1.1. Problem Statement and Research Motivation

Biological differences, such as hormonal influences, lead to notable disparities in how men and women respond to physical stress, including exercise. A key area of difference lies in their maximum heart rate during exercise, a critical indicator of cardiovascular health. Understanding these gender-specific differences is particularly crucial for individuals experiencing exercise-induced angina, as it provides insights into tailored diagnostic and therapeutic strategies.

This study aims to analyze these differences, contributing to a more nuanced understanding of gender-specific cardiovascular health. Previous research highlights the importance of considering gender in cardiac performance studies (Smith et al., 2023). Moreover, Taylor et al. (2022) emphasize that personalized approaches based on biological sex can significantly enhance the efficacy of cardiovascular treatments. These findings strongly motivate the current investigation.

1.2. The Dataset

The dataset used in this research examines the relationship between gender and the maximum heart rate achieved during exercise:

Gender (sex): Encoded as 1 for males and 0 for females.

Maximum heart rate (thalach): The highest heart rate reached during physical exertion.

Descriptive analyses, such as boxplots and histograms, indicate that women generally have slightly higher maximum heart rates, while men show greater variability. Statistical tests validate the significance of these differences, making the dataset a valuable tool for exploring gender-specific cardiovascular responses.

1.3. Research Question

This study addresses the following question:

Do men and women have significantly different maximum heart rates during exercise-induced angina?

To answer this, statistical analyses will identify meaningful differences between their average maximum heart rates, supported by visualizations.

1.4. Hypotheses

Null Hypothesis (H₀): There is no difference in the average maximum heart rate between men and women.

Alternative Hypothesis (H₁): There is a significant difference in the average maximum heart rate between men and women.

Analysis Results:

Women have a higher average maximum heart rate (146.5 bpm) compared to men (134.6 bpm).

Levene’s test confirmed that the variances between the two groups are sufficiently similar for direct comparison.

T-test results established that the difference is statistically significant.

These results underscore critical gender-based differences in cardiovascular responses, emphasizing the importance of gender-specific approaches in diagnosing and treating the heart healthy.