

## **Leptin, Arterial Stiffness and Obesity: Correlation and Impact**

**Carmine Finelli<sup>1\*</sup> and Simone Dal Sasso<sup>2</sup>**

<sup>1</sup>*Department of Internal Medicine, ASL Napoli 3 Sud, Via di Marconi, Torre del Greco, Napoli, Italy*

<sup>2</sup>*Independent Researcher, Naples, Italy*

**\*Corresponding Author:** Carmine Finelli, Department of Internal Medicine, ASL Napoli 3 Sud, Via di Marconi, Torre del Greco, Napoli, Italy.

**Received:** February 25, 2024; **Published:** April 05, 2024

Clinical and epidemiological researches have examined the relationship between leptin and arterial stiffness, either in isolation or in conjunction with other adipokines in obese patients. The developed adipocytes of white subcutaneous adipose tissue are the primary producers of leptin. In the central nervous system, leptin plays a critical function in controlling energy expenditure and food intake. It lowers appetite and raises energy needs. However, hyperleptinemia, which is associated with higher levels of fat in obesity, suggests that there is a leptin resistant state [1].

Certain vascular receptors found in endothelial cells and vascular smooth muscular cells (VSMCs) mediate the vascular effects of leptin [2]. An experimental investigation showing that leptin-deficient ob/ob mice developed hyperphagia and obesity but did not develop atherosclerosis supports the direct impact of leptin on the arterial wall [3].

Nevertheless, leptin might have diametrically opposed effects on metabolism and blood vessels. According to experimental researches, leptin corrects deficient antioxidant defense in ob/ob mice, promotes endothelium-dependent NO-mediated vasorelaxation, and shields macrophages from excessive cholesterol [4,5]. It has been demonstrated that leptin possesses anti-insulin resistance qualities [1,6,7]. On the other hand, prolonged hyperleptinemia in obesity can lead to insulin resistance and harmful cardiovascular consequences through a variety of mechanisms [8]. Obesity-related arterial hypertension and endothelial dysfunction may be exacerbated by leptin-induced RAAS activation and endothelin-1 production [9,10]. Blood pressure may rise as a result of leptin's activation of the renal sympathetic nervous system, which increases renal salt retention [8].

Hyperleptinemia brought on by obesity contributes to vascular inflammation. It induces monocytes to express pro-inflammatory cytokines such TNF- $\alpha$ , interleukin-2, and IL-6 [11] and lymphocyte T helper 1 proinflammatory cytokine production [12]. Leptin stimulates the production of MCP-1 in aortic endothelial cells via raising fatty acid oxidation through protein kinase A [13]. Transforming growth factor- $\beta$ 1 (TGF- $\beta$ 1), matrix metalloproteinases, adhesion molecules, and VSMC proliferation and migration may all be enhanced by leptin [14]. Stimulation of protein kinase A, which raises fatty acid oxidation in endothelial cells, and a reduction in paraoxonase 1 antioxidant activity are two of the ways by which leptin enhances oxidative stress [15,16]. Additionally, leptin may encourage the calcification of vascular cells and osteoblastic differentiation [4].

Fasting therapy, decreasing leptin levels, significantly enhances endothelial function and lowers artery damage marker levels via enhancing endothelial progenitor cells (EPCs) function and triggering autophagy [17]. Elevated levels of leptin are linked to an adverse

cardiometabolic risk profile. Although leptin has been positively associated with vascular damage in several investigations, no observational study has examined leptin's potential prognostic value for arterial stiffening [18]. The prevalence of people with diabetes mellitus (DM) worldwide is still rising. Regardless of racial or cultural variations, obesity, smoking, hypercholesterolemia, and hypertension are independently connected with the risk of cardiovascular disease (CVD) in patients with diabetes [19]. It was suggested that serum leptin is positively associated with aortic stiffness in patients with type 2 DM [19].

These findings: i) indicate a predictive role of circulating leptin levels for vascular damage, independent of body weight and blood pressure; ii) provide a novel insight into intermittent fasting or fasting therapy as a lifestyle intervention strategy to promote the maintenance of vascular homeostasis in obese patients [20].

In conclusion, obese patients or sedentary people must to be encouraged to live with sufficient physical activity and healthy eating habits for decreasing arterial stiffness and balancing autonomic nervous function.

### Disclosure Statement

The authors declare that there are no conflicts of interest.

### Bibliography

1. Obradovic M., *et al.* "Leptin and obesity: Role and clinical implication". *Frontiers in Endocrinology (Lausanne)* 12 (2021): 585887.
2. Ryan MJ., *et al.* "Vascular smooth muscle-specific deletion of the leptin receptor attenuates leptin-induced alterations in vascular relaxation". *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology* 310.10 (2016): R960-R967.
3. Poetsch MS., *et al.* "Role of leptin in cardiovascular diseases". *Frontiers in Endocrinology (Lausanne)* 11 (2020): 354.
4. Raman P and Khanal S. "Leptin in atherosclerosis: focus on macrophages, endothelial and smooth muscle cells". *International Journal of Molecular Sciences* 22.11 (2021): 5446.
5. López-Acosta O., *et al.* "Smooth muscle cells from a rat model of obesity and hyperleptinemia are partially resistant to leptin-induced reactive oxygen species generation". *Antioxidants (Basel)* 12.3 (2023): 728.
6. Su X., *et al.* "The important role of leptin in modulating the risk of dermatological diseases". *Frontiers in Immunology* 11 (2021): 593564.
7. Kirichenko TV., *et al.* "The role of adipokines in inflammatory mechanisms of obesity". *International Journal of Molecular Sciences* 23.23 (2022): 14982.
8. Kumar R., *et al.* "Association of leptin with obesity and insulin resistance". *Cureus* 12.12 (2020): e12178.
9. Shariq OA and McKenzie TJ. "Obesity-related hypertension: a review of pathophysiology, management, and the role of metabolic surgery". *Gland Surgery* 9.1 (2020): 80-93.
10. Jung MH and Ihm SH. "Obesity-related hypertension and chronic kidney disease: from evaluation to management". *Kidney Research and Clinical Practice* 42.4 (2023): 431-444.
11. Aliyu M., *et al.* "Interleukin-6 cytokine: An overview of the immune regulation, immune dysregulation, and therapeutic approach". *International Immunopharmacology* 111 (2022): 109130.

12. Kim M., *et al.* "Early involvement of peripherally derived monocytes in inflammation in an NMO-like mouse model". *Scientific Reports* 14.1 (2024): 1177.
13. Luk C., *et al.* "Paracrine role of the endothelium in metabolic homeostasis in health and nutrient excess". *Frontiers in Cardiovascular Medicine* 9 (2022): 882923.
14. Xu X., *et al.* "Transforming growth factor- $\beta$  in stem cells and tissue homeostasis". *Bone Research* 6 (2018): 2.
15. Meneses MJ., *et al.* "Paraoxonase-1 as a regulator of glucose and lipid homeostasis: impact on the onset and progression of metabolic disorders". *International Journal of Molecular Sciences* 20.16 (2019): 4049.
16. Masenga SK., *et al.* "Mechanisms of oxidative stress in metabolic syndrome". *International Journal of Molecular Sciences* 24.9 (2023): 7898.
17. Sun J., *et al.* "Fasting therapy contributes to the improvement of endothelial function and decline in vascular injury-related markers in overweight and obese individuals via activating autophagy of endothelial progenitor cells". *Evidence-Based Complementary and Alternative Medicine* (2020): 3576030.
18. D'Elia L., *et al.* "Serum leptin is associated with increased pulse pressure and the development of arterial stiffening in adult men: results of an eight-year follow-up study". *Hypertension Research* 44.11 (2021): 1444-1450.
19. Wu TJ., *et al.* "Serum leptin level is positively correlated with aortic stiffness in patients with type 2 diabetes mellitus". *Frontiers in Bioscience (Landmark Ed)* 28.6 (2023): 128.
20. Finelli C. "Intermittent fasting: a trend or an efficient method to lose weight?". *EC Clinical and Medical Case Reports* 6.12 (2023): 01-04.

**Volume 7 Issue 4 April 2024**

**©All rights reserved by Carmine Finelli and Simone Dal Sasso.**