Comparison between the Existing (Clinical) Norms and Developed Norms of Indian Retired Sportspersons

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Abstract

The **aim** of the study was to compare the existing clinical norms and developed norms of Indian retired sportspersons. The study was **conducted** on 430 males. Ages of the sample ranged from 30 to 35 years of same socio-economic status from different games/sports. The comparisons were physiable only for those variables, where the mean and standard deviation are available in the existing (clinical) norms. Date was **collected** using ECG polygraphs. Data were processed and extracted using frequency domain analysis and time domain analysis. Collected data was **computed** with Mean and Standard Deviation. The **finding** regarding comparison between the existing norms and developed norms for the variables namely SDNN where 't' was 38.94. Likely, 't' was 57.7 for SDANN, 't' was 8.98 for RMMSD and 't' was 31.48 for HF (Normalized Power) which were found to be significantly different at .05 level. Whereas, there was insignificant difference between the existing norms and developed norms for the variables namely Total power (Absolute Power) where 't' was 1.27. Likely, 't' was 1.36 for LF (Absolute Power) variable, 't' was 1.63 for HF (Absolute Power) and 't' was 0.05 for LF (Normalized Power). The study **concluded** that SDNN, SDANN, RMMSD and HF (Normalized Power) variables are significantly different between the existing (clinical) autonomic norms and developed norms for Indian retired sportspersons where as variables namely Total power (Absolute Power), LF (Absolute Power), HF (Absolute Power) and LF (Normalized Power) between the existing (clinical) autonomic norms and developed norms for Indian retired sportspersons.

KEYWORDS: Clinical, Norms, Autonomic, Existing

INTRODUCTION

The autonomic nervous system (ANS or visceral nervous system or involuntary nervous system) is the part of the peripheral nervous system that acts as a control system, functioning largely below the level of consciousness, and controls visceral functions[1]. The ANS affects heart rate, digestion, respiratory rate, salivation, perspiration, pupillary dilation, micturition (urination), and sexual arousal. Most autonomous functions are involuntary but a number of ANS actions can work alongside some degree of conscious control. Everyday examples include breathing, swallowing, and sexual arousal, and in some cases functions such as heart rate.

In general, ANS functions can be divided into sensory (afferent) and motor (efferent) subsystems. Within both, there are inhibitory and excitatory synapses between neurons. Relatively recently, a third subsystem of neurons that have been

named 'non-adrenergic and non-cholinergic' neurons (because they use nitric oxide as a neurotransmitter) have been described and found to be integral in autonomic function, in particular in the gut and the lungs[2].

Clinical problems like Parkinson's disease, diabetes etc. can occur due to disturbance in autonomic nervous system (ANS). There are many test battery available (activity and reactivity) to measure the disturbance of autonomic function clinically. It is seen that as soon as the sportsmen stop participating actively in competitive sports they encounter with lots of problem like hypertension, diabetes etc. Clinical norms are available to see whether the patient is having their autonomic function disturbed or not. But, no such norms are available to measure the autonomic function of the sportspersons (retired or not actively participating in the competitive sports) as, they might not be the same presently used for clinical purpose.

OBJECTIVES

Objective of the study is to compare the existing clinical norms and developed norms of retired Indian sportspersons.

HYPOTHESIS OF THE STUDY

It was hypothesized that there will be significant difference between the existing clinical norms and developed norms of retired Indian sportspersons.

SAMPLE FOR THE STUDY

The study was conducted on 430 males. Ages of the sample ranged from 30 to 35 years of same socio-economic status from different games/sports.

METHODOLOGY

Subjects were asked to come with two hours fasting before the test. No medication was taken before 48 hours of the testing. Subjects were make to rest for 30 minutes before the commencement of the test and then heart rate variability (HRV) was performed, which quantifies autonomic drive to the myocardium. The ECG analog were filtered and quantified using the software namely 1) AUTONOMIC FUNCTION TEST HRV_Soft version 1.1, 2) HRV Software, Biomedical Signal Analysis Group, Department of Applied Physics, University of Kupio, Finland. Both sympathetic and parasympathetic drives to myocardium were assessed by SDNN, LF (Normalized Power), LF/HF ratio, LF (Absolute power), TP (Absolute Power), NN 50 count, pNn50 count, SDSD, RMSSD, HF (Normalized Power), HF (Absolute Power) SDANN, and SDSD with regard to HRV variables (sympathetic and parasympathetic activity and reactivity). Reactivity tests were assessed by Hand Grip Test (HGT), Cold Pressor Test (CPT), lying to Standing Test (LST), Deep Breathing test (DBT), Expiratory Inspiratory ratio (E: I ratio), Valsalva maoeuvre ratio (VM ratio). This was achieved by simultaneous measurement of ECG and respiration on a digital polygraph (Medicaid Company, Chandigarh, India).

STATISTICS

Collected data was computed with Mean and Standard Deviation. The findings have been presented with table numbers 1 and 2.

FINDINGS

Table- 1
Clinical Norms Available for Autonomic Activity and Reactivity [3]

S.No.	Variables	Units	Normal Values
1	SDNN	ms	141 ± 39 (mean ± SD)
2	SDANN	ms	127 ± 35(mean ± SD)
3	RMMSD	ms	27 ± 12 (mean ± SD)
4	Total Power (AP)	ms^2	3466 ± 1018 (mean ± SD)
5	LF (AP)	ms^2	1170 ± 416 (mean ± SD)
6	HF (AP)	ms^2	975 ± 203 (mean ± SD)
7	LF (NP)	n.u.	54 ± 4 (mean ± SD)
8	HF (NP)	n.u.	29 ± 3 (mean ± SD)
9	LF/HF Ratio	ratio	1.5 - 2.0
10	DBT (Change in HR)	bpm	≥ 15
11	E: I Ratio	ratio	≥ 1.21
12	VM Ratio	ratio	≥ 1.21
13	Hand Grip Test	mmHg	≥ 16 (Increase in Diastolic BP)
14	Cold Pressor Test	mmHg	≥ 10 (Increase in Diastolic BP)
15	Lying to Standing Test	mmHg	≤ 10 (Decrease in Systolic BP)
16	30: 15 Ratio	ratio	≥ 1.04
17	SDSD	ms	Norms not available
18	NN50 count	F	Norms not available
19	pNN50 count	%	Norms not available

SDNN: Standard Deviation of all NN Intervals, SDANN: Standard Deviation of the Averages of NN Intervals in all 5 Minutes Segments of the Entire Recording, SDSD: Standard Deviation of Differences Between Adjacent NN Intervals. RMSSD: The Square Root of the Mean of the Sum of the Squares of Differences Between Adjacent NN Intervals, Total power (AP): Total Power (Absolute Power), LF (AP): Low Frequency (Absolute Power) HF (AP): High Frequency (Absolute Power), LF (NP): Low Frequency (Normalized Power), HF (NP): High Frequency (Normalized Power), DBT: Deep Breathing Test, E: I Ratio: Expiratory Inspiratory Ratio, VM Ratio: Valsalva Manoeuvre Ratio, LST: Lying to Standing Test

According to table- 1, the normative reference for SDNN is 141 ± 39 (ms) i.e. it ranged from 102 to 180, whereas, the normative reference for SDANN is 127 ± 35 (ms) i.e. it ranged from 92 to 127. The normative reference for RMMSD is 27 ± 12 (ms) i.e. it ranged from 15 to 37. The normative reference for Total Power (Absolute Power) is 3466 ± 1018 (ms^2) i.e. it ranged from 2448 to 4484. The normative reference for Low

Frequency (Absolute Power) is 1170 ± 416 (ms^2) i.e. it ranged from 754 to 1586. The normative reference for High Frequency (Absolute Power) 975 ± 203 (ms^2) i.e. it ranged from 772 to 1178. The normative reference for Low Frequency (Normalized Power) 54 ± 4 (n.u.) i.e. it ranged from 50 to 58. The normative reference for High Frequency (Normalized Power) 29 ± 3 (n.u.) i.e. it ranged from 26 to 32. The normative reference for LF/HF ratio 1.5-2.0 i.e ranged from 1.5 to 2.0. The normative reference for deep breathing test (change in heart rate) ≥ 15 (bpm) i.e. heart rate equal to and more than 15 beat per minute (bpm) is normal. The normative reference for Expiratory Inspiratory Ratio ≥ 1.21 i.e ratio equal to and more than 1.21 is normal. The normative reference for valsalva manoeuvre ratio ≥ 1.21 i.e ratio equal to and more than 1.21 is normal. The normative reference for hand grip test is ≥ 16 mmHg (Increase in Diastolic BP) i.e. blood pressure more than equal to 16 mmHg is normal. The normative reference for Cold Pressor Test is ≥ 10 mmHg (Increase in Diastolic BP) i.e. blood pressure more than equal to 10 mmHg is normal. The normative reference for lying to standing test is ≤ 10 mmHg (Decrease in Systolic BP) i.e. blood pressure less than equal to 10 mmHg is normal and the normative reference for 30: 15 ratio is ≥ 1.04 i.e ratio equal to and more than 1.04 is normal. There is no normative reference available for SDSD, NN50 count and pNN50 count.

Table- 2
Comparison Between the Existing Autonomic Norms and Developed Norms

S.No	Variables	Existing Norms (1)	Developed Norms (2)	't' 1 & 2
1	SDNN (ms)	141 ± 39 $^{\omega}$	53 ± 26 ^{a}	38.94*
2	SDANN (ms)	127 ± 35 $^{\omega}$	22 ± 14 ^{a}	57.7*
3	RMSSD (ms)	27 ± 12 $^{\omega}$	43 ± 25 ^{a}	8.98
4	TP (AP) (ms^2)	3406 ± 1018	3630 ± 3521	1.27^{N}
5	LF (AP) (ms^2)	1170 ± 416	1098 ± 1013	1.36^{N}
6	HF (AP) (ms^2)	975 ± 203	1057 ± 1023	1.63^{N}
7	LF (NP) (n.u.)	54 ± 4	54 ± 15	0.05^{N}
8	HF (NP) (n.u.)	29 ± 3	46 ± 15 ^{a}	31.48
9	LF/HF ratio*	1.5 - 2.0	1.5 ± 1.15	**
10	DBT (bpm)*	≥ 15	19 ± 6	**
11	E: I Ratio*	≥ 1.21	1.3 ± .13	**
12	VM Ratio*	≥ 1.21	1.5 ± .22	**
13	HGT (mmHg)*	≥ 16	32 ± 10	**
14	CPT (mmHg)*	≥ 10	9 ± 5	**
15	LST (mmHg)*	≤ 10	11 ± 6	**
16	30: 15 Ratio*	≥ 1.04	1.49 ± .22	**
17	SDSD (ms) *	NNA	43 ± 25	**
18	NN50 Count (f)*	NNA	56 ± 48	**
19	pNN50 Count(%)*	NNA	20 ± 18	**

1= Existing Norms, 2= Developed Norms
^{a} = Significant Difference Between 1 and 2, ω = When existing norms is different from developed norms. ** = S. No. 9 to 19 do not have the Standard Deviation in the Existing Norms, Hence, Comparison were not Significantly Feasible, SDNN: Standard Deviation

of all NN Intervals, SDSD: Standard Deviation of Differences Between Adjacent NN Intervals, RMSSD: The Square Root of the Mean of the Sum of the Squares of Differences Between Adjacent NN Intervals, SDANN: Standard Deviation of the Averages of NN Intervals in all 5 Minutes Segments of the Entire Recording, TP: Total Power; LF (AP), Low Frequency (Absolute Power), HF (AP): High Frequency (Absolute Power), LF (NP): Low Frequency (Normalized Power), HF (NP): High Frequency (Normalized Power), C.HR: Change in Heart Rate, DBT: Deep Breathing Test, E: I Ratio: Expiratory Inspiratory Ratio, VM ratio: Valsalva Maneoure Ratio, LST: Lying to Standing Test, HGT: Hand Grip Test, CPT: Cold Pressor Test, NNA: Norms not available

The analysis of data in table- 2 regarding comparison between existing norms and developed norms for SDNN where 't' was 38.94. Likely, 't' was 57.7 for SDANN. Likely 't' was 8.98 for RMMSD and 't' was 31.48 for HF (Normalized Power) which were found to be significantly difference at .05 level. Whereas, there was insignificant difference between existing norms and developed norms for Total power (Absolute Power) where 't' was 1.27. Likely, 't' was 1.36 for LF (Absolute Power) variable. Likely, 't' was 1.63 HF (Absolute Power) and 't' was 0.05 LF (Normalized Power) variable.

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