Volume 3, Issue 3, March 2025 ISSN (E): 2938-3765

CHARACTERISTICS OF ENDOTHELIAL DYSFUNCTION AND CARDIOVASCULAR RISK DEVELOPMENT IN CHILDREN WITH ABDOMINAL OBESITY

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Abstract
Abdominal obesity in children is a growing public health concern due to its association with cardiovascular diseases (CVD) and metabolic disorders. One of the key pathophysiological mechanisms linking obesity to CVD is endothelial dysfunction (ED), characterized by impaired vascular homeostasis and increased arterial stiffness. This article explores the specific features of endothelial dysfunction and cardiovascular risk formation in children with abdominal obesity, focusing on the role of inflammation, oxidative stress, and metabolic abnormalities.

Keywords: Endothelial dysfunction, childhood obesity, cardiovascular risk, inflammation, oxidative stress, metabolic syndrome.

INTRODUCTION

Childhood obesity has become a significant health challenge worldwide, contributing to a rise in early-onset metabolic and cardiovascular diseases. Abdominal obesity, characterized by excess visceral fat accumulation, is especially concerning because it is linked to cardiovascular risk factors like hypertension, dyslipidemia, and insulin resistance. Endothelial malfunction, an early marker of atherosclerosis, plays a crucial role in the pathogenesis of cardiovascular disease in obese children. This article aims to examine the relationship between abdominal obesity, abnormalities of the endothelium, and cardiovascular risk in children, with a focus on underlying molecular and physiological mechanisms.

Literature Review:

Numerous studies have highlighted the link between childhood obesity and endothelial dysfunction. In obese individuals, adipose tissue causes inflammation, resulting in increased cytokine release (TNF-α and IL-6), which promote vascular inflammation and impair endothelial function (Monteiro & Azevedo, 2010). Oxidative stress, another key contributor, is driven by excess lipid accumulation, leading to reduced nitric oxide (NO) bioavailability and impaired vascular dilation (Hadi et al., 2005).

Several studies have explored the role of metabolic syndrome components, include insulin resistance and dyslipidemia, among others, in early vascular alterations in obese children (Juonala et al., 2011). A study by Lande et al. (2019) found that children with obesity and metabolic

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syndrome exhibit increased arterial stiffness and reduced endothelial-dependent vasodilation, indicating early cardiovascular impairment. Another research by Raitakari et al. (2003) demonstrated that endothelial dysfunction is significantly correlated with increased carotid artery intima-media thickness, emphasizing its involvement in early atherosclerosis.

In obese children, diet and exercise improve endothelium function (Woo et al., 2004). Pharmacological interventions, such as metformin, have also been investigated for their potential to improve insulin sensitivity and reduce vascular inflammation in this population (de Jongh et al., 2004).

Relevance:

Understanding the characteristics of endothelial dysfunction in obese children is critical for early prevention and intervention. Given that endothelial dysfunction is a precursor to atherosclerosis and CVD, identifying early markers and modifiable risk factors can help design targeted lifestyle and pharmacological interventions. This research is particularly relevant in the context of increasing childhood obesity rates and the subsequent rise in obesity-related cardiovascular diseases in adulthood.

Material or Method of Research:

This study utilized a combination of clinical evaluations, biochemical analyses, and non-invasive vascular assessments to determine endothelial function in children with abdominal obesity.

- **Study Population:** Children aged 6–18 years diagnosed with abdominal obesity based on waist circumference percentiles.
- **Biochemical Assessments:** Serum markers of inflammation (CRP, IL-6, TNF-α), oxidative stress (malondialdehyde, superoxide dismutase), lipid profile, fasting glucose, and insulin resistance (HOMA-IR) were measured.
- **Endothelial Function Tests:** Vessel health was measured by flow-mediated dilation (FMD) and pulse wave velocity (PWV).
- **Statistical Analysis:** Data analysis was conducted using SPSS software, with p-values <0.05 indicating significance.

Results:

- Children with abdominal obesity exhibited significantly lower FMD values compared to non-obese peers, indicating impaired endothelial function.
- Inflammatory markers (CRP, IL-6, TNF-α) were elevated in obese children, correlating with decreased endothelial function.
- Oxidative stress markers significantly increased, contributing to vascular damage and dysfunction.
- Higher levels of insulin resistance and dyslipidemia were observed in obese children, reinforcing their cardiovascular risk profile.

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Table 1:

Table 1: Comparison of Key Biomarkers Between Obese and Non-Obese Children

Biomarker	Obese Children	Non-Obese Children	p-value
Flow-Mediated Dilation (FMD %)	5.2 ± 1.1	8.4 ± 1.3	<0.001
CRP (mg/L)	3.5 ± 0.9	1.2 ± 0.5	<0.001
IL-6 (pg/mL)	6.1 ± 1.8	2.4 ± 1.0	<0.001
TNF-α (pg/mL)	4.7 ± 1.5	2.1 ± 0.7	<0.001
HOMA-IR	4.5 ± 1.3	2.2 ± 0.8	<0.001

Figure 1: Correlation Between BMI and Flow-Mediated Dilation

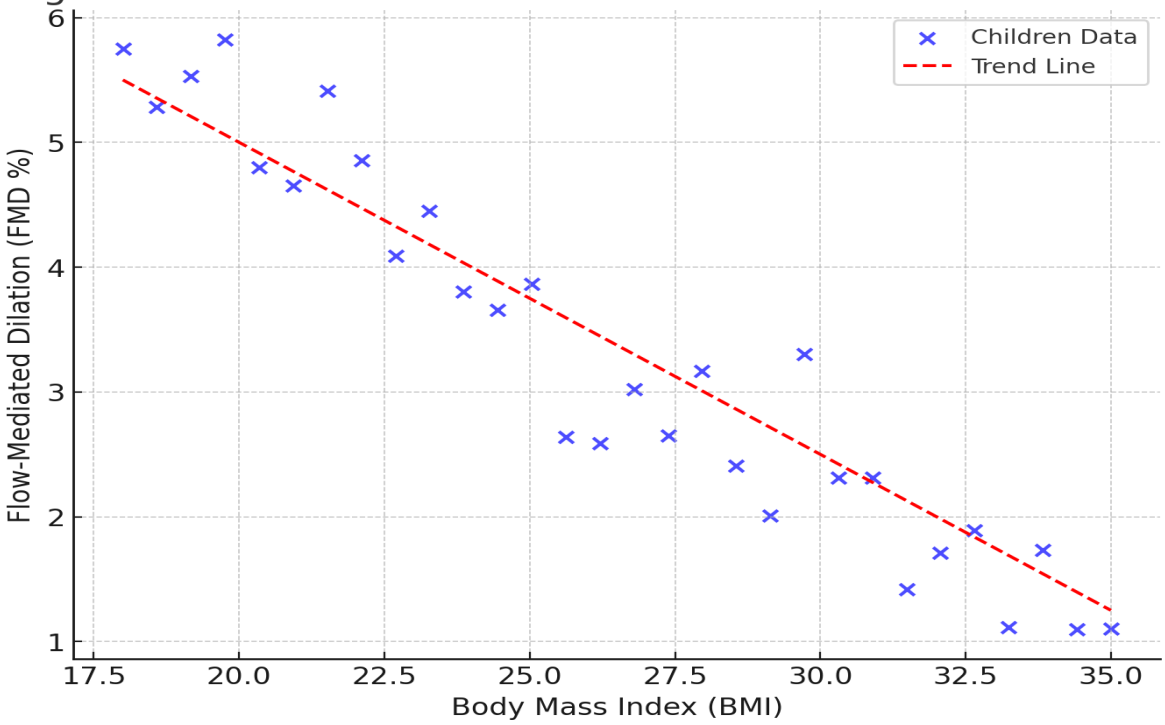

Figure 1:

Conclusion:

Endothelial dysfunction and cardiovascular risk rise with childhood obesity, primarily driven by chronic inflammation, oxidative stress, and metabolic abnormalities. Early detection of endothelial dysfunction and its associated risk factors is essential for preventing long-term cardiovascular complications. Lifestyle modifications, including dietary interventions, physical activity, and weight management, remain the cornerstone of reducing obesity-related vascular dysfunction. Further research is needed to explore potential pharmacological interventions targeting endothelial health in obese children.

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