INACTIVITY—THE SLOW BUT CERTAIN PATH TO CARDIOVASCULAR DISEASE

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Abstract

Cardiovascular diseases (CVD) remain the leading cause of global mortality, with Romania classified as a high cardiovascular risk country. Sedentary behaviors and obesity, closely interrelated factors, significantly contribute to the increased CVD risk. This study analyzed 45 subjects aged between 18 and 49 years, none of them being a professional athlete. Data collected included sex, age, BMI, metabolic equivalents (METs), and predictive values for the age and sex of the patient. The study aimed to evaluate the relationship between these variables and to assess the situation regarding the incidence of sedentary lifestyle. Only 18% of the subjects demonstrated an increased exercise tolerance. Approximately 50% were overweight, and 26% were obese. Subjects with normal BMI showed greater exercise tolerance compared to overweight and obese individuals. Overall, 82% of participants did not meet the ESC guidelines for physical activity. The low levels of physical activity highlight the urgent need for national educational and structural interventions to reduce cardiovascular risk and promote an active lifestyle, particularly among vulnerable groups such as young people and overweight individuals.

Key Words: sedentarism, cardiovascular risk, obesity, metabolism.

INTRODUCTION

Cardiovascular diseases (CVD) remain the leading cause of mortality worldwide (Di Cesare M, 2024). In Europe, and particularly in Romania—classified as a very high cardiovascular risk country according to the Systematic Coronary Risk Evaluation (SCORE 2021) developed by the European Society of Cardiology (ESC) (JI, 2019; collaboration, 2021)—this classification highlights the urgent need to mitigate the

already elevated cardiovascular risk by adopting proper dietary habits and regular physical activity. Unlike low-risk countries, where other factors may compensate for a lower baseline risk, in Romania, the combination of sedentary behavior, obesity, and other modifiable risk factors significantly increases the likelihood of developing cardiovascular diseases.

Insufficient physical activity is recognised as one of the most important modifiable risk factors for CVD, alongside smoking, hypertension, obesity, and dyslipidemia (Lavie CJ, 2019). Physical exercise plays a significant role not only in preventing cardiovascular diseases but also in improving the prognosis of individuals already diagnosed with cardiovascular pathologies. One key benefit is the promotion of collateral circulation, which can improve both symptoms and long-term outcomes (R., 2022).

Previous studies have demonstrated that an active lifestyle offers significant cardiovascular health benefits, such as lowering blood pressure, improving endothelial function, and preventing the progression of atherosclerosis (Lavie CJ, 2019).

Additionally, the updated guidelines from the European Society of Cardiology recommend a minimum of 150 minutes of moderate-intensity or 75 minutes of high-intensity exercise per week for primary and secondary prevention of cardiovascular diseases (Frank L J Visseren, 2021). Despite these recommendations, physical activity levels remain insufficient in the general population, with the prevalence of obesity tripling over the past 4–5 decades (Nichols, 2023). In 2022, approximately 14% of men and 18.5% of women were classified as obese. These increases are attributed to dietary shifts toward high-calorie, processed foods and reduced physical activity, particularly in urbanized environments and high-income countries (Nichols, 2023).

The purpose of this study is to emphasize the importance of implementing nationwide educational and awareness programs to encourage the population to adopt an active lifestyle by integrating regular physical activities into daily routines. Given the significant impact of inactivity on cardiovascular risk, the study highlights the necessity of structural and educational interventions to promote physical exercise as an effective tool in preventing cardiovascular diseases. Through these measures, the aim is

to mitigate the risks associated with sedentary behavior, improve public health, and foster healthier behaviors, particularly among high-risk populations.

METHODOLOGY

This study was conducted after obtaining informed consent from participants and receiving approval for the study protocol from the Ethics Committee of "Dunărea de Jos" University in Galați.

We analyzed the exercise ECG tests of 45 subjects. The tests were performed at the "Aristide Serfioti" Military Emergency Hospital in Galați between January 1, 2022, and December 1, 2024, using an ergometer bicycle, following the Bruce protocol (Vilela EM, 2023). Exclusion criteria included age under 18 or over 49 years and a history of performance training, as the study focused on the general population.

The collected data, highlighted in Table 1. Collected Data, included participants' sex, age, body mass index (BMI), metabolic equivalents (METs), age-predicted values, maximum systolic blood pressure, heart rate and reason for termination.

Table 1. Collected Data

Name	Age	BMI	METs	MaxR	MaxBP	Reason for termination
X	**44**	**35,7**	**6,6 (56%)**	**153**	**213/110**	**Muscle fatigue**

RESULTS

Distribution by Body Mass Index (BMI):

Only approximately a quarter of participants (11, 24.4%) had a normal BMI, half were overweight (48.8%), and a quarter were obese (26.6%)

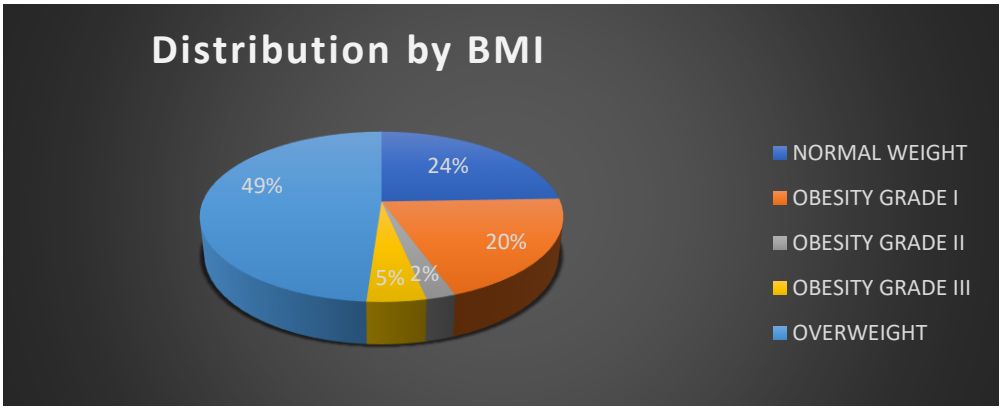

Figure 1: Distribution by BMI

Exercise capacity:

Patients were classified based on the ratio of the number of METs achieved to the predicted value for their sex and age. A predicted value below 60% denotes low tolerance, while a value above 80% indicates high capacity. Middle values, between 60% and 80%, were classified as moderate tolerance.

After evaluating the exercise tests, increased tolerance was observed in only 18% of the subjects. 55% had moderate tolerance, while the remaining 27% displayed low tolerance.

The term "moderate" attributed to the intermediate category can be misleading, as it does not necessarily indicate a normal exercise capacity. As a reference, a minimum of 3 training days per week is required to ensure high exercise tolerance (Kharabsheh SM, 2006).

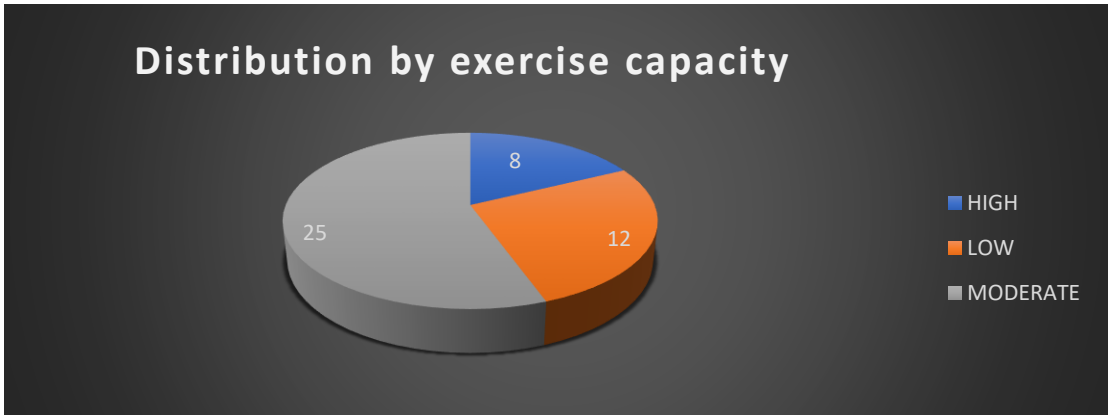

Figure 2: Distribution by exercise capacity

The relationship between BMI and METs:

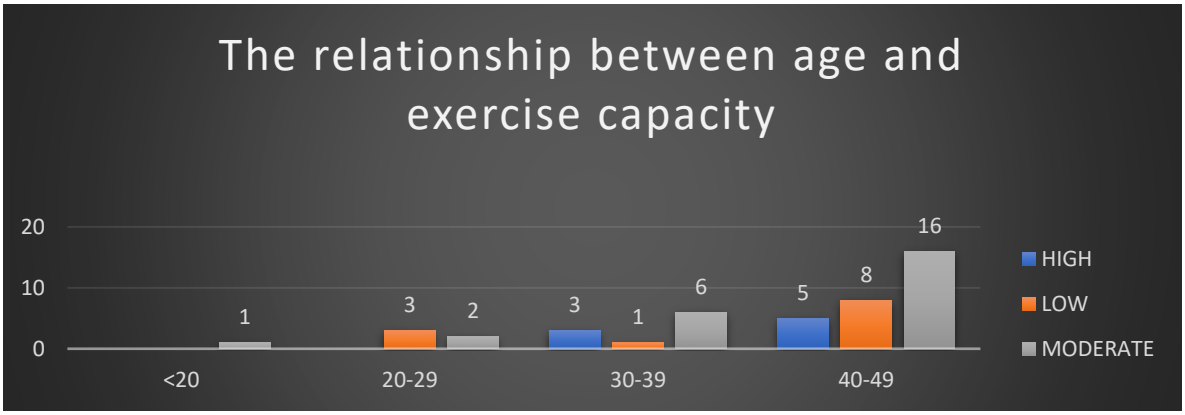

Figure 3: The relationship between BMI and METs

Age Group Distribution:

The majority of patients (65%) were in their 40s. 22% of the subjects were aged between 30-39 years, 11% between 20-29 years, and only 2% were between 18-20 years old.

In the 20-29 age group, no cases of high tolerance were recorded. 3 out of 5 (60%) had low tolerance, and 40% had moderate tolerance. Among participants aged 30-39 years, the majority (60%) had moderate capacity, 30% had high tolerance, and 10% had low tolerance. In the oldest age group (40-49 years), 55% had moderate capacity, 17% had high, and 28% had low tolerance.

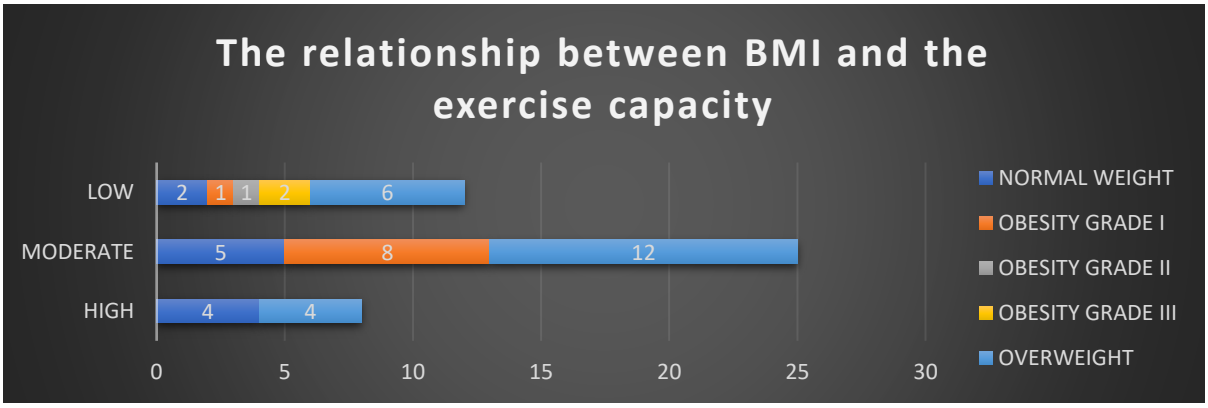

Figure 4: The relationship between BMI and the exercise capacity

No cases of low tolerance were found among subjects with a normal BMI. They were equally divided between the other two categories. Among overweight participants, 4 (8.8%) had high tolerance, 12 (26.6%) had moderate tolerance, and 6 (13%) had low tolerance. Among the obese participants, the majority (75%) had moderate tolerance, while 25% had low tolerance.

The relationship between sex and exercise capacity:

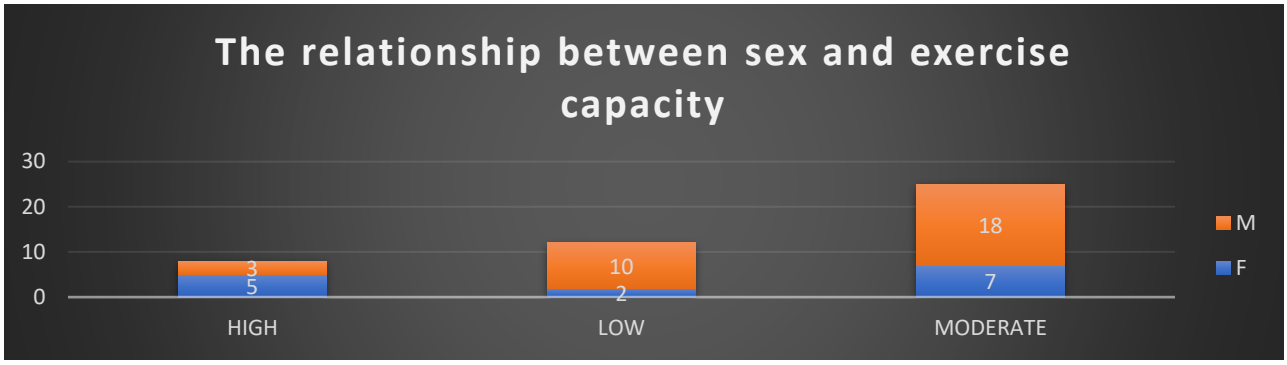

Figure 5: The relationship between sex and exercise capacity

Female subjects accounted for 31%. Of these, 50% had moderate capacity, 35% had high capacity, and the remaining 15% had low capacity. Male subjects, making up 69%, mostly (58%) had moderate capacity. Only 9.6% of them had high capacity, while 32% had low capacity.

Reason for termination:

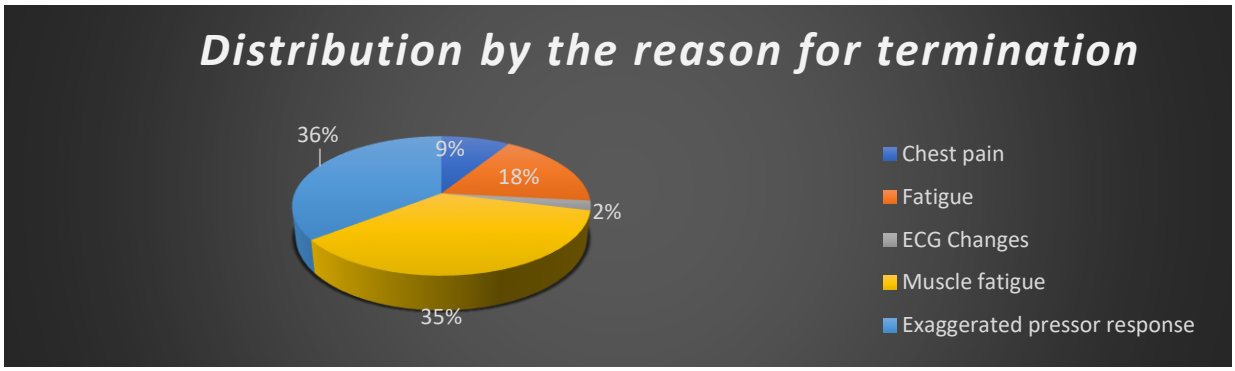

Figure 6: Distribution by the reason for termination

The most frequent reason for exercise test termination was an exaggerated pressor response, in 36% of cases, followed closely by muscle fatigue (35%), fatigue (18%), the onset of chest pain, with or without anginal characteristics (9%), and ECG changes suggestive of myocardial ischemia (1%).

DISCUSSION

The results of our study highlight a concerning trend regarding the low level of physical activity, especially among young people, where reduced exercise tolerance was more pronounced. This finding aligns with trends reported in other international studies, which indicate a progressive decline in physical activity levels among younger

generations, associated with an increase in sedentary behaviors, such as excessive use of electronic devices and reduced time spent on structured physical activities (Barnett TA, et al., 2018).

The correlation observed between overweight and reduced exercise tolerance has been observed in other studies in the literature (Powell-Wiley TM, et al., 2021). Studies have shown that a high body mass index negatively influences physical performance, both by increasing metabolic load during exercise and by frequently being associated with comorbidities such as hypertension or dyslipidemia (R., 2022). In contrast, high exercise capacity can act as a protective factor, preventing excess weight accumulation and improving long-term cardiovascular health (Lavie CJ, 2019). In this study, none of the participants with high tolerance were classified as obese, highlighting the significant benefits of regular physical exercise.

A notable aspect is the sex difference, with women having higher exercise tolerance compared to men. Although this result may be influenced by a relatively small number of participants and their distribution by age or activity level, it is an aspect that requires further investigation to better understand the physiological and behavioral differences between gender in relation to physical activity.

Among the limitations of the study is the geographical area, restricted to the southeast of Romania, as socio-demographic characteristics and lifestyle habits can vary significantly between regions of the country. Future studies could extend the analysis to a national level for a more representative picture. Another limitation is the lack of concurrent pulmonary monitoring, such as in cardiopulmonary exercise testing, which can estimate maximal oxygen consumption, providing a more accurate assessment of exercise capacity (Razvi Y, 2023) (Green GK, 2023).

The ESC guidelines for physical exercise are clear: at least 150 minutes of moderate activity or 75 minutes of intense activity per week are essential for reducing cardiovascular risk (Frank L J Visseren, 2021) (Sanjay Sharma, 2021). However, 82% of the study participants did not meet these standards. This highlights the need for public health measures to promote physical activity, including educational campaigns and

accessible community programs, to combat sedentary lifestyles and reduce the associated cardiovascular risk.

In only 10% of cases, the test was stopped due to symptoms suggestive of myocardial ischemia. In the remaining 90% of cases, the reasons for termination were attributed either to the inability of the peripheral vascular system to adapt to the exercise demands, reflected by excessive increase in peripheral resistance, or the presence of muscular or myocardial deconditioning, manifested through muscle fatigue or fatigue. Both the vascular bed and the myocardium and skeletal muscles can gradually adapt to exercise, but this requires regular physical exertion (Pedralli ML, 2020). Maintaining a sedentary lifestyle will eventually lead to these individuals transitioning into the other 10%, where atherosclerosis has already become manifest (Alexander Y, 2021).

Our study contributes to a better understanding of the impact of sedentary lifestyles on cardiovascular health, emphasizing the need for tailored interventions for targeted groups, such as young people and those who are overweight, to improve overall health and quality of life.

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