Assess the relationship between Tolerance time in TMT and Selected Clinical Profiles among Nursing Students

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Introduction: Cardio respiratory fitness is having a major role in reduction of incidence cardiovascular disorders among the population of India. The exercise treadmill test (ETT) can help with cardiorespiratory activity estimation, blood pressure (BP) response to heart rate during exercise, chronotropic reserve, recovery of heart rate (HRR) and myocardial ectopic[7-14]. In the general population, aberrations in these parameters have been linked to death from heart disease.

Method: Quantitative exploratory research design was adopted for this study.150 BSc Nursing students from KGMU College of Nursing were selected for this study. Association and correlation between cardio-repertory determinant (Tolerance time in TMT) and demographic variables and selected clinical profiles were analysed using inferential and non-inferential statistical method. The association between the variables was assessed by using Chi square and fisher exact significance test and correlation was assessed by Kendall's Tau C.

Results: Tolerance time in TMT is associated with the age and correlation suggests that age is moderately positively correlated with age. Rather than thatTolerance time in TMT is associated and Weakly positively correlated (0.119) with waist circumference.

Conclusion:waist circumference finding is a good indicator for cardio respiratory fitness as per the study.

Key words: Cardio-respiratory fitness, Tolerance time in TMT, Clinical Profile , Nursing, students

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Introduction

Cardio respiratory fitness (CRF) refers to the ability of the circulatory and respiratory system to supply oxygen to skeletal muscles during sustained physical activity. Cardio-respiratory fitness have a major role in reduction of incidence of cardiovascular disorders and mortality among the population of India[1]

Recent data have shown that the cause of large national health burden of chronic diseases is due to behavioural dimensions such as physical inactivity and low levels of cardio-respiratory fitness[2]. The identified modifiable risk factors that can affect cardio respiratory fitness included blood pressure and fasting blood levels of glucose, triglycerides, total cholesterol and high-density lipoprotein and cholestero[l3].Cardio-respiratory

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fitness has been acknowledged in some studies as a key predictor of the adverse health outcomes 6. Cardio-respiratory wellness (CRF) alludes to the capacity of the circulatory and respiratory framework to supply oxygen to skeletal muscles during supported actual work. It can lessen the gamble of coronary illness, cellular breakdown in the lungs, type 2 diabetes, stroke, and different sicknesses. It assists with further improving lung and heart condition and builds sensations of well- being

The exercise treadmill test (ETT) can help with cardiorespiratory activity estimation, blood pressure (BP) response to heart rate during exercise, chronotropic reserve, recovery of heart rate (HRR), and myocardial ectopic [7-14]. In the general population, aberrations in these parameters have been linked to death from heart disease.

The possible tracking of cardiovascular disease risk factors from childhood to adulthood makes it important to increase our understanding of the complex relationships between physical activity, cardio- respiratory fitness and cardiovascular risk factors early in life. Furthermore, since clustering of risk factors is evident in childhood and persists into young adulthood the presence of multiple risk factors could indicate the acceleration of atherosclerosis in such population[8-11].

Researcher has noticed high incidence of mortality due to cardiovascular disorder among young adults1 which can be prevented by proper screening techniques. Although a specific risk factor influences the risk that a person will have cardiovascular disease, risk factors tend to aggregate and usually appear in combination[12].

TMT helps to predict the cardiovascular diseases in early stages thereby reducing the disease progression. From this perspective the researcher planned to explore the relationship between tolerance time in TMT and Clinical Profile (Family history, Co-morbid illness, BMI, MUAC, Waist Circumference, Hip Circumference, Skin Fold test)

From the previous knowledge, the aim of the present study was to identify relationship between Tolerance time in TMT andselected Clinical Parameters among young nursing students.

Material and Method

The descriptive exploratory study was adopted to evaluate the influencing factors of cardio-respiratory fitness of the nursing students and explored the relation and association between cardiovascular fitness (Tolerance time in TMT) and selected clinical profile. The present study was approved by ethical committee of King Georges Medical University, Lucknow, UttarPradesh, India (ref.code:84th CCMIID/PI). This study was conducted in 150 BSc Nursing students aged 18-25 years, who were studying in KGMU College of nursing Lucknow. The entire participant enrolled after the written informed consent form according to inclusion and exclusion criteria.

Inclusion criteria: nursing student who were in between the aged 18-25 yrs. having no history of cardiovascular Illness.

Exclusion criteria: Participant who had history if any pathology related to cardio- vascular system. Participant who had history of Asthma and who had health issues during the time of enrolment like fever, dysmenorrhea, cough, respiratory infection.

A Pro Bodyline treadmill was used for the exercise testing which was conducted according to the Modified Bruce Protocol. Pre-test phase: I.pre-exercise HR was measured and recorded. II. The submaximal targeted exercise HR was estimated using the formula for estimating MHR [(208- (0.7x age) x85%].The values were recorded on the form.

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The purpose of treadmill was described. Each of the stages were as per tolerance with a goal to achieve steady-state HR (HRss) at each workload as long as HRss has been achieved, the speed & incline was increased at the end of three-minute interval.

Test administration: I. the treadmill tests starts at 1.7 mph & 10% incline. The maximal HR were recorded. II. The test was terminated until the subject's HR response exceeds 85% of MHR the participant's responses were exceeded 115 bpm for two stages upon completion of test.

III. The nursing students were cool down on the treadmill, walking with moderate speed until breathing returns to normal & HR drops below 100 bpm. The point at which exercise testing was stopped, when the desired heart rate was reached.

Post test phase: The measurement of HRR was done after 1 minute of maximal heart rate by using the formula HR max-HR rest/after 1minute.

The values of HRR were considered <20 low, 21-52 normal and >53 High.

A post test phase measurement of tolerance time in TMT was done by using the following category:

The value of tolerated time in TMT were <6minutes considered low, 06-12 minutes normal and >12 minutes High.[58]

Selected Clinical profiles such as Family history of respiratory disease., Co-morbid illness, History of breathing, History of Cough, Heart Rate, Blood Pressure , Auscultation Finding, Respiratory rate , Chest Circumference , Anterior posterior diameter, transverse diameter, Lungs Auscultation finding, Height, Weight, BMI, Mid upper arm circumference ,Waist circumference were evaluated by hospital (KGMU) standard protocol.

Statistical Analysis:

Data was analysed by with the help of inferential & non inferential statistics. The association between the variables were assessed by using Chi square and fisher exact significance test and correlation was assessed by using Kendall's Tau C.

Results :

In the view of demographic variables Table-1 shows that most of the individuals were age group of 24- 25 (33.33%), maximum were females (66%). All the individuals except one (married) are unmarried. All of them are Pursuing B.Sc. Nursing. All of them are financially dependent. Maximum of them (73%) stays in urban area. Family income of most of them is >25000 (30%). Most of them are vegetarians (55%).on the basis of frequency of fast Majority of the sample belongs to the category of 0-2days/week (58%) and remaining 42 % in the category of 3 and more than 3 days per week. Majority of samples take feast 0-2 per week (92.67%) and remaining will be in the category of 3 and more feast per week(7.33%) Most of these consume fast food between 0 to 2 times in a week (58%). Maximum individuals do not have drug indulgence (95%). Maximum does physical exercise occasionally (44%).For most of the individuals Tolerance time in TMT belongs to the category of normal (79.33%)

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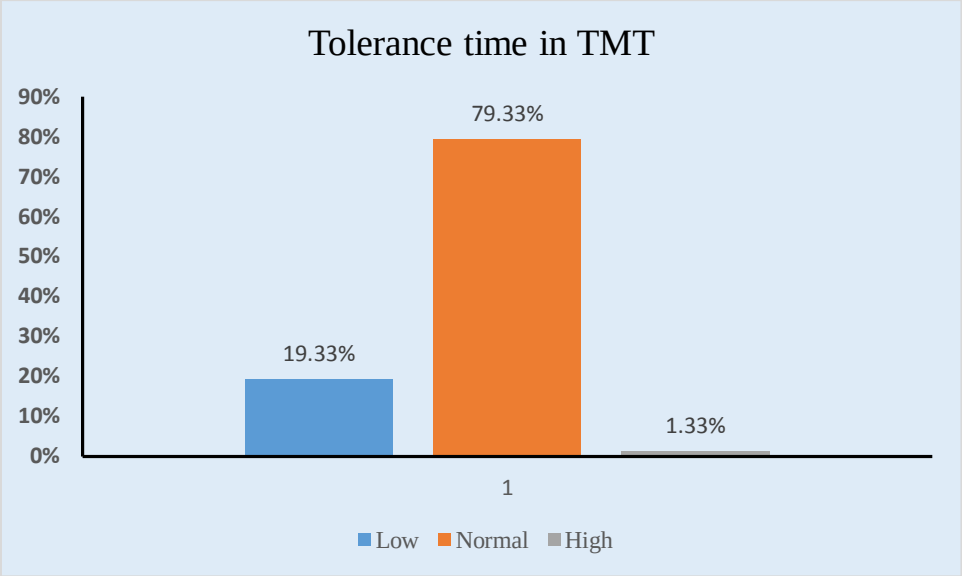

Fig1: The bar diagram showing percentage distribution of B.Sc. nursing Students according to the Tolerance time in TMT findings

Table 1: Frequency & Percentage distribution of Demographic variables

Variable	Category	Frequency	Percent
Age	18-19	24.00	16.00
	20-21	45.00	30.00
	22-23	31.00	20.67
	24-25	50.00	33.33
Gender	Male	51.00	34.00
	Female	99.00	66.00
Marital Status	Married	1.00	0.67
	Unmarried	149.00	99.33
Educational status	Pursuing B.Sc. Nursing	150.00	100.00
Financial dependency	Dependent	150.00	100.00
Place of stay	Rural	40.00	26.67
	Urban	110.00	73.33
Family income	>5000	14.00	9.33
	5001-10000	23.00	15.33
	10001-20000	29.00	19.33
	20001-25000	39.00	26.00
	>25000	45.00	30.00
Diet	Veg	83.00	55.33
	Non-Veg	67.00	44.67
Freq. OF Fast Food	0-2	87.00	58.00
	3 or above	63.00	42.00

Freq. OF Fast	0-2	147.00	98.00
	3 or above	3.00	2.00
Freq. OF Feast	0-2	139.00	92.67
	3 or above	11.00	7.33
Drug indulgence	No	143.00	95.33
	Other	6.00	4.00
	Over counter	1.00	0.67
Physical Exercise	Not at all	25.00	16.67
	Occasionally	66.00	44.00
	Once a week	17.00	11.33
	Twice week	16.00	10.67
	3 time week	26.00	17.33
Heart Rate Recovery	Low	41.00	27.33
	Normal	102.00	68.00
	High	7.00	4.67

Table No 2: depicts that the p-value corresponding to age is less than 0.05. Tolerance time in TMT is significantly related with age. The value of correlation is 0.315, which shows that the TMT is moderately positively correlated with Age. The p-value for Chi-square and Fisher's exact test for the other demographic profile are more than 0.05, no other Demographic profile finding is significantly related with Tolerance time in TMT.

Table-2 : Frequency and Percentage distribution of Demographic status of the Samples on the basis of tolerance time in TMT

N=150

Variable	Category	Tolerance Time in TMT			Chi Square (p-Value)	Fisher's Exact Significance	Correlation (Kendall's tau c)
		Low	Normal	High			
Age	18-19	6	18	0	10.710 (0.038)	0.026	0.315 (0.22)
		25.0%	75.0%	0.0%			
	20-21	10	34	1			
		22.2%	75.6%	2.2%			
	22-23	10	21	0			
		32.3%	67.7%	0.0%			
	24-25	3	46	1			
		6.0%	92.0%	2.0%			

Gender	Male	9	41	1	0.353 (0.838)	0.922	-0.030 (0.635)
		17.6%	80.4%	2.0%			
	Female	20	78	1			
		20.2%	78.8%	1.0%			
Marital Status	Married	0	1	0	0.262 (0.877)	>0.999	-0.005 (0.321)
		0.0%	100.0%	0.0%			
	Unmarried	29	118	2			
		19.5%	79.2%	1.3%			
Place of stay	Rural	8	32	0	0.743 (0.690)	>0.999	.018 (0.748)
		20.0%	80.0%	0.0%			
	Urban	21	87	2			
		19.1%	79.1%	1.8%			
Family income	>5000	3	11	0	7.903 (0.443)	0.276	0.083 (0.108)
		21.4%	78.6%	0.0%			
	5001-10000	6	17	0			
		26.1%	73.9%	0.0%			
	10001-20000	5	23	1			
		17.2%	79.3%	3.4%			
	20001-25000	11	28	0			
		28.2%	71.8%	0.0%			
	>25000	4	40	1			
		8.9%	88.9%	2.2%			
Diet	Veg	13	68	2	3.067 (0.216)	0.243	-0.099 (0.130)
		15.7%	81.9%	2.4%			
	Non-Veg	16	51	0			
		23.9%	76.1%	0.0%			
Freq. OF Fast Food	0-2	17	69	1	0.057 (0.972)	>0.999	.008 (0.900)
		19.5%	79.3%	1.1%			
	3 or above	12	50	1			

		19.0%	79.4%	1.6%			
Freq. OF Fast	0-2	29	116	2	0.797 (0.671)	>0.999	.014 (0.091)
		19.7%	78.9%	1.4%			
	3 or above	0	3	0			
		0.0%	100.0%	0.0%			
Freq. OF Feast	0-2	28	109	2	1.003 (0.606)	.736	.026 (0.311)
		20.1%	78.4%	1.4%			
	3 or above	1	10	0			
		9.1%	90.9%	0.0%			
Therapy for Chronic illness	No	28	113	2	0.386 (0.984)	>0.999	0.006 (0.756)
		19.6%	79.0%	1.4%			
	Other	1	5	0			
		16.7%	83.3%	0.0%			
	Over counter	0	1	0			
		0.0%	100.0%	0.0%			
Physical Exercise	Not at all	6	18	1	6.950 (0.542)	0.495	0.026 (0.625)
		24.0%	72.0%	4.0%			
	Occasionally	12	53	1			
		18.2%	80.3%	1.5%			
	Once a week	6	11	0			
		35.3%	64.7%	0.0%			
	Twice week	2	14	0			
		12.5%	87.5%	0.0%			
	3 time week	3	23	0			
		11.5%	88.5%	0.0%			

Table No3 : Association & correlation of Tolerance time in TMT with selected clinical

Profiles

Table No 3 depicts that p-value for Fisher's test for W.C. finding is less than 0.05 it is obtained that Tolerance time in TMT is associated with the W.C. finding. The variable W.C. is weaklypositively

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correlated (0.119) with Tolerance time in TMT. All the other p-values are more than 0.05, therefore, no other clinical profile finding is significantly related with Tolerance time in TMT.

Variable	Category	Tolerance Time in TMT			Chi Square (p-Value)	Fisher's Exact Significance	Correlation (Kendall's tau c)
		Low	Normal	High			
family H/o cardiac dis.	Yes	7	35	1	0.768 (0.681)	0.533	-0.044 (0.456)
		16.3%	81.4%	2.3%			
	No	22	84	1			
		20.6%	78.5%	.9%			
family H/o respiratory dis.	Yes	7	20	0	1.294 (0.524)	0.611	.055 (0.311)
		25.9%	74.1%	0.0%			
	No	22	99	2			
		17.9%	80.5%	1.6%			
co-morbid illness	Yes	1	11	0	1.240 (0.538)	0.544	-0.031 (0.241)
		8.3%	91.7%	0.0%			
	No	28	108	2			
		20.3%	78.3%	1.4%			
h/o breathing	Yes	2	4	0	0.843 (0.656)	0.387	0.024 (0.442)
		33.3%	66.7%	0.0%			
	No	27	115	2			
		18.8%	79.9%	1.4%			
H/o Cough	Yes	1	4	0	0.070 (0.965)	>0.999	0.002 (0.921)
		20.0%	80.0%	0.0%			
	No	28	115	2			
		19.3%	79.3%	1.4%			
H.R.	Normal	28	113	2	0.232 (0.890)	>0.999	0.007 (0.763)
		19.6%	79.0%	1.4%			
	Abnormal	1	6	0			
		14.3%	85.7%	0.0%			

B.P.	Normal	24	103	2	.609 (0.737)	0.678	-0.031 (0.518)
		18.6%	79.8%	1.6%			
	Abnormal	5	16	0			
		23.8%	76.2%	0.0%			
Auscultation Finding	Normal	26	110	2	0.421 (0.810)	0.749	-0.021 (0.575)
		18.8%	79.7%	1.4%			
	Abnormal	3	9	0			
		25.0%	75.0%	0.0%			
R.R.	Normal	27	118	2	4.405 (0.111)	0.134	-0.038 (0.204)
		18.4%	80.3%	1.4%			
	Abnormal	2	1	0			
		66.7%	33.3%	0.0%			
C.C.	Normal	26	110	2	0.421 (0.810)	0.749	-0.021 (0.575)
		18.8%	79.7%	1.4%			
	Abnormal	3	9	0			
		25.0%	75.0%	0.0%			
A/P diameter	Normal	28	116	2	0.133 (0.936)	>0.999	-0.007 (0.754)
		19.2%	79.5%	1.4%			
	Abnormal	1	3	0			
		25.0%	75.0%	0.0%			
transverse diameter	Normal	28	117	2	0.413 (0.813)	>0.999	-0.012 (0.592)
		19.0%	79.6%	1.4%			
	Abnormal	1	2	0			
		33.3%	66.7%	0.0%			
Lungs Auscultation finding	Normal	26	113	2	1.292 (0.524)	0.452	-0.036 (0.339)
		18.4%	80.1%	1.4%			
	Abnormal	3	6	0			
		33.3%	66.7%	0.0%			
Height	Low	3	16	1	3.092	0.409	-0.022

		15.0%	80.0%	5.0%	(0.543)		(0.517)
	Normal	26	101	1			
		20.3%	78.9%	.8%			
	High	0	2	0			
		0.0%	100.0%	0.0%			
Weight	Low	5	22	1	2.263 (0.688)	0.621	0.002 (0.971)
		17.9%	78.6%	3.6%			
	Normal	22	82	1			
		21.0%	78.1%	1.0%			
	High	2	15	0			
		11.8%	88.2%	0.0%			
BMI	Low	4	22	1	2.295 (0.682)	0.608	-0.055 (0.258)
		14.8%	81.5%	3.7%			
	Normal	19	79	1			
		19.2%	79.8%	1.0%			
	High	6	18	0			
		25.0%	75.0%	0.0%			
MUAC	Low	2	12	1	4.960 (0.291)	0.283	-0.017 (0.589)
		13.3%	80.0%	6.7%			
	Normal	27	103	1			
		20.6%	78.6%	.8%			
	High	0	4	0			
		0.0%	100.0%	0.0%			
W.C.	Low	24	65	2	9.478 (0.050)	0.036	0.119 (0.025)
		26.4%	71.4%	2.2%			
	Normal	5	46	0			
		9.8%	90.2%	0.0%			
	High	0	8	0			
		0.0%	100.0%	0.0%			

H.C.	Low	20	57	2	6.636 (0.156)	0.161	0.089 (0.064)
		25.3%	72.2%	2.5%			
	Normal	8	46	0			
		14.8%	85.2%	0.0%			
	High	1	16	0			
		5.9%	94.1%	0.0%			
Skin Fold Test	Normal	28	103	2	2.578 (0.276)	0.368	0.055 (0.059)
		21.1%	77.4%	1.5%			
	Abnormal	1	16	0			
		5.9%	94.1%	0.0%			

Discussion

Tolerance time in TMT is significantly related with age. The value of correlation is 0.315, which shows that the tolerance time of TMT is moderately positively correlated with Age. The p-value for Chi-square and Fisher's exact test for the other demographic profile are more than 0.05, no other demographic profile finding is significantly related with tolerance time of TMT.

Association & correlation Tolerance time in TMT with selected clinical Profiles W.C. finding is less than 0.05. It is obtained that Tolerance time in TMT is associated with the W.C. finding. The variable W.C. is weakly positively correlated (0.119) with Tolerance time in TMT. All the other p-values are more than 0.05, therefore, no other clinical profile finding is significantly related with Tolerance time in TMT

Limitation

1. The literatures related to Indian context were limited in number.
2. The study was conducted for a small sample size with simple random sampling, which limits the generalization of principles.
3. Exploratory studies all data are interpreted by the investigator and it can be judgmental and biased.
4. The study was conducted in a limited setting
5. There is a limitation in fund raising, intended to conduct a study in generalized and extended setting funding is essential.
6. Exploratory studies have its own boundaries to establish cause and effect relationship.
7. Exploratory study design was opted because of the limitations in the randomization of samples
8. All samples were from one area because of convenience of researcher due to newly emerged pandemic diseases

Conclusion

Our study put forwarded that to investigate the association and correlation of cardio respiratory determinants with Clinical Profiles Through this investigation the researcher intended to conclude that various test finding such as Age, waist circumference is showing

Association & correlation with various cardio respiratory determinants.

References

1. DorairajPrabhakaran, PanniyammakalJeemon, and AmbujRoy,"Cardiovascular Diseases in IndiaCurrent Epidemiology and Future Directions",Circulation Originally published19 Apr2016
2. Michael J LaMonte, Patricia A. Eisenman, Ted D Adams, Barry B Shultz, Barbara EAinsworthand Frank G Yanowitz, Cardio respiarory fitness and coronary heart disease risk factors. 2000; 102:1623- 1628.
3. Hurtig-WennlöfA1, Ruiz JR, Harro M, Sjöström M .Cardiorespiratory fitness relates more strongly than physical activity to cardiovascular disease risk factors in healthy children and adolescents: the European Youth Heart Study.Eur J CardiovascPrevRehabil. 2007 Aug;14(4):575-81.
4. Shelter K, Marcus R, Froelicher VF, Vora S, Kalisetti, Prakashi M, Do D, Myers J. Heart rate recovery: validation and Methodologic issues. J Am CollCardiol. 2001; 38:1980–7.
5. Cole CR, Blackstone EH, Pashkow FJ, Snader CE, Lauer MS. Heart-rate recovery immediately after exercise as a predictor of mortality. N Engl J Med. 1999; 341:1351–7.
6. Cole CR, Foody JM, Blackstone EH, Lauer MS. Heart rate recovery after submaximal exercise testing as a predictor of mortality in a cardiovasculary healthy cohort. Ann Intern Med. 2000;132(7):552–5.
7. Qiu S, Cai X, Sun Z, Li L, Zuegel M, Steinacker JM, Schumann U. Heart rate recovery and risk of cardiovascular events and all-cause mortality: a meta-analysis of prospective cohort studies. J Am Heart Assoc. 2017;6:e005505.
8. Anita Hurtig-Wennlöf 1, Jonatan R Ruiz, MaarikeHarro, Michael Sjöström, "Cardiorespiratory fitness relates more strongly than physical activity to cardiovascular disease risk factors in healthy children and adolescents: the European Youth Heart Study", Eur J CardiovascPrevRehabil, 2007 Aug;14(4):575-81.
9. Webber LS, Voors AW, Srinivasan SR, Frerichs RR, Berenson GS. Occurrence in children of multiple risk factors for coronary artery disease: the Bogalusa Heart Study. Prev Med 1979;8:407- 418
10. Smoak CG, Burke GL, Webber LS, Harsha DW, Srinivasan SR, Berenson GS. Relation of obesity to clustering of cardiovascular disease risk factors in children and young adults: the Bogalusa Heart Study. Am J Epidemiol 1987;125:364-372.
11. Qiu S, Cai X, Sun Z, Li L, Zuegel M, Steinacker JM, Schumann U. Heart Rate Recovery and Risk of Cardiovascular Events and All-Cause Mortality: A MetaAnalysis of Prospective Cohort Studies. J Am Heart Assoc. 2017 May 9;6(5):e005505.
12. Mehdi H Shishehbor 1, Byron J Hoogwerf, Michael S Lauer "Association of triglyceride-to-HDL cholesterol ratio with heart rate recovery Diabetic Care PMID: 15047652 DOI: 10.2337/diacare.27.4.936 April 2004

13. Mustafa Akcakoyun 1, YunusEmiroglu, Selcuk Pala, RamazanKargin, Gamze Babur Guler, OzlemEsen, HekimKarapinar, Birol Say, Ali MetinEsen "Heart rate recovery and chronotropic incompetence in patients with subclinical hypothyroidismPacing and clinical electrophysiology : PACE, Jan 2010 PMID:
14. Angela D. Liese, Hans-Werner Hense, HanneloreLöwel, Angela Döring, Maria Tietze and Ulrich Keil "Association of Serum Uric Acid with All-Cause and Cardiovascular Disease Mortality and Incident Myocardial Infarction in the MONICA Augsburg Cohort" , Epidemiology, Vol. 10, No. 4 (Jul., 1999), pp. 391.
15. Michael J. Shea, MD, Michigan ,X-Rays of the Chest, MSD Manual of consumerversion-2019,https://www.msdmanuals.com/en-in/home/heart-and-blood-vesseldisorders/diagnosis-of-heart-and-blood-vessel-disorders/x-rays-of-the-chest.
16. Suresh K Sharma, Text Book of Nursing Research ,second edition. Elsevier's,2016
17. Shishehbor MH, Baker DW, Blackstone EH, Lauer MS. Association of educational status with heart rate recovery: a population-based propensity analysis. Am J Med. 2002 Dec 1; 113(8):643-9. doi: 10.1016/s0002-9343(02)01324-4. PMID: 12505114.
18. Lin LY, Kuo HK, Lai LP, Lin JL, Tseng CD, Hwang JJ. Inverse correlation between heart rate recovery and metabolic risks in healthy children and adolescents: insight from the National Health and Nutrition Examination Survey 1999-2002. Diabetes Care. 2008 May;31(5):1015-20.
19. Costa, Amanda C. de Araújo, Nilo M. Okuno. Reliability of heart rate recovery indexes after maximal incremental tests Bruno M. Arch Med Deporte 2020;37(3):153-156.
20. EladMaor 1, ShayeKivity, EranKopel, ShlomoSegev, YechezkelSidi, Ilan Goldenberg, David Olchovsky. "Differences in heart rate profile during exercise among subjects with subclinical thyroid disease": Thyroid :official journal of American Thyroid association DOI: 10.1089/thy.2013.0043
21. Anand A, Verma N, Tiwari S, Verma D. Correlation of obesity indices with heart rate recovery as a marker of autonomic function in healthy young adults. J Family Med Prim Care 2020; 9:3370- 3373.
22. Khoury P, Morrison JA, Kelly K, Mellies M, Horvitz R, Glueck CJ. Clustering and interrelationships of coronary heart disease risk factors in schoolchildren, ages 6-19. Am J Epidemiol 1980;112:524- 538