic activity Billman,2013(15). Also frequency domain indices analyis of heart rate variability a very low frequency VLF power(%) was statistically highly significant ($p<o.oo1$) when compared among the groups.The mean value of LFnu and LF/HF ratio were higher when compared among the three groups. Furthermore,the mean value ofHFnu wasfoundto be lowertomildtomoderateandsevereactivitygroups.

Mamathaet al;(2019)observed parasympathetic activity is greater in young adults practicing yoga followed by those doing regular aerobic exercises when compared to those who do not practice yoga or do any types of exercise(16).

CONCLUSION

vigorous and moderate physical activity are considered betterthan low physical activity to remain fit and healthy. It plays a vital role in reducing risk of coronary artery disease, diabetes, hypertension in coming years.

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