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REVERSAL OF IMPACT OF BMI ON AUTONOMIC MODULATION IN GERIATRIC POPULATION

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ABSTRACT

Background: The main cause for most of the old age complication is due to derangement of cardiovascular and autonomic nervous activity. This study was proposed to record and asses the HRV in elderly population involved with respect to Body mass index to predict and prevent further deterioration and thereby help the elder to lead more normal, healthy and active life.

Materials& methods: 80 normal volunteers were selected, with ages between 55 to 85 years. They were evaluated clinically for Heart rate variability (HRV) and body mass index. Based on BMI, subjects were divided in to two groups. Group I with 40 subjects whose BMI was ≤25 and group II with 40 subjects whose BMI was 25 to 30. To assess the autonomic changes, in this study different parameters of HRV were recorded in both the groups and compared during normal (N), deep breathing (DB) and cold pressor test (CPT) conditions.

Results showed that the SDANN, Time domain HRV was more in subjects with high BMI when compared to subjects with normal BMI during normal condition, in CPT condition parasympathetic activity was more in subjects with high BMI compared to subjects with normal BMI.

Conclusion; This study showed in old age higher the BMI more the HRV and the degree of parasympathetic activity was more in higher BMI.

Key words: HRV, BMI, LF, HF, LF/HF ratio, SDANN

INTRODUCTION

Biological aging is concerned with changes occurring in the structure and functions of the human body; physiological aging is concerned with individual and behavioral changes; emotional aging describes changes in one's attitude and lifestyle dependent on one's self-perception of being old; and finally functional aging is the comparison of individuals of the same age group in terms of those within the group being unable to maintain their functions in society[1].Obesity can be defined as excess of body fat accumulation with multiple organ specific pathological consequences. In an Indian population, the increasing risk of diabetes associated with increasing BMI starts at even lower BMI levels 15 to 20 than in most other ethnic groups where it is more than 25. Asian populations are more likely to have a greater total % of body fat mass and larger amount of abdominal fat than other groups at a given level of BMI. High waist circumference increases the risk of glucose intolerance and diabetes, independent of risk reflected by high BMI[2].

Clear evidence exists that obesity has a wider impact on cardiovascular health beyond its effect on coronary heart disease, and also associated with increased risk of atrial fibrillation, venous thromboembolism and sudden death. So, obesity is associated with a broad range of fatal and non fatal cardiovascular events. Obesity can be assessed in many ways, each method has advantages and disadvantages and the appropriation and scientific acceptability of each method will depend on the situation.

BMI has traditionally been used to identify individuals who are most likely to be over weight or obese. It is calculated by dividing the weight (kg) by height (meters) squared. Generally high value indicates excessive body fat and consistently relates to increased health risks and mortality.

HRV is beat-to-beat fluctuation in the rhythm of the heart which is an indirect measure of heart health[3].

There is a well recognized relationship between autonomic nervous system function and body habits. A decrease in parasympathetic nervous system mediated HRV in obesity may in part explain the mortality and morbidity that are associated with the obese state [4].

Therefore, the present study was conducted to assess the HRV in old age with respect to Body mass index.

MATERIALS AND METHOD

This study was conducted in the department of Physiology, Kasturba Medical College, Mangalore on the inmates of LITTLE SISTER OLD AGE HOME at Nanthoor circle, Mangalore, Karnataka. We recruited about 80 old aged individuals of the age group of 50 to 85 years, belongs to both the sexes, after their informed and written consent. The study was approved by institutional ethical committee. A detailed clinical history of all the subjects was taken. Relevant past history, family history, any drug history, personal history like smoking, alcoholism, occupation etc, were also taken. General physical examination, vital signs, complete systemic examination was done. Only medically fit persons were included in the study. Subjects suffering from any systemic disorders and those who are not consented are excluded from the study.

Heart rate Variability was recorded using Digital data Acquisition system, HRV soft 1.1 VERSION, AIIMS, NEW DELHI. A high quality ECG recording was taken under standardized condition to minimize artifacts. The ECG signal was first analogally recorded & then digitally converted and analyzed in the time domain and frequency domain.

The recording was done in the morning between 8.30 to 9.30am in a cool room temperature of 20 to 28 degree Celsius after breakfast. They were requested to come in a relaxed condition & quiet mood . The room was darkened & without acoustic disturbance. They were instructed to be relaxed and to breathe quietly at their own rate.

After a resting period, the subjects ECG was recorded in the supine position during normal breathing for 5 min . After this a break of 2min was given. Then the next ECG recording was taken during deep breathing for 1 min, the procedure was as follows.

The subject was asked to inspire for the first 5 seconds from the count of 1 to 5 and expire the next 5 seconds from the count of 5 to 1. This recording was taken for 6 such cycles i.e. for one minute.

Cold pressor test

The subjects were asked to keep one hand till wrist in an ice cold box for 1 min, during which the ECG was recorded.

Statistical analysis

The statistical analysis was done by using ANOVA, student's unpaired 't' test, Mann Whitney U test, and Tukey's Test. P value was taken as significant at 5 percent confidence level i.e. $p < 0.05$.

RESULTS

The Study group consists of 80 volunteers in the age group of 50 to 85 years. They were divided in to two groups, each with 40 subjects of both sexes whose BMI is less than or equal to 25 (Group I) and 40 subjects of both sexes whose BMI is between 25 to 30 (Group II). The different parameters of HRV under different conditions in these two groups were recorded, tabulated and analyzed (table:-1). In time domain method, the SDANN i.e., standard deviation of adjacent normal to normal beat was taken in different conditions between these two groups were compared. The mean value of SDANN in group I was 10.13±5.57 and group II was 15.03±5.34 in Normal breathing condition which showed significantly higher value ($P<0.05$) in Group II. In DB and CPT condition, the mean SDANN value of HRV in the group I was 14.96±5.99 and 11.74±6.13 and in the group II was 23.63±10.30 and 16.22±7.49 respectively .In both these conditions also the SDANN was significantly higher ($p<0.05$) in group II when compared to group I. HRV in frequency domain analysis showed that in normal condition, the LF component of group I was 23.45±8.09 and group II was 29.46±10.77. Here also the group II shown greater value in the LF than group I. The LF in the DB and CPT conditions were in group I was 74.25±13.31and 48.62±16.81 and group II was 71.40±14.96 and 47.30±15.63 respectively. The LF in group I was higher than group II. The HF component of HRV in Normal, DB and CPT showed higher values in group II when compared to group I, the values of group I was 36.83±19.39, 27.46±9.53 and 40.80±19.70 that of group II was 40.86±16.04, 28.47±12.26 and 45.97±15.41 in Normal DB and CPT conditions respectively. The LF/HF ratios compared between the two groups were also not significantly different in these groups in normal, DB, CPT conditions.

Table I: - Effect of BMI on HRV in Time domain and Frequency domain methods during Normal breathing, Deep breathing and Cold pressor test. n=40 in each group.

	HRV	BMI		P-Value
		<=25 Mean ± S.D	25-30 Mean ± S.D	
Normal	SDANN	10.13±5.57	15.03±5.34	0.004
	LF	23.45±8.09	29.46±10.77	0.07 NS
	HF	36.83±19.39	40.86±16.04	0.337 NS
	LF/HF Ratio	0.78±0.44	0.87±0.55	0.594 NS
Deep breathing	SDANN	14.96±5.99	23.63±10.30	0.001
	LF	74.25±13.31	71.40±14.96	0.565 NS
	HF	27.46±9.53	28.47±12.26	0.794 NS
	LF/HF Ratio	3.04±1.23	3.22±1.70	0.983 NS
Cold Pressure	SDANN	11.74±6.13	16.22±7.49	0.031
	LF	48.62±16.81	47.30±15.63	0.974 NS
	HF	40.80±19.70	45.97±15.41	0.04
	LF/HF Ratio	1.37±0.58	1.12±0.49	0.169 NS

DISCUSSION

As obesity can be determined by BMI, when BMI is compared with HRV in elderly, it showed higher HRV in subjects with BMI 25 to 30 compared to subjects with BMI <25.

Study by Friederich et al compared 38 women with BMI >30 and 34 age and BMI matched healthy women showed greater reduction in HRV among obese women[5].In another study by Guizar JM et al compared 34 obese and 36 non obese men and found that significant decrease in HRV in obese men[6].

Research by Taylor, Donald H., Jr., Ostbye, Truls showed that heavier body weight in old age has no discernible effect on mortality risk, while the highest mortality risk was associated with low body mass index[6] .Research by Grabowski, David C., Ellis, John E on mortality risk indicates that obesity in older persons may be protective when compared with normal weights or thinness. Adjustments for functional status, health

services utilization, and demographic factors still revealed a reduced mortality risk in obese elderly compared with normal [7]. An explanation for the lack of a positive association with BMI and mortality at older ages is that, in older persons, BMI is a poor measure of body fat. The measurement of weight does not differentiate between fat and fat-free mass, and fat-free mass (especially muscle) is progressively lost with increasing age [7].These above reasons supports increased HRV in overweight compared to non obese in elderly.

Conclusion:

In this study, in old age higher the BMI more the HRV. In old age parasympathetic autonomic modulation is better in overweight than normal BMI individuals.

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REFERENCES

1. Koonin EV, Altschul SF, Bork P.(1995.1996) BRCA1 protein products: functional motifs. Nat Genet. The Merck Manual of Geriatrics. Second Edition,Vol 13:266-267.
2. Sarah H wild,Christ opher(2006) ,BMJ.Risk factors for diabetes and CHD. Vol 333:1009-1011.
3. Schiel R, Beltschikow W, Kramer G, Stein G. (2006 Mar 27)Overweight, obesity and elevated blood pressure in children and adolescents Eur J Med Res..;Vol 11(3):97-101.
4. Freeman. R, Weiss ST, Roberts M, Zibikowski SM, Sparrow D.(1995) The relationship between heart rate variability and measure of body habitus. Clin Auton Res :Vol 5 (5) 261-6
5. Guizar JM, Ahuatzin R, Amador N, Sanchez G, Romer G.(2005) Heart autonomic function in overweight adolescents Indian Pediatr. Vol 42 (5) :464-9.
6. Taylor, Donald H., Jr., Ostbye, Truls.(2001) The effect of middle- and old-age body mass index on short-term mortality in older people Publisher: Blackwell PublishersLtd. Journal of the American Geriatrics Society ISSN: 0002-8614.
7. Grabowski, David C., Ellis, John E. Publisher: Blackwell Publishers Ltd.(2001) Publication High body mass index does not predict mortality in older people: analysis of the longitudinal study of aging. Journal of the American Geriatrics Society Subject: Seniors ISSN: 0002-8614.