

IMPACT OF BODY MASS INDEX ON ERYTHROCYTE MEMBRANE FATTY ACID COMPOSITION AND OXIDATIVE STRESS IN HEALTHY ADULTS

Inga Bikulčienė^{1,2}, Inga Fomčenko³, Virginijus Šapoka³, Arvydas Kaminskas¹, Dovilė Karčiauskaitė^{1,2}

¹Lithuania, Vilnius University, Faculty of Medicine, Institute of Biomedical Sciences

²Lithuania, Vilnius University, Faculty of Medicine, Translational Health Research Institute

³Lithuania, Vilnius University, Faculty of Medicine

inga.bikulciene@mf.vu.lt

The fatty acid (FA) composition of erythrocyte membranes reflects long-term dietary intake, metabolic status, and systemic inflammation, and may vary among individuals with different body mass indices (BMIs). This study aimed to investigate the relationships between BMI, erythrocyte membrane FA composition, and oxidative stress in healthy adults.

This cross-sectional study, conducted from May 2023 to June 2024, included 190 healthy men and women aged 29–43 years who attended the outpatient clinic at the National Centre of Osteoporosis in Vilnius, Lithuania. Based on BMI values, participants were categorised into one of four groups: underweight, normal weight, overweight, or obese. Blood samples were analysed for serum malondialdehyde (MDA) using high-performance liquid chromatography, and erythrocyte membrane FA composition was assessed using gas chromatography–mass spectrometry.

Across BMI groups, MDA levels were higher in the obese group than in the healthy weight group (107.8 ± 17.2 vs. 96.5 ± 16.6 ng/mL, $p = 0.007$). Underweight individuals had lower total SFA levels than those in the healthy weight group (60.9 (41.0, 62.5) vs. 81.2 (68.7, 88.6) %, $p < 0.001$), whereas healthy weight individuals had higher SFA levels than those in the obese group (81.2 (68.7, 88.6) vs. 47.4 (40.9, 65.0) %, $p < 0.001$). C16:0 was higher in the healthy weight group (52.5 (44.4, 58.6) %) compared with the overweight (36.4 (24.4, 39.0) %) and obese (28.6 (23.7, 40.8) %) groups ($p < 0.001$). Total MUFA levels were lowest in healthy weight individuals (14.0 (7.7, 16.6) %) and highest in the overweight (18.9 (13.5, 20.3) %) and obese (18.4 (15.8, 20.7) %) groups ($p < 0.001$), driven largely by increases in C18:1n-9. PUFAs were depleted in the healthy weight group (4.9 (4.1, 11.0) %) but elevated in the obese group (32.9 (17.4, 37.8) %, $p < 0.001$). Levels of n-3 PUFAs increased with BMI (5.7 (1.0–10.4) %), with the highest concentrations of C20:5n-3, C22:5n-3, and C22:6n-3 observed in the obese group. n-6 PUFA levels (mainly C18:2n-6) were lowest in the healthy weight group and highest in the obese group (3.8 (3.6, 25.8) % vs. 23.2 (12.6, 26.0) %, $p < 0.001$).

In conclusion, higher BMI was associated with increased oxidative stress. Alterations in erythrocyte membrane FA composition were observed, with obesity characterised by reduced SFA levels and elevated MUFA and PUFA levels. These findings suggest that excess adiposity is linked to membrane lipid remodelling in healthy adults.