

Abstract

Obesity is one of the key public health challenges of the 21st century. It is characterized by disturbances in the endocrine function of adipose tissue, associated with altered production and activity of adipokines, as well as low-grade chronic inflammation and metabolic abnormalities. A growing body of evidence suggests that whole-body cryotherapy (WBC) may serve as a complementary, nonpharmacological strategy to support the regulation of metabolic homeostasis in overweight individuals. This method involves brief exposure of the body to extremely low temperatures to induce a multisystem physiological response. Despite its well-documented analgesic, anti-inflammatory, and anti-edematous effects, its impact on the endocrine function of adipose tissue, sirtuins, carbohydrate metabolism, and biophysical parameters of the skin has not yet been fully understood.

The aim of this study was to evaluate the effect of a single cryogenic stimulus and a series of 10 and 20 systemic cryotherapy treatments on selected biophysical parameters of the skin, adipokine and sirtuin profiles, and carbohydrate metabolism indices in overweight and obese individuals compared with individuals with a normal BMI.

A total of 80 individuals were recruited for the study, of whom 32 met the inclusion criteria. Participants were assigned to the study group (SG, BMI > 27; n = 16) and the control group (CG, BMI 18–25; n = 16). Ultimately, 23 participants completed the study (SG: n = 12; CG: n = 11).

The assessment of skin biophysical parameters included measurements of stratum corneum hydration, TEWL, pH, and skin elasticity, performed before and after the 1st, 10th, and 20th WBC treatments. Biochemical blood analyses were conducted before the intervention, after the 9th and 19th treatments, and 2 weeks after the completion of the treatment series.

The skin's response to a cryogenic stimulus varied depending on BMI and anatomical location. In overweight and obese individuals, a significant improvement in skin firmness of the face and forearm, increased hydration, and changes in pH within the forearm were observed, accompanied by an increase in TEWL after the intervention in both groups. The effects were more pronounced in the forearm than in the facial skin.

Systemic cryotherapy was associated with changes in selected metabolic markers, including fasting glucose, insulin, and HbA1c. The study group also showed beneficial changes in insulin resistance markers (HOMA-IR, QUICKI) and selected adipokines and sirtuins. A decrease in leptin was noted in both groups, while the response of other adipokines and sirtuins varied and depended on the number of treatments and baseline BMI. In individuals with normal body weight, an increase in fructosamine was observed that persisted during follow-up.

Systemic cryotherapy appears to be a safe method that can modulate the biophysical parameters of the skin and selected metabolic markers. The body's response to the cryogenic stimulus depends on the number of treatments, BMI, and the anatomical location of the assessed areas.