

The Relationship Between Obesity and the Risk of Systemic Arterial Hypertension in Children and Adolescents: Lessons Learned

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One out of five children around the world is overweight or obese. This is shown in the meta-analysis published by Zhang X *et al.* in 2024, which included 2,033 studies from 154 different countries or regions.¹ Although the prevalence of childhood obesity varies between global regions, it is evident that its incidence is growing significantly. According to the latest United Nations International Children's Emergency Fund (UNICEF) and World Bank estimates, 33.6% of children and adolescents 5-19 years old are affected by overweight or obesity, as are 8% of children under the age of five.² Recently, Muyulema SL *et al.* published the results of global childhood overweight and obesity trends over the last 20 years. In this study, they analyzed 194 countries around the world, showing that the global prevalence of childhood overweight and obesity increased from 5.4% to 5.7% between 2000 and 2022.³

Inflammation, Metabolic Syndrome and Systemic Hypertension: "a dangerous and synergistic triad": Metabolic Syndrome (MS) has been well defined in adults, and includes various conditions like Systemic Arterial Hypertension (SAH), elevated fasting blood sugar levels (greater than 100 mg/dl) or type 2 diabetes mellitus, low HDL cholesterol levels (less than 40 mg/dl in men or 50 mg/dl in women), high triglyceride concentrations (greater than 150 mg/dl), and a waist circumference greater than 101 cm (men) or 90 cm (women).⁴ It is not clearly defined in children, due to the imprecision of the various factors that compose it and the changes in different stages of life. However, risk factors like obesity, increased waist circumference (increased visceral fat), insulin resistance, and, in certain cases, lipid profile abnormalities, are compatible with MS, especially in children over the age of 10.

Various studies have associated inflammation as a common pathophysiological phenomenon in the onset of SAH and obesity. A common molecule in both inflammation and obesity is tumor necrosis factor alpha (TNF- α), which is basically produced by macrophages and synthesized in large quantities in obese people's adipose tissue and muscle. Adipocyte enlargement modifies the production of adipocytokines,

triggering a chronic inflammatory process with ensuing migration of leukocytes and a wide variety of proteins like selectins, integrins, adhesion molecules, chemokines, cytokines, and metalloproteases, among others. Adipocyte hypertrophy also triggers increased production of other cytokines like IL-6, serum amyloid, plasminogen activator inhibitor-1 (PAI-1), leptin, and resistin. Elevation of these molecules triggers local endothelial effects, leading to increased production of adhesion molecules (VCAM and ICAM).⁵

Other inflammatory biomarkers are elevated in SAH, including interleukin-1 β and -6, C-reactive protein (CRP), and C3 and C4 complement fractions. In fact, C3 levels have predictive value, as they correlate with future systolic blood pressure and heart rate levels.^{6,7} (Figure 1)

In an effort to better understand the relationship between obesity and the incidence of SAH in children, Almeida *et al.*⁸ recently conducted an interesting study in Brazil attempting to establish this relationship and the influence of other risk factors on the development of SAH. The investigators posed the hypothesis that children with obesity would have a high frequency of SAH. This study employed a rigorous methodology, selecting individuals between 3 and 18 years of age who met the criteria for obesity and SAH, in whom other variables were also measured, including waist circumference (as an indirect measure of visceral fat, which accompanies MS). The study showed that the SAH prevalence was only 20% in children with obesity, including those with severe obesity. Although this figure seems small, it would be interesting to consider that if we took a more global sample, the percentage would not be negligible in real numbers. The investigators also established that a strong factor associated with SAH was a history of first-degree relatives with this condition. These results motivate us to screen more for SAH in obese individuals and those with a family history of SAH.

Finally, to reduce the incidence of obesity and the onset of SAH, we should choose measures to modify the existing risk factors, which can be addressed with health policies aimed at prevention and early detection.

Keywords

Obesity; Hypertension; Risk Factors; Child.

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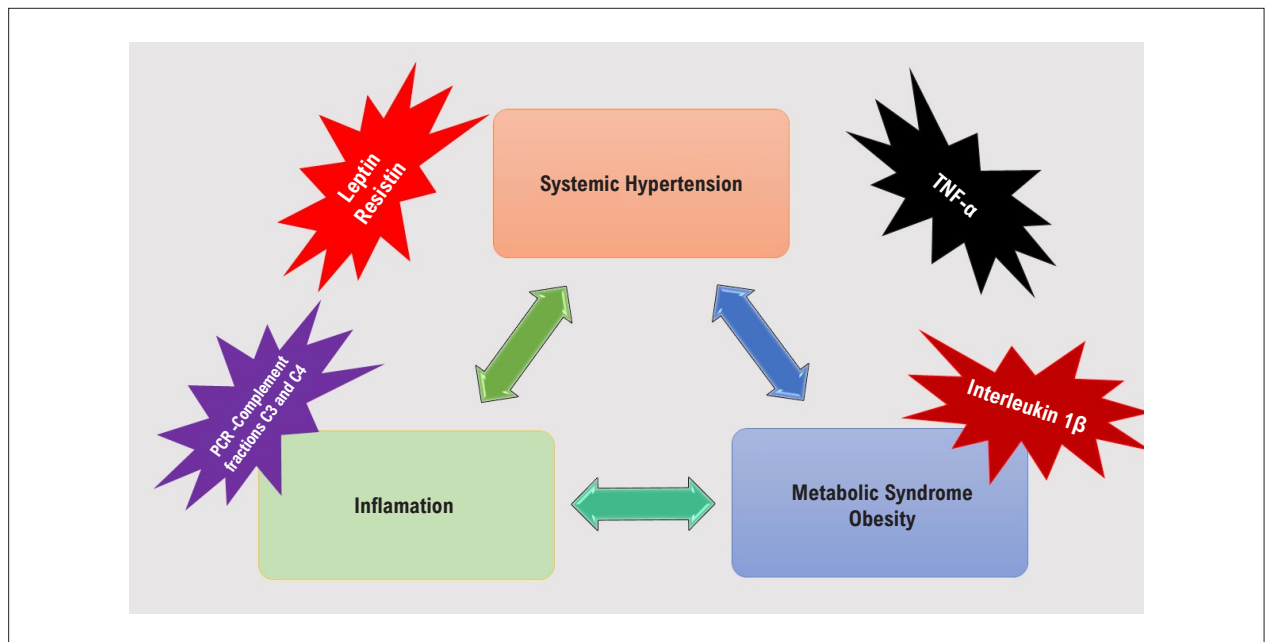


Figure 1 – Classic triad of inflammation, metabolic syndrome – obesity, and systemic arterial hypertension. The influence of inflammatory mediators is depicted.

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