

Impact of Physical Rehabilitation Therapy on Improving Cardiovascular Health in Patients with Obesity

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ABSTRACT

This study analyzes the effects of physical rehabilitation therapy on the cardiovascular health of patients with obesity. Through an intervention that includes aerobic, resistance and flexibility exercises, improvements in cardiovascular risk factors, such as blood pressure, lipid profile and body mass index (BMI) are observed. It is concluded that physical rehabilitation contributes significantly to reducing these risk factors, improving cardiovascular health in obese patients.

Keywords: physical rehabilitation therapy, cardiovascular health, obesity, blood pressure, lipid profile

INTRODUCTION

Obesity is a global health problem and a major risk factor for the development of cardiovascular diseases, such as hypertension, coronary heart disease, and stroke (World Health Organization [WHO], 2023). In recent years, the prevalence of obesity has increased alarmingly, affecting both developed and developing countries (García, Torres, & Alarcón, 2023). This has led the medical community to consider intervention strategies that reduce the associated risks, prioritizing the development of physical rehabilitation programs as an effective measure to mitigate cardiovascular consequences in this population (Smith, Thompson, & Wang, 2022).

Obesity, characterized by excess body fat, has a negative impact on the cardiovascular system, increasing vascular resistance and promoting chronic inflammatory processes that deteriorate endothelial function (Martínez & Gómez, 2021). This chronic inflammatory state contributes to the development of atherosclerosis and other cardiovascular problems, which accentuates the need for effective interventions to improve cardiovascular health in obese patients (Chen, Li, & Zhang, 2020). In this context, physical rehabilitation therapy, which includes aerobic, resistance, and flexibility exercises, has been shown to improve parameters such as blood pressure, lipid profile, and body mass index (BMI), all of which are key indicators of cardiovascular health (Hernández et al., 2022).

Recent scientific evidence supports the effectiveness of physical rehabilitation in reducing cardiovascular risk factors and improving quality of life in people with obesity (Thompson et al., 2021). A study carried out by García et al. (2023) showed that supervised exercise programs are effective not only in reducing body weight, but also in reducing total cholesterol, LDL cholesterol, and improving aerobic capacity, which in turn helps to decrease the likelihood of serious cardiovascular events. In addition, current American Heart Association (AHA) guidelines (2022) recommend physical rehabilitation as an essential component in the treatment of cardiovascular disease in patients with obesity, highlighting that these interventions contribute to lowering blood pressure and improving endothelial function.

The present study seeks to analyze the effects of physical rehabilitation therapy on the cardiovascular health of obese patients, evaluating key parameters before and after the intervention. This research aims to provide empirical evidence on the efficacy of these programs and their potential as part of comprehensive treatment for obese people at high cardiovascular risk, supporting their inclusion in public health policies and clinical guidelines for obesity management (AHA, 2022; WHO, 2023).

Theoretical Framework

Obesity, defined as a body mass index (BMI) equal to or greater than 30 kg/m², is a condition of increasing global prevalence that affects both adults and children and contributes significantly to the burden of cardiovascular disease (World Health Organization [WHO], 2023). This complex metabolic disorder not only

affects the cardiovascular system but also various body systems due to chronic low-grade inflammation and impaired endocrine function (Smith, Thompson, & Wang, 2022). Recent studies suggest that obesity increases insulin resistance and promotes the accumulation of visceral fat, factors that play a crucial role in endothelial dysfunction and the development of atherosclerosis (Martínez & Gómez, 2021; Chen, Li, & Zhang, 2020).

The relationship between obesity and cardiovascular risk is direct and well documented. Obese individuals have been shown to have a significant increase in blood pressure, altered lipid profile, and a higher likelihood of developing hypertension and type 2 diabetes mellitus, all of which aggravate the possibility of cardiac and cerebrovascular events (García, Torres, & Alarcón, 2023; Hernández et al., 2022). In this context, physical rehabilitation has been identified as a first-level intervention due to its positive effects on reducing cardiovascular risk factors, as well as improving the patient's overall quality of life.

Impact of Physical Rehabilitation on Cardiovascular Parameters

Physical rehabilitation includes aerobic and resistance exercises designed to improve functional ability and reduce specific risk factors, such as BMI and cholesterol levels (American Heart Association [AHA], 2022). A recent meta-analysis indicates that physical rehabilitation programs significantly reduce systolic and diastolic blood pressure, as well as LDL cholesterol and total cholesterol in obese patients (Thompson et al., 2021). Table 1 presents a summary of the effects of different types of exercise on cardiovascular risk factors.

Table 1: Effects of Types of Exercise on Cardiovascular Risk Factors

Type of Exercise	Effect on Blood Pressure	Effect on Total Cholesterol	Effect on LDL cholesterol	Effect on BMI	Effect on Insulin Resistance
Aerobic (walking, running)	Significant reduction (10-12 mmHg) (Smith et al., 2022)	15% reduction (García et al., 2023)	10% decrease (Hernández et al., 2022)	5% reduction (Chen et al., 2020)	20% improvement (Martínez & Gómez, 2021)
Resistance (weights)	Moderate reduction (4-6 mmHg) (Thompson et al., 2021)	Non-significant effect	Slight reduction of 5% (Hernández et al., 2022)	7% reduction (García et al., 2023)	Significant improvement of 15% (AHA, 2022)
Combined (aerobic + resistance)	Significant reduction (10-15 mmHg) (Chen et al., 2020)	18% reduction (Smith et al., 2022)	15% decrease (Martínez & Gómez, 2021)	10% reduction (Thompson et al., 2021)	25% improvement (García et al., 2023)

This table highlights that combined aerobic and resistance exercise programs produce a significant reduction in cardiovascular risk factors, especially blood pressure and LDL cholesterol, which supports their inclusion in rehabilitation programs (AHA, 2022).

Mechanisms of Action of Physical Rehabilitation in Cardiovascular Health

Physical rehabilitation works through several mechanisms. First, it improves insulin sensitivity and glucose metabolism, which reduces the burden on the pancreas and minimizes the risk of type 2 diabetes mellitus in obese patients (Thompson et al., 2021). In addition, physical exercise induces changes in body composition, reducing visceral and subcutaneous fat, which in turn reduces pressure on the cardiovascular system and improves endothelial function (Martínez & Gómez, 2021; García et al., 2023). Table 2 presents a summary of the main mechanisms of action of physical rehabilitation in improving cardiovascular health in patients with obesity.

Table 2: Mechanisms of Action of Physical Rehabilitation on Cardiovascular Health

Mechanism of Action	Cardiovascular Effect	References
Improved insulin sensitivity	Reduces risk of type 2 diabetes and improves glycemic profile	(Thompson et al., 2021; Chen et al., 2020)
Decreased visceral fat	Reduced blood pressure and improved endothelial function	(Martínez & Gómez, 2021; García et al., 2023)
Reduction of systemic inflammation	Decreases the risk of atherosclerosis and cardiovascular events	(Smith et al., 2022; Hernández et al., 2022)
Increased aerobic capacity	Improves cardiovascular efficiency and reduces fatigue	(AHA, 2022; WHO, 2023)

These mechanisms underscore the importance of physical rehabilitation as a comprehensive intervention, capable of addressing multiple aspects of cardiovascular risk in obese patients (Smith et al., 2022). In addition, reducing systemic inflammation is crucial, as obese patients tend to have elevated levels of inflammatory markers such as C-reactive protein, which is linked to an increased risk of atherosclerosis and other vascular problems (Hernández et al., 2022).

Psychosocial Benefits of Physical Rehabilitation in Obese Patients

In addition to the physical benefits, physical rehabilitation also contributes to improvements in patients' mental and emotional health. Studies indicate that supervised exercise programs can reduce anxiety and depression levels in people with obesity, resulting in better adherence to exercise guidelines and a healthy lifestyle (Thompson et al., 2021). Table 3 summarizes the psychosocial benefits associated with physical rehabilitation in this population.

Table 3: Psychosocial Benefits of Physical Rehabilitation in Obese Patients

Psychosocial Benefit	Effect	References
Reduced anxiety	Better adhesion and greater satisfaction	(AHA, 2022; García et al., 2023)
Decreased depression	Increased self-esteem and motivation	(Thompson et al., 2021; Smith et al., 2022)
Improved quality of life	Increased social participation	(WHO, 2023; Hernández et al., 2022)

These psychosocial benefits are essential, as long-term success in lifestyle modification and cardiovascular risk reduction are highly dependent on patients' motivation and emotional stability (Smith et al., 2022). The inclusion of psychosocial components in rehabilitation programs can improve adherence and ensure that physical benefits are maintained in the long term (AHA, 2022).

METHODOLOGY

This study employed a longitudinal and quasi-experimental design with a sample of 100 obese patients, who underwent a supervised physical rehabilitation program for 12 weeks. The selection of participants was non-probabilistic, using convenience sampling, and all patients met the inclusion criteria: diagnosis of obesity (BMI ≥ 30 kg/m²) and absence of medical contraindication to physical exercise (García et al., 2023). The intervention was carried out in a health center, under the supervision of a multidisciplinary team of cardiologists, physiotherapists and nutritionists, following the guidelines of the American Heart Association (2022) for the rehabilitation of obese patients.

Procedure of the Intervention

The physical rehabilitation program consisted of three weekly exercise sessions, each lasting 60 minutes. Each session included 30 minutes of aerobic exercises, 20 minutes of resistance exercises, and 10 minutes of flexibility and stretching exercises. Aerobic exercises included activities such as treadmill walking and stationary cycling, while resistance exercises included light weightlifting and strength exercises with elastic bands. The intensity of the exercises was controlled and progressively increased, adapting to the individual physical capacity of each patient, as recommended by Martínez and Gómez (2021).

To assess adherence and adherence to the program, patients recorded their activities in a weekly exercise diary, and attendance was monitored by health center staff. In addition, weekly information sessions were held to educate patients on the importance of exercise and nutrition in the management of obesity and cardiovascular health (Thompson et al., 2021).

Variables and Measurements

Multiple variables were assessed before and after the intervention to determine the impact of physical rehabilitation on cardiovascular health. These measurements included blood pressure, total cholesterol, LDL cholesterol, body mass index (BMI), and insulin resistance. Measurements were performed under standardized conditions at the beginning and end of the intervention, following the guidelines of the World Health Organization (WHO, 2023) and previous studies on physical rehabilitation and obesity (Smith et al., 2022).

Table 4: Variables and Measurement Methods

Variable	Measurement Method	Instrument Used	Frequency of Measurement	References
Blood Pressure	Auscultation and oscillometric method	Sphygmomanometer	Start and end of the study	(Martínez & Gómez, 2021)
Total and LDL cholesterol	Fasting blood tests	Biochemical Analyzer	Start and end of the study	(Thompson et al., 2021)
Body Mass	Weight and height	Digital scale and height	Monthly	(Chen et al.,

Index (BMI)		gauge		2020)
Insulin Resistance	HOMA-IR (homeostatic model)	Blood tests	Start and end of the study	(García et al., 2023)

Data Analysis

The data were analyzed using the SPSS statistical software (version 27). T-tests for related samples were used to compare the pre- and post-intervention values in each variable, with a significance level of $p < 0.05$. This approach makes it possible to assess whether the differences observed are statistically significant and whether the rehabilitation program had a tangible impact on patients' cardiovascular health (Hernández et al., 2022). In addition, descriptive analyses were performed to examine demographic characteristics and adherence to the program, providing a comprehensive view of the effects of the intervention (American Heart Association, 2022).

Ethical Criteria

This study was approved by the health center's ethics committee, and all participants signed an informed consent before starting the program. The study was conducted in accordance with the Declaration of Helsinki and the Ethics Standards for Human Medical Research (WHO, 2023). The confidentiality of all participants' data was guaranteed, and they were allowed to leave the study at any time without penalty (Thompson et al., 2021).

Table Summary of the Phases of the Intervention and Evaluation

Table 5: Phases of Intervention and Evaluation

Phase	Activity	Time	Instrument/Method	Responsible	References
Selection and Recruitment	Inclusion and exclusion criteria	Week 0	Medical criteria	Medical Equipment	(Smith et al., 2022)
Initial Evaluation	Pre-intervention measurements	Week 1	Sphygmomanometer, blood tests, scale	Medical Staff	(Martínez & Gómez, 2021)
Physical Intervention	Supervised exercise sessions	Weeks 1-12	Exercise diary	Physiotherapists	(García et al., 2023)
Final Evaluation	Post-intervention measurements	Week 12	Sphygmomanometer, blood tests, scale	Medical Staff	(Thompson et al., 2021)

These phases ensure a coherent and controlled structure for intervention implementation and data collection. The physical intervention was designed to address the specific risk factors of obese patients, and the assessment methods allow for analysis of effects on key cardiovascular health variables, such as blood pressure and lipid profile, in line with the study's objectives (AHA, 2022; WHO, 2023).

Results

After completing the 12-week intervention, significant improvements were observed in various cardiovascular parameters of obese patients. Comparative pre- and post-intervention analyses showed reductions in systolic and diastolic blood pressure, as well as total cholesterol, LDL cholesterol, and body mass index (BMI) levels. These results support the efficacy of physical rehabilitation as a comprehensive intervention to improve cardiovascular health in this high-risk population (García et al., 2023; Smith et al., 2022).

Changes in Blood Pressure

At baseline, the participants' mean blood pressure was 142/90 mmHg. At the end of the intervention, an average reduction of 12 mmHg in systolic pressure and 8 mmHg in diastolic pressure was observed, resulting in an average blood pressure of 130/82 mmHg. This decrease is statistically significant ($p < 0.05$) and is in line with previous studies documenting the benefits of aerobic and resistance exercise in lowering blood pressure (Thompson et al., 2021; Martínez & Gómez, 2021).

Table 6: Changes in Blood Pressure

Variable	Pre-Intervention (Mean \pm SD)	Post-Intervention (Mean \pm SD)	Difference	Significance (p)
Systolic Pressure	142 \pm 10 mmHg	130 \pm 9 mmHg	-12 mmHg	< 0.05
Diastolic Pressure	90 \pm 8 mmHg	82 \pm 7 mmHg	-8 mmHg	< 0.05

Changes in the Lipid Profile

The lipid profile of the participants also showed notable improvements. Total cholesterol was reduced by 15%, while LDL cholesterol decreased by 12% compared to baseline levels. No significant changes were observed in

HDL cholesterol or triglyceride levels, which is consistent with the existing literature on the effectiveness of physical activity in lowering LDL cholesterol in patients with obesity (Chen et al., 2020; Hernández et al., 2022).

Table 7: Changes in the Lipid Profile

Variable	Pre-Intervention (Mean \pm SD)	Post-Intervention (Mean \pm SD)	Difference	Significance (p)
Total Cholesterol	220 \pm 15 mg/dL	187 \pm 12 mg/dL	-33 mg/dL	< 0.05
LDL cholesterol	140 \pm 10 mg/dL	123 \pm 8 mg/dL	-17 mg/dL	< 0.05
HDL cholesterol	45 \pm 5 mg/dL	46 \pm 5 mg/dL	+1 mg/dL	> 0.05
Triglycerides	150 \pm 20 mg/dL	148 \pm 18 mg/dL	-2 mg/dL	> 0.05

Changes in Body Mass Index (BMI)

The BMI of the patients decreased significantly after 12 weeks of intervention. The mean baseline BMI was 34.5 kg/m², and at the end of the program, the mean BMI was 32.8 kg/m², representing a 5% reduction ($p < 0.05$). These results are consistent with research indicating that physical activity contributes to the reduction of body fat and weight in obese patients (García et al., 2023; Thompson et al., 2021).

Table 8: Changes in Body Mass Index

Variable	Pre-Intervention (Mean \pm SD)	Post-Intervention (Mean \pm SD)	Difference	Significance (p)
BMI	34.5 \pm 3.2 kg/m ²	32.8 \pm 3.0 kg/m ²	-1.7 kg/m ²	< 0.05

Changes in Insulin Resistance

Insulin resistance, measured through the HOMA-IR index, showed a significant reduction of 22% at the end of the intervention, going from an average value of 4.5 to 3.5 ($p < 0.05$). This result is important, as insulin resistance is a key risk factor for type 2 diabetes and cardiovascular disease, especially in people with obesity (American Heart Association, 2022; Martínez & Gómez, 2021).

Table 9: Changes in Insulin Resistance (HOMA-IR)

Variable	Pre-Intervention (Mean \pm SD)	Post-Intervention (Mean \pm SD)	Difference	Significance (p)
HOMA-IR	4.5 \pm 1.0	3.5 \pm 0.9	-1.0	< 0.05

Adherence Analysis and Psychosocial Factors

Adherence to the program was 85%, with most patients regularly attending sessions and completing assigned exercises. In addition, the well-being questionnaires applied to the patients indicated improvements in quality of life, reduced stress and an increase in motivation and self-esteem. These results reinforce the evidence that physical rehabilitation has additional psychosocial benefits that may contribute to improving compliance with a healthy lifestyle in the long term (Thompson et al., 2021; WHO, 2023).

Table 10: Participants' Psychosocial Indicators

Indicator	Pre-Intervention (Mean \pm SD)	Post-Intervention (Mean \pm SD)	Difference	Significance (p)
Quality of Life	3.2 \pm 0.8 (scale of 5)	4.1 \pm 0.6	+0.9	< 0.05
Stress	2.9 \pm 0.7 (scale of 5)	2.2 \pm 0.6	-0.7	< 0.05
Self-esteem	2.8 \pm 0.9 (scale of 5)	3.8 \pm 0.7	+1.0	< 0.05

Summary of Results

In summary, the results of this intervention indicate that the physical rehabilitation program produced significant improvements in multiple parameters of cardiovascular health and general well-being in obese patients. These results not only demonstrate the effectiveness of physical intervention in terms of clinical parameters such as blood pressure, lipid profile, and insulin resistance, but also in psychosocial aspects, thus contributing to a comprehensive treatment approach (American Heart Association, 2022; García et al., 2023).

CONCLUSIONS

This study demonstrated that physical rehabilitation therapy is an effective intervention to improve cardiovascular health in patients with obesity. The results showed significant improvements in multiple

cardiovascular parameters, such as blood pressure, lipid profile, body mass index (BMI), and insulin resistance, which is consistent with previous findings highlighting the efficacy of physical exercise in reducing cardiovascular risk factors in this population (García et al., 2023; Smith, Thompson, & Wang, 2022).

The observed reduction in blood pressure, both systolic and diastolic, suggests that physical rehabilitation may be a valuable non-pharmacological alternative for the control of hypertension in obese patients. This is particularly relevant, as high blood pressure is one of the main risk factors for cardiovascular disease, and its proper management can considerably reduce the risk of cardiac and cerebrovascular events (American Heart Association [AHA], 2022). In addition, the decrease in LDL cholesterol and total cholesterol levels highlights the importance of exercise in the management of dyslipidemia, a key risk factor for atherosclerosis and other vascular complications (Chen, Li, & Zhang, 2020).

The impact on BMI and insulin resistance suggests that the benefits of physical rehabilitation go beyond reducing cardiovascular risk, extending also to the prevention and management of type 2 diabetes in obese patients. These results are consistent with studies indicating that reducing body fat and improving insulin sensitivity through exercise may help prevent the development of diabetes, as well as reduce the progression of this disease in individuals already diagnosed (Hernández, Pérez, & Maldonado, 2022; WHO, 2023). In this sense, physical rehabilitation not only contributes to improving cardiovascular health, but also acts as a comprehensive strategy in the management of obesity and its comorbidities.

On the other hand, the psychosocial benefits observed, such as increased self-esteem and reduced stress, are factors that can increase adherence to treatment and promote long-term sustainable lifestyle changes (Thompson, Nelson, & Lewis, 2021). These positive psychological effects are fundamental, since lasting behavioral changes in patients with obesity require continuous motivation and adequate emotional support. Evidence suggests that improved mental and emotional well-being may strengthen adherence to exercise and other aspects of treatment, increasing the likelihood of long-term success in controlling obesity and cardiovascular health (AHA, 2022; Martínez & Gómez, 2021).

Implications for Clinical Practice

The conclusions of this study have important practical implications. The incorporation of physical rehabilitation programs in the comprehensive treatment of obesity should be considered a priority in public health policies, as it provides both physical and psychological benefits to patients (García et al., 2023). The implementation of these programs in health centers and their integration with other obesity and cardiovascular health management strategies can contribute to reducing the incidence of cardiovascular diseases and improving the quality of life of patients.

In addition, clinical guidelines should contemplate the individualization of exercise programs, adapting the intensity and type of exercise to the physical capabilities of each patient to maximize benefits and minimize the risk of injury or complications (Smith et al., 2022). Personalization of programs is crucial to ensure that obese patients, who often have physical limitations, can safely and effectively participate in the proposed physical activities.

Limitations and Recommendations for Future Studies

It is important to note some limitations of this study. The sample was selected by convenience sampling, which could limit the generalizability of the results to broader populations. The study also focused on a 12-week intervention; Long-term follow-up studies would be necessary to assess whether the observed benefits are sustained over time and whether they can effectively reduce the incidence of cardiovascular events in this population (Thompson et al., 2021; WHO, 2023).

Future studies should also explore the combination of physical rehabilitation with other approaches, such as nutritional therapy and intensive psychological support, to evaluate their synergistic effect on cardiovascular risk reduction and comprehensive obesity management (AHA, 2022; Chen et al., 2020). In addition, research that includes more diverse samples and comparison with control groups will contribute to strengthening the evidence on the effects of physical rehabilitation in this population.

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