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EDITORIAL

HEART RATE VARIABILITY IN METABOLIC SYNDROME

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Metabolic syndrome (MetS) is a cluster of metabolic risk factors for cardiovascular disease and type 2 diabetes. It is also associated with insulin resistance (glucose intolerance) and obesity or overweight[1,2]. According to the International Diabetes Federation, a quarter of the world's adult population has MetS, and more cases are diagnosed in males over 40 years of age[1].

MetS occurs when a person has three or more of the following measurements: (1) Abdominal obesity - waist circumference of 40 inches or more in men, and 35 inches or more in women; (2) Triglyceride level of 150 milligrams per deciliter of blood (mg/dL) or more; HDL cholesterol of less than 40 mg/dL in men or less than 50 mg/dL in women;(3) Systolic blood pressure of 130mmHg or greater, or diastolic blood pressure of 85mmHg or greater; and (4) Fasting glucose of 100 mg/dL or greater[1,3].

There are increased risk for: Atherosclerosis, Peripheral vascular disease, Coronary heart disease, Heart attack, Stroke and Type 2 diabetes. *The National Cholesterol Education Program's Adult Treatment Panel III report* (ATP III) identified the proinflammatory state with elevations of C-reactive protein and a prothrombotic state with increased plasma plasminogen activator inhibitor and fibrinogen as associated with the metabolic syndrome[4].

Many of the factors that contribute to metabolic syndrome can be addressed through lifestyle changes: balanced diet (maintaining a healthy weight, reduce fat intake, change the consumption of saturated fats to unsaturated fats, increase the intake of fruits, vegetables, legumes and whole grains and reduced intake of sugar) and exercise (aerobic and muscle strengthening). The World Health Organization recommends 30 minutes of activity at least five times a week[1,2,4,5].

Promising results of an important study published in the *BMC Public Heatlh*[6] was *The Study Cardiovascular Risk in Adolescents* entitled "ERICA". This study aimed to estimate the prevalence of cardiovascular risk factors including metabolic syndrome in adolescents aged 12 to 17 years in Brazilian cities with over 100,000 inhabitants. We collected about 85,000 adolescents. The participants answered a questionnaire on demographic characteristics and lifestyle (physical activity, smoking, alcohol), mental disorders, reproductive and oral health, and blood samples for fasting glucose, total cholesterol, HDL-cholesterol, LDL - cholesterol, triglycerides, and glycated hemoglobin. It is expected that with the data from "ERICA" able to contribute to the knowledge about risk factors for atherosclerosis, obesity, diabetes mellitus among adolescents and serve to support the development of health policies

ATP III recommended first-line therapy the increased physical activity. The studies with exercise have increased in the scientific literature, between these studies autonomic modulation in patients with metabolic syndrome and exercise have risen too[5,7]. The heart autonomic modulation can be measured noninvasively, this process is known the analysis of heart rate variability (HRV)[8]. HRV can be used to

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estimate autonomic nervous control of the cardiovascular system and reduced HRV significantly increases cardiovascular mortality[9].

There is strong evidence that obesity leads to increased sympathetic modulation and a decreased vagal tone leading to a lack of autonomic control (characterized by reduction of heart rate variability) that can bring about changes in the renin-angiotensin-aldosterone system in alpha agonists and central alpha 2-1 and beta-adrenergic receptors. In addition, changes in plasma catecholamines and increased muscle sympathetic nerve activity are important characteristics in obese individuals[8,9,10]. All these factors contribute further to increased blood pressure[11,12,13].

Souza et al[14] have reviewed studies of HRV in obese children,and find that obese children have lower activity of the parasympathetheticnervous system. In addition,[8-13] there is evidence showing that interventions such as diet and physical activity can promote improvements in autonomic nervous system balance in this population.

Vanderlei et al[15,16,17] showed autonomic dysfunction characterized by reduced sympathetic modulation in obese children. The RRTri, TINN, SDNN, RMSSD, pNN50, SD1, SD2, LF and HF indices were lower among the obese children when compared to the eutrophic group.

Vanderlei, Vanderlei and Garner[18], in an elegant study in this issue of JGDH publish important contribution in the area of HRV. This is the article "Heart rate dynamics by novel chaotic globals to HRV in obese Youths" which is innovative evaluation of obese youth by chaotic behavior of HRV. Time heart rate series can be studied by means of statistical methods, this article studies the dynamic point of view, combining the nonlinear deterministic systems (chaotic behavior). Eighty-six young people were distributed in two groups (obese and control). The results illustrate that there is great variation in both the mean values and standard deviation for both young non-obese and obese, there is an increase in the chaotic response when going from non-obese to young obese, thus showing that the youth obesity increases the chaotic response.

Stuckey et al[10] systematically reviewed associations between heart rate variability and metabolic syndrome. Fourteen studies were included. Heart rate variability generally was reduced in women with metabolic syndrome compared to those without, while results in men were inconsistent. Time and frequency domain heart rate variability parameters were associated with individual metabolic syndrome risk factors, though sex differences exist. The authors concluded HRV is altered differently in men and women with metabolic syndrome.

Stuckey et al[19] evaluated whether an 8-week exercise intervention would improve MetS risk factors and HRV in a population with MetS risk factors. The waist circumference and diastolic BP were reduced and maximal oxygen uptake (VO_2max) increased. Low frequency (LF) was reduced and high frequency (HF) was increased, Thus, exercise intervention improved MetS risk factors and HRV parameters, but only changes in systolic BP were associated with improved autonomic function.

Koskinenet al[20] associated the presence of the MetS with lower HF and LF in men and women, and with higher LF/HF ratio in women. In young men, waist circumference was the strongest individual MetS component that associated with HRV. After adjustments for age and heart rate, MetS was associated with lower HF and higher LF/HF ratio in women.

Jarczoket al[21] recruited 2441 study participants and affirmed a negative correlation between HRV and glycemic status that appeared to be almost linear in a large cohort of healthy workers. Liao et al[22]examined the association between the level of cardiac autonomic activity and MetS disorders. HRV indices were significantly lower in individuals with MetS. An increase in fasting insulin was associated with 88% higher odds of having a lower HF. The pattern of associations was similar for LF and SDNN.

In recent years HRV has been an important instrument to evaluate autonomic modulation. The association of HRV indices with appropriate forms of exercise prescription can raise awareness for better treatment of patients with metabolic syndrome. MetS presented alterations in the autonomic nervous system, characterized by decreases in parasympathetic activity and global HRV, but the reduction in sympathetic modulation is not entirely clear. HRV analysis by chaotic behavior can bring an advance for evaluation and treatment of obese, diabetic, hypertensive and metabolic syndrome.

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