

# Low Testosterone in Males and Its Impact on Cardiometabolic and Cardiovascular Disease Risk (A Review Article)

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## Abstract

Testosterone, the primary male sex hormone, plays a crucial role in metabolic and cardiovascular health. Emerging evidence suggests that low testosterone levels in men are associated with increased risk of cardiometabolic diseases, including obesity, type 2 diabetes mellitus (T2DM), metabolic syndrome, and cardiovascular diseases (CVD) (Grossmann, 2011; Saad et al., 2011). This review explores the pathophysiological mechanisms linking low testosterone to these health risks and discusses potential clinical implications and therapeutic interventions.

**Keywords:** pulmonary embolism; Factor V Leiden; pulmonary hypertension; embolus; mutation

## Introduction

Testosterone is essential for maintaining muscle mass, bone density, lipid metabolism, and glucose homeostasis. In aging men, testosterone levels decline naturally, a phenomenon known as late-onset hypogonadism (LOH) (Zitzmann & Nieschlag, 2007). However, some men experience testosterone deficiency due to medical conditions, lifestyle factors, or endocrine disorders.

Low testosterone has been implicated in various metabolic and cardiovascular dysfunctions, leading to an increased risk of CVD and related conditions (Yeap et al., 2012). Understanding the interplay between testosterone and cardiometabolic health can aid in developing targeted interventions for at-risk individuals.

## Pathophysiological Links Between Low Testosterone and Cardiometabolic Risk

### 1. Insulin Resistance and Type 2 Diabetes Mellitus

- Testosterone influences glucose metabolism by enhancing insulin sensitivity in muscle and adipose tissue.
- Low testosterone is associated with increased insulin resistance, contributing to the development of T2DM (Grossmann, 2011).
- Studies suggest that testosterone replacement therapy (TRT) may improve glycemic control in hypogonadal men with T2DM (Traish et al., 2014).

### 2. Obesity and Metabolic Syndrome

- Testosterone plays a role in regulating fat distribution and muscle mass.
- Low testosterone levels promote visceral adiposity, which is a key component of metabolic syndrome (Saad et al., 2011).
- Adipose tissue, particularly visceral fat, leads to increased inflammation and insulin resistance, further exacerbating metabolic dysfunction (Zitzmann & Nieschlag, 2007).

### 3. Dyslipidemia and Atherosclerosis

- Low testosterone is associated with unfavorable lipid profiles, including increased LDL cholesterol and triglycerides and decreased HDL cholesterol (Vigen et al., 2013).
- This lipid imbalance contributes to endothelial dysfunction and the development of atherosclerotic plaques, increasing CVD risk (Morgentaler & Traish, 2009).
- Testosterone may have direct vasodilatory effects that help maintain vascular health (Morgentaler & Traish, 2009).

### Low Testosterone and Cardiovascular Disease Risk

- Low testosterone is linked to hypertension, arterial stiffness, and increased sympathetic nervous system activity (Yeap et al., 2012).

- Hypogonadal men have a higher prevalence of coronary artery disease (CAD) and heart failure (Vigen et al., 2013).
- Some studies suggest an inverse relationship between testosterone levels and mortality from CVD (Yeap et al., 2012).

### Clinical Implications and Therapeutic Considerations

- **Testosterone Replacement Therapy (TRT):** While TRT may improve metabolic parameters, its cardiovascular safety remains debated. Some studies indicate a reduced risk of major adverse cardiovascular events (MACE), while others raise concerns about potential risks (Vigen et al., 2013; Traish et al., 2014).
- **Lifestyle Interventions:** Weight loss, exercise, and dietary modifications can improve both testosterone levels and cardiometabolic health (Grossmann, 2011).
- **Monitoring and Risk Assessment:** Routine screening for testosterone deficiency in men with metabolic syndrome or CVD may be beneficial (Saad et al., 2011).

### Conclusion

Low testosterone in males is increasingly recognized as a significant risk factor for cardiometabolic and cardiovascular diseases. While TRT shows promise in improving metabolic parameters, its cardiovascular safety requires further investigation. A multidisciplinary approach, combining hormonal evaluation, lifestyle interventions, and cardiovascular risk management, is essential for optimizing health outcomes in affected individuals.

### Future Directions

Further research is needed to clarify the causal relationships between low testosterone and CVD, determine the long-term effects of TRT, and

identify personalized therapeutic strategies for testosterone-deficient men at cardiovascular risk.

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