Short communication

Institute of Basic Preclinical Sciences " Victoria de Girón"

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ABSTRACT

Obesity, "epidemic of the XXI century", affects the cardiovascular system, whose diseases are among the leading causes of morbimortality in most developed countries, as well as in some developing nations such as Cuba, where mortality rate of cardiovascular causes reached 228.2 every 100000 inhabitants in 2018.

Classification: observational of prevalence, descriptive-correlational; transversal; and applied.

Objective: To describe functional cardiac modifications associated with overnutrition and expressed during and after physical effort, Havana, Cuba.

Population: 102 subjects who attended said laboratory with to have a periodical health follow-up from January 2017 to April 2018, of 30-70 years of age, without personal history of ischemic heart disease or contraindications to perform an Exercise Stress Test, and in whose attention the researchers participated.

Method: Anamnesis, physical exam, bioimpedance and exercise stress test. The subjects were classified according to body fat percentage: groups N (normal), H (high) and V (very high).

Results: 83 subjects completed the study, predominating women and subjects of 50-59 years of age. The most prevalent cardiovascular risk factors were overnutrition, sedentary lifestyle and hypertension. Functional capacity was diminished with the increase in body fat percentage (BFP). In subjects of group N there was no ST-segment deviation. 18 subjects presented arrhythmia during and after the exercise, among them 88,2% had a BFP higher than normal; the most frequent arrhythmias were sinus tachycardia and ventricular extrasystole. **Conclusions:** overnutrition is associated with functional cardiac modifications that imply an increase of cardiovascular risk, with decreased exercise tolerance and augmented incidence of ischemia and cardiac arrhythmias.

Keywords: overnutrition, obesity, heart diseases, exercise test, arrhythmias, myocardial ischemia.

INTRODUCTION

Obesity is a growing problem worldwide, associated with an increase in cardiovascular risk. The World Health Organization informs that 39% of people of age above 18 years suffer overweight.[1] By 2025, 18% of men and 21% of women would be obese[2]

Obesity is defined by increase of adipose mass.[3] It is not only a disease itself but also a significant risk factor in the progression of cardiovascular diseases, being able to alter the morphophysiology of the heart causing obesity cardiomyopathy.[4]

Objective: To describe functional cardiac modifications associated with overnutrition and expressed during and after physical effort, Havana, Cuba.

MATERIALS AND METHODS

The research project was approved by the ethics committee and the scientific council of the ICBP "Victoria de Girón" and communicated to its homologue in Calixto García Hospital. Each subject informed consent.

Universe: patients of the Ergometry Laboratory of the said hospital. Inclusion criteria: age 30-70 years. Exclusion criteria: personal history of ischemic heart disease, and contraindications to perform an Exercise Stress Test (EST).

Population: 102 subjects who attended said laboratory in 2017 to April 2018, in whose attention the researchers participated. No sample was selected.

Method: All subjects underwent anamnesis, physical examination, and EST.

The nutritional state was assessed through Body Mass Index (BMI) and Body Fat Percentage (BFP). BFP was measured using an OMROM BF-306 Body fat Monitor (portable upper train device determining bioelectrical impedance). Measurements were taken after at least 2 hours of fasting, with empty bladder and intestine, not freshly bathed, and avoiding contact with conductive materials. This allowed to classify subjects (cut points adjusted for age and sex as established in the instruction manual): BFP: normal: group N; high: H; very high: V. Data about associated risk factors (tobacco addiction, hypertension, diabetes mellitus, sedentary lifestyle) was also collected.

Recommendations for EST: to wear comfortable clothes and shoes, have breakfast, and avoid alcohol, coffee or cigarettes three hours before EST, as well as intense physical activity or uncommon exercise twelve hours before. Adequate preparation of the skin was made. All procedures were carried out according to the usual norms. EST was performed on a device model Ergocid-AT plus, according to protocol, and was considered conclusive if the patient reached 85% of the Maximum Effort Heart Rate (MEHR): MEHR = 220 - age.

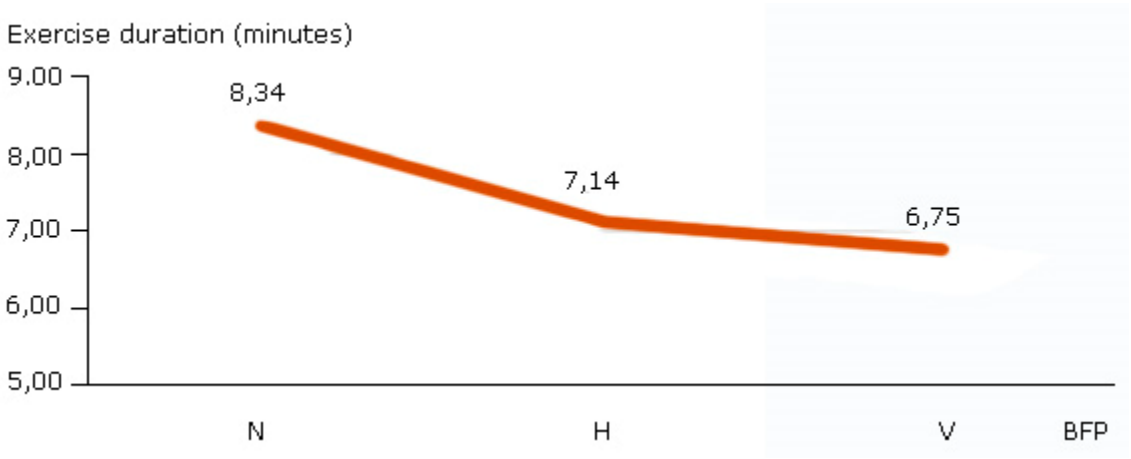
Functional class was assessed through speed and inclination of the stage, which allowed to calculate the Metabolic Equivalents (mets). It was classified as follows: Normal > 7.9 mets; I: 7-7.9 mets, II: 5-6.9 mets; III: 2-4.9 mets.

Descriptive statistics were performed and the mean and standard deviation of the quantitative variables were calculated, as well as the frequencies and percentage of qualitative variables. STATGRAPHICS Plus Professional Edition for Windows 5.1 was used for statistical analysis. Means were compared through ANOVA and Kruskall-Wallis test; all this, to compare groups N, H and V. Statistical significance was considered $p < 0.05$.

RESULTS

Among the 102 patients who started the study, 83 completed it (81,4%). 56,6% were female, and 38 males, in their fifties.

Concerning BMI the group with most subjects was that of overweight (32), and regarding BFP, most belonged to group H. Mean IMC for groups N, H and V was: for male subjects: 23,97, 28,35 and 32,97 respectively, and for female subjects: 23,33, 27,20 and 32,37 respectively. For both sexes, mean IMC for groups N, H and V corresponded to normal weight, overweight and obese respectively. That correspondence wasn't shown in each subject individually. Since the definition of obesity refers directly to the body fat composition, this one was the criteria followed for classification as stated in the methodology. 62 subjects were hypertensive, only 8 of them in group N; 52 carried a sedentary lifestyle, only 7 of them in group N. There were 12 diabetics, as well as 16 smokers and 11 ex-smokers; differences between groups regarding these risk factors weren't as substantial.



The time of exercise the subjects could endure is shown in graphic 1. There was a standard deviation of ±1,48 min for group N, ± 1,28 min for H and ± 1,57 min for V. Analysis of variance

(ANOVA) showed significant difference (p-value=0,0047) for groups H et V each in comparison with group N (estimated difference between each pair of means of: 1,2 and 1,59 respectively, with limits of 0,9 in both cases). The means (60,2, 41,7 and 34,53 for groups N, H and V respectively) were also significantly different according to Kruskall-Wallis test, p-value=0,0059.

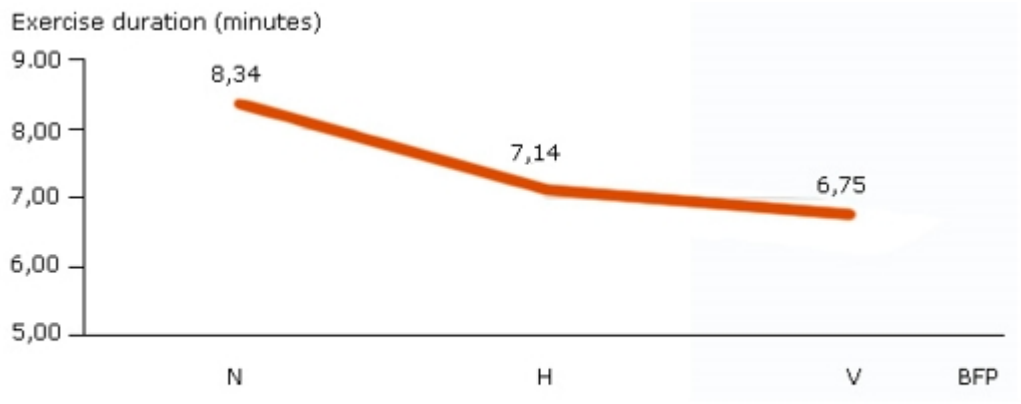


Fig. 1. Exercise duration (Mean) per group classified according to BFP. BFP: normal: group N; high: H; very high: V.

Exercise tolerance can be assessed not only through exercise duration but also in METS. In this study we calculated METS using speed and inclination of the stage. This allowed to assemble the subjects according to their functional class, as shown in the methodology.

The EST is widespread in detecting coronary artery disease; the ST-segment deviations assessed in exercise electrocardiogram are related to myocardial ischemic lesions. 12 subjects (14,5% of the population) presented those changes, as shown in Figure 2.

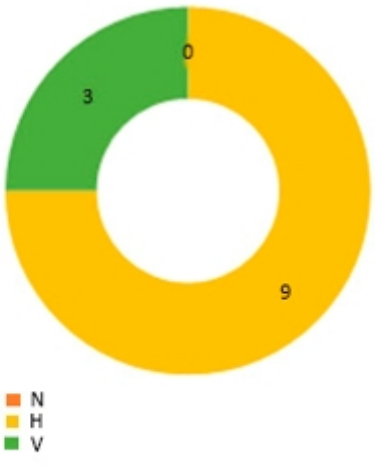


Fig. 2. Number of subjects classified according to the presence of ST-segment displacement.

Among those subjects whose echocardiogram presented a ST-segment, deviation, none had a normal BFP, and only 3 of them suffered symptoms: angor; they all with a high BFP.

A group of patients suffered arrhythmias in exercise and recovery, as shown in table 2. Sinus tachycardia is defined in this case by a heart frequency over 100 beats per minute 4 minutes or more after the end of the exercise.

Table 1. Subjects according to New York Heart Association functional class

Functional Class	Normal		I		II		Total
	FrA	%	FrA	%	FrA	%	
Group N	10	76,9	3	23,1	0	0,0	13
Group H	18	45,0	19	47,5	3	7,5	40
Group V	10	33,3	17	56,7	3	10,0	30

Table 2. Subjects who presented arrhythmias during and after the exercise in each group

Arrhythmias	Group N		Group A		Group MA		Total
	FrA	%	FrA	%	FrA	%	
Sinus tachycardia	1	12,5	3	37,5	4	50,0	8
Supraventricular extrasystole	0	0,0	1	100,0	0	0,0	1
Ventricular tachycardia	0	0,0	1	100,0	0	0,0	1
Ventricular extrasystole	1	16,7	4	57,1	2	33,3	7
Left bundle branch block	0	0,0	1	100,0	0	0,0	1
Total	2	11,8	9	52,9	6	35,3	18

DISCUSSION

Sedentary lifestyle and hypertension are closely related to overnutrition. The first implies a lower expenditure of the reserves of available energy; its relationship with obesity is causal. In the studied population, sedentary lifestyle must have contributed to the genesis and worsening of overnutrition.

Regarding hypertension, blood pressure is typically high in subjects with obesity as a result of an increase in systemic vascular resistance and cardiac output. The former is related to inflammation

and sympathetic activity. The latter is attributable to an increase mainly in stroke volume but also in heart rate, this one linked to sympathetic activation.[2]

Exercise tolerance was significantly lower with the increase of BFP. Both exercise duration and functional class reflected that phenomenon. Some other researches have arrived to similar results, recently[5,6], even in elders.[7] It might be explained by the extra body fat that the subject must carry, while performing an exercise that already implies a high metabolic demand, for which the heart of the obese, mainly if already weakened, is eventually unable to supply enough.

Along with exercise time, segment ST deviation and exercise-induced angina are usually assessed for evaluating cardiac fitness, specifically for the diagnosis and prognosis of coronary artery disease. As in other researches,[8] in the current one ST-segment deviation was associated to obesity, as well as angina. Those results were to be expected since literature indicates that adiposity is associated with the accelerated progression of atherosclerosis and, according to other studies, also with the rupture of atherosclerotic plaques inside the coronary arteries.[2] Its contribution to the risk of coronary heart disease is related to increase in cortisol, inflammatory cytokines and hormones: leptin and insulin.[9]

Another important cause of morbimortality of cardiovascular origin in the obesity, are rhythm alterations. In the present study, arrhythmias were detected during and after exercise, mainly in subjects with BFP over normal. This result was to anticipate, since, according to emerging evidence, atrial and ventricular arrhythmias are promoted by obesity. Though the molecular mechanisms remain poorly understood, adipocytes are suspected mediators, directly: by infiltrating the myocardium; or indirectly: through secretion of adipokines. Some of them stimulate the sympathetic system, which directly triggers β-adrenergic mediated increase of intracellular calcium.[3] That could in itself explain the increased frequency of sinus tachycardia. The other most prevalent arrhythmia among our subjects was ventricular extrasystole, which is consistent with the findings of other studies that have demonstrated an augmented frequency of ventricular ectopy among obese humans, with a slightly increased risk of mortality.[10]

Conclusions: In present study overnutrition is associated with functional cardiac modifications that imply a diminished quality of life and increase of cardiovascular risk, with decreased exercise tolerance accompanied of augmented incidence of signs of ischemia and cardiac arrhythmias.

Words: 1871

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