

# Abstract

Modern society increasingly focuses on body aesthetics, utilizing advanced treatments to enhance appearance, including those targeting degenerative changes in fat tissue, such as cellulite, also known as Gynoid Lipodystrophy (GLD). While the aesthetic results of these interventions are evident, their long-term impact on the body, including metabolic processes, remains poorly understood. Notably, fat tissue, once viewed merely as an energy reservoir and thermal barrier, is now recognized as a dynamic endocrine organ affecting overall body homeostasis.

This study aimed to evaluate the effectiveness and safety of a series of liporeductive treatments in women with stage II cellulite. Ninety healthy young women were recruited for the project, from which 32 participants were selected based on inclusion criteria. The participants were randomized into a treatment group (n=16) and a control group of equal size. Measurements of body mass and composition were conducted. Cellulite assessment on the posterior thighs was performed using the Nürnberger and Müller visual-palpation scale, and body circumferences and skinfolds were measured at the waist, abdomen, hips, buttocks, and lower limbs. The study protocol included five blood and urine samples to measure biochemical indicators: before and after the first and last treatments, and 24 hours post-treatment series. Blood tests included hemogram with differential, serum proteinogram, lipidogram, liver function tests, and levels of adiponectin, resistin, leptin, myoglobin, creatine kinase, TNF- $\alpha$ , and active vitamin D metabolite. Urine samples were analyzed for physical, chemical, and morphological characteristics. The liporeductive treatments involved a proprietary therapy program combining myofascial, osteopathic, drainage, and liporeductive massage techniques.

Following the series of treatments, the treatment group showed a significant reduction in average body mass by 0.96 kg, a decrease in fat percentage from 26.6% to 25.9%, and a reduction in fat mass from 15.99 kg to 15.44 kg (all changes were significant). Body circumferences decreased significantly: hips by -2.86 cm, waist by -2.53 cm, widest part of the thigh by -2.03 cm, and narrowest part of the thigh by -1.61 cm. Skinfold thickness notably decreased, especially on the hips (-6.11 mm) and lower abdomen (-4.89 mm). Cellulite severity significantly improved, with 78.57% of participants showing improvement in GLD grading. No clinically significant changes in lipoprotein profiles or serum proteins were observed post-treatment. Liver enzyme activity remained stable after the series of treatments, though a trend towards increased ALT and AST activity was noted for the single treatment. Similarly, leptin

levels did not change significantly post-series, though a trend towards a decrease was observed for a single treatment. Resistin levels increased significantly after the series of treatments (from 171.84 pg/dl to 219.06 pg/dl). Muscle damage markers (myoglobin, creatine kinase) and inflammatory markers remained unchanged both after a single treatment and the series. Vitamin D3 levels increased by an average of 2.96 ng/ml after a single treatment (a trend towards significance), but the series did not significantly affect its levels. Urine pH showed significant increases after a single treatment and a trend for the series. A significant decrease in urine specific gravity was also observed after the single treatment.

In conclusion, the series of liporeductive massages proved effective in reducing body mass, composition, circumferences, and skinfold thickness, and significantly improved the severity of cellulite. The intervention did not significantly impact key blood and urine parameters. The effect on liver enzyme activity requires further research. The method's safety is supported by the lack of impact on muscle damage markers and inflammatory indicators, and the expected effects on urine physicochemical properties. However, the observed increase in resistin levels is an adverse finding that warrants further investigation.

### **Keywords**

Liporeductive massage, cellulite, adipose tissue, biochemical markers of blood and urine, adiponectin, leptin, resistin, TNF- $\alpha$ , vitamin D, creatine kinase, myoglobin.