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Relationship Between the Maximum Cardiac Frequency and the Fat Percentage in the Apparently Healthy Population

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ABSTRACT

Introduction and Objectives: Obesity is a multifactorial disease that affects various systems of the organism and is constituted as a coronary risk factor, which generates multiple affectations of the function and anatomy of the heart as well as in other main organs. The objective is to determine the relationship between the maximum heart rate and the fat percentage in people with obesity.

Materials and Methods: Observacional, descriptives and cross-sectional study with 396 participants (236 women and 160 men), with an average age of 26.6 ± 10.6 years. For the development of this research, an effort test was performed and anthropometry, vital signs, Borg scale were obtained.

Results: An average FCM of 172.82 ± 18.81 bpm was obtained in the exercise test. being higher in women compared to men (M: 179.8 ± 14.2 vs H: 178.1 ± 17.1). Similarly, the fat percentage was higher in women than in men (29.40 ± 10.47 vs 24.81 ± 8.83). In addition, a pearson r was found for the FCM and a fat percentage of -0.20.

Conclusions: The results of the present study show that there is no correlation between the maximum heart rate values obtained in the study population versus the fat percentage.

KEYWORDS

Cardiac frequency, Fat percentage, Population, Heart rate

INTRODUCTION

Overweight and obesity, present in many countries of the world and currently seen as a pandemic [1]. The World Health Organization (WHO), since 1988, considered obesity as a global epidemic [2] and in 2016, more than 1,900 million adults aged 18 years and over were overweight, of which more than 650 million were obese [9].

Overweight and obesity are defined as an excess of fat in the body; Very important factors in the increase of weight can be the imbalance between the intake of calories and the energy expenditure of a person. On the other hand, the increase in consumption of hypercaloric foods, the sedentary lifestyle and urbanization that is increasing, results in the decrease of physical activity increasing the probability of developing

obesity [4].

According to the World Disease Burden Report, it revealed that the global, regional and national disposition in what is related to overweight and obesity from 1980 to 2013, is growing all over the world, especially in the young population [2]. In epidemiological studies have shown results where obesity is a major risk factor for cardiovascular disease, the relationship between these two is very complicated given that some see it as an indirect relationship due to other associated pathologies such as Hypertension (HT), dyslipidemia and diabetes mellitus [5].

On the other hand, obesity is associated with a higher prevalence of hypertension that, together with being overweight, are determinant risk factors for the development of this pathology [6]. With respect to the heart rate, is the number of times the heart contracts or beats for one minute, the maximum heart rate essentially delimits the effort and intensity of the exercise; In addition, to provide us with data to benefit the exercise also provides information at the time of a physical assessment [7].

It should be mentioned, in addition, the heart rate is a perceptive parameter that has the quality to determine how the response is to the caloric or metabolic work, we can also add the change of the environment for example the temperature or even mental tension [8]. To perform an appropriate evaluation before prescribing the exercise should know how the patient is at the musculoskeletal level, It should be mentioned that because of overweight and obesity may be damaged joints, the most important thing is to know the exercises are most appropriate for This type of patients and not cause more damage in him [9].

The application physical tests allow us to know our physical condition, to know the respective health assessments of each patient, these are of the utmost importance to carry out the appropriate exercise plan especially if it presents problems with obesity and overweight. The most important thing is the application of an individual examination focused on the patient's health status. So for example the danger of the pathology, perceive the current situation to put in place the most appropriate prescription. To be able to achieve good results in the improvement of their physical condition for the prevention of diseases [10].

In order to determine the maximum heart rate of an individual aimed at prescribing exercise, certain factors should be taken into account that could modify their values, such as age, gender, history of heart disease and other comorbidities [11]. Having an adequate energy balance in our body where there is a balance between caloric intake and caloric expenditure accompanied by physical exercise, is essential in the maintenance of cardiovascular function [9].

Therefore, when prescribing physical exercise, an interdisciplinary work is recommended by health experts such as physiotherapists, physicians and physical exercise instructors [12]. This is how this study aims to determine the relationship between the maximum heart rate and the fat percentage in people with obesity.

MATERIALS AND METHODS

Tests and measurements were carried out on the 396 participants aged 26.6 ± 10.6 years old from the city of Cúcuta, Colombia. The eligibility aspects were very specific and strict, because the research is considered low-moderate risk due to the complexity of the stress test and the age of some participants. These should be over 18 years old, apparently healthy and who signed an informed consent, endorsed by the ethics committee of the institution under number 0056-4.

The exclusion of participants was done if they presented pain in the lower limbs, dyspnea and / or fatigue at rest greater than or equal to 3, if they were under the medication of beta-blockers, with a history of cardiovascular alterations, surgical procedures of this type or acute myocardial infarction. myocardium Another criterion that was taken into account was the hemodynamic instability during the test and the manifestation of not wanting to continue.

Data Collection

Regarding the collection of personal, family and sociodemographic data, an instrument of its own creation was applied and carried out with an interrogation directed at the patient. Regarding the morphological and anthropometric variables, the "Adult Acrylic Halter Wall Kramer 2104" (Stadiometer), Balance Tezzio Digital Balance TB-30037 (Electric bioimpedance), Asmico 150 cm 60 "Gree" (Tape measure), Nellcor Puritan Bennet (Portable pulse oximeter) and manual blood pressure monitor.

Each participant was subjected to a test of effort in an endless band following the protocol of Bruce which consists of performing the exercise in stages of three minutes, each stage increases both the speed and the slope of the tape causing sudden jumps in the workload, thus high levels of effort are reached quickly. Instructions such as avoiding alcohol consumption, caffeine, smoking, vigorous exercise and some type of drug or medication, were necessary 12 h before the stress test as this could interfere with the HRmax or performance during the test.

The Borg [7] scale was used, which determines the effort perceived by patients. This test estimates the subjective lack of air and perceived effort from a 10-item scale. This tool aims to evaluate the intensity settings and / or workloads. Using the Polar Rs800CX system, the heart rates (FC) were obtained before, during and after the test in real time. As well as the portable pulse oximeter (Nellcor Puritan Bennet) provides arterial oxygen saturation; The aforementioned tools were used pre, peri and post stress test. Likewise, Systolic (SBP) and Diastolic Blood Pressure (DBP) were obtained, manually before, after and 5 minutes after completing the stress test.

Statistic Analysis

Regarding the description of quantitative variables, minimum, maximum and variability values (Standard deviation) were expressed as arithmetic mean. On the other hand, an analysis of the Pearson Correlation Coefficient between the different variables was carried out. The analyzes were carried out in the Stata program (Data Analysis and Statistical Software) and in all cases the level of significance was established at 5% ($p < 0.05$).

RESULTS

Table 1 shows the characteristics of the study population ($n=396$) classified by sex (H: 160 vs. M: 236), educational level (Primary, secondary or not completed, technical, technological, undergraduate, postgraduate), fat percentage, body mass index (BMI) among other variables. The BMI of the participants was 3.78% for underweight, 56.06% normal weight, 26.51% and 13.63% for over weight and obesity respectively.

The fat percentage of the study population is $27.53\% \pm 10.02$; highlighting, the high fat percentage of women compared to that of men (29.40 ± 10.47 vs 24.81 ± 8.83) in different age ranges (Figure 1).

Regarding HR, the average value for resting HR was 92.01 bpm ± 14.93 and the HRM in the exercise test was 179.35 bpm ± 15.48 ; separating by sex, values were found in the female sex of 179.81 bpm ± 14.26 and for the male sex 178.66 bpm ± 17.15 . Regarding the participants with a high percentage of fat in the male sex, the FCM was lower with 173.27 bpm ± 21.27 compared to the average value of the female sex 178.95 bpm ± 14.27 . In addition, in Table 2, different variables are correlated through the Pearson r to determine the relationship between the maximum heart rate and the fat percentage; as well as the resting heart rate versus the fat percentage levels of the total population ($n=396$) and the correlation of the FCM with the participants who had a high fat percentage ($n=211$).

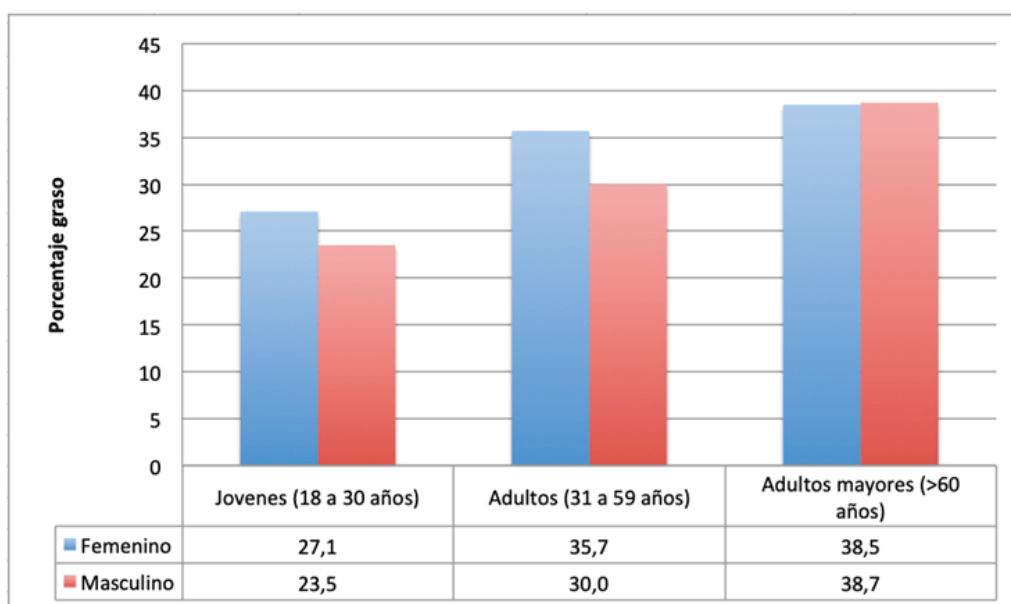
DISCUSSION

Currently, it has been described that children close to puberty have less fat percentage, due to the start of the release of growth hormone that favors lipolysis. Therefore, maintaining a high fat percentage can be an indicator of sedentary lifestyle at an early age,

Table 1: Characterization of the population

Variable	Quantity	Female	Male	Average
Total Sample				396
Age				26 ± 10 años
Gender	396	236	160	100
Ethnicity				
White	113	88	25	28.53
Half Blood	226	164	62	57.07
Afro-Colombian	57	30	27	14.39
Academic level				
Primary	3	1	2	0.76
Bachelor	119	42	77	30.05
Bachelor's degree not finished	18	11	7	4.55
Technical	18	8	9	4.55
Technological	8	5	3	2.02
Bachelor's degree	217	161	56	54.80
Postgraduate	13	8	5	3.28
Anthropometry - BMI				
Infrapeso	15	9	6	3.78
Normopeso	222	139	83	56.06
Overweight	105	54	49	26.51
Obesity	54	34	20	13.63
Fat Percentage	396	29.40 ± 10.47	24.81 ± 8.83	100

BMI: Body Mass Index

**Figure 1:** Fat percentage by sex**Table 2:** Heart rate pre and post stress test and correlation with fat percentage

Heart rate	Female (n=236)				Male (n=160)				Total (n=396)
	Average	DS	n	%	Average	DS	n	%	Pearson's r
Repose	94.1	15.3	236	100	88.9	13.8	160	100	-0.10
Maximum	179.8	14.2	236	100	178.1	17.1	160	100	-0.20
In people with high fatty percentage	178.9	14.2	199	84.3	173.2	21.2	22	13,7	-0.15

DS: Standard deviation

which affects physical abilities. In the present investigation, the data obtained from women have a significantly higher fat percentage than that of men [13], which agrees with our results. On the other hand, the research by Hernández López, Sierra Galán and Pichel Pérez (2000) [14], showed that the FCM is age dependent and is higher in men, compared to women, which is evidenced in this study where the average FCM in men was 178.1 bpm, while in women it was 179.8 bpm.

In addition, Seres and Cols (2003) [15], stated in their study that there were no differences in age, sex and height between both groups and during the effort, the obese subjects presented oxygen consumption, heart rate, systolic blood pressure and ventilation. minutes significantly higher than the control group, which differs with this study, where obese people had a lower MCF than people with normal weight.

This increase in weight, associated in part with sedentary lifestyle, promotes obesity and, therefore, the increase in energy expenditure during oxidative activity, secondary to the need to mobilize more body weight, which favors faster passage to a glycolytic threshold which produces more acidosis and accelerates the process of fatigue.

In addition, overweight is related to the increase in heart rate, not only in activity but also at rest, and with decreased ejection volume, increased arterial stiffness, endothelial dysfunction, increased ventricular stiffness and stimulation. continuous sympathetic nervous system in children with increased fat percentage, which hinders the ability to maintain a prolonged exercise [16].

CONCLUSIONS

The results of the present study show that there is no correlation between the maximum heart rate values obtained in the study population versus the fat percentage.

Conflict of Interest

The authors declares that there is no conflict of interest regarding the publication of this paper.

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