Omega-3 fatty acids are more likely to cause C2C12 cell adipose deposition and decomposition compared with palmitic acid

Shilei Zhang[1,2], Yongjie Wang[1], Saeed Hemza[1], Sarah Shelby[1], and Yan Huang[1]

[1]Department of Animal Science, University of Arkansas, Fayetteville, AR 72701 [2]Department of Animal Science, Hebei Agricultural University, Hebei 071001

Introduction

- In contrast to white adipocytes, brown adipocytes generate heat, via higher number and activity of of mitochondria.
- The decrease of brown adipose tissue causes animal obesity and inflammation.
- Ω-3 fatty acids promote brown adipose tissue production, but it is unknown whether saturated fatty acids have similar effects.
- The differences between myogenic, adipogenic, and thermogenic genes expression in C2C12 cells were explored during the adipogenesis differentiation by supplementing DHA+EPA and palmitic.

Methods

This study gave different concentrations of Ω3-fatty acid and saturated fatty acids during the differentiation of C2C12 cells: Ω3-fatty acid control group was given 95 % alcohol (95% alcohol is the solvent for DHA and EPA), treatment groups was given EPA and DHA 5, 10, 25, 50, 75 μmol / L each; saturated fatty acids control group was given the solvent of palmitic acid (NaOH 10 mmol/L, 1.25 % Fatty acid free BSA), treatment groups was given palmitic acid 10, 20, 50 , 100, 150 μmol / L.

Oil Red O staining was used to monitor lipid accumulation in C2C12 cells (Day 10). The related genes were detected by real time qPCR, and the 18S gene was used as the housekeeping gene.

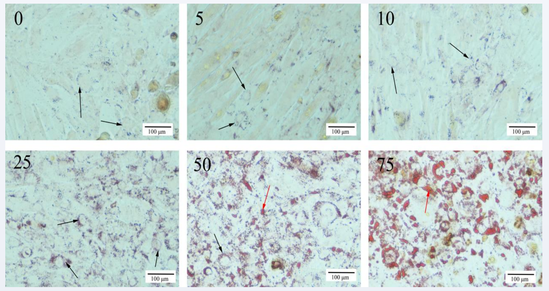


Figure 1 Effects of DHA + EPA at different concentrations on C2C12 cell adipogenesis (The black arrows refer to small lipid droplets, and the red arrows refer to larger lipid droplets.)

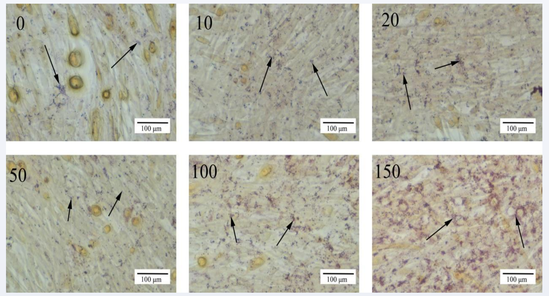


Figure 2 Effects of palmitic acid at different concentrations on C2C12 cell adipogenesis

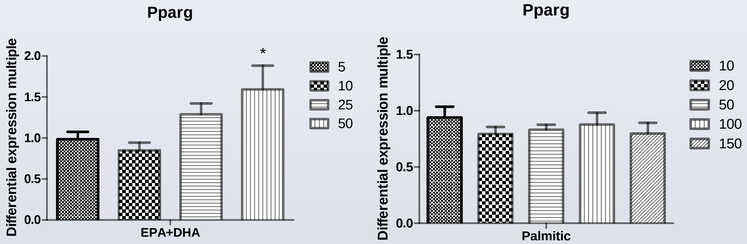


Figure 3 Effects of EPA+DHA and palmitic acid at C2C12 cell adipogenesis-related genesns. * P <0.05; n = 4

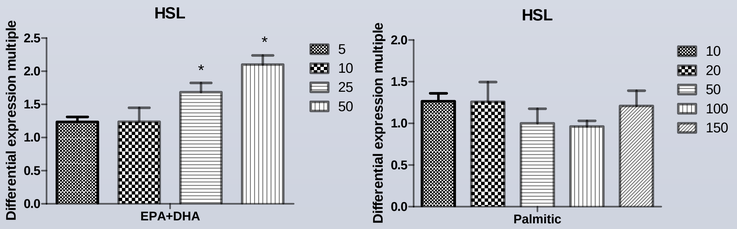
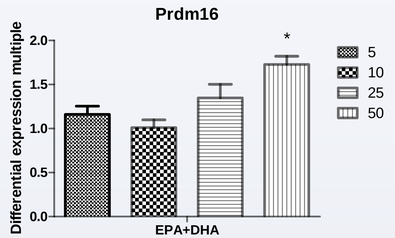


Figure 4 Effects of DHA + EPA and palmitic acid at C2C12 cell lipolysis-related genes. * P <0.05; n = 4

Results

It can be found that compared to palmitic acid, DHA + EPA is more likely to cause cell adipogenesis. The expression of Pparg which related to adipogenesis in the EPA + DHA 50 μmol/L group was significantly increased. Among the lipolysis related genes, HSL increased significantly in the EPA + DHA group (≥ 25 μmol/L). On the other hand, among thermogenesis-related genes, Prdm16 increased significantly (≥50 μmol/L) after administration of DHA+EPA. After palmitic acid administration, Prdm16 (≥50 μmol/L) was significantly reduced.



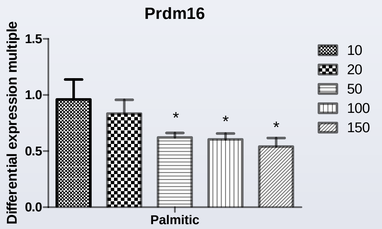


Figure 5 Effects of EPA+DHA and palmitic acid at C2C12 cell mitochondrial thermogenesis-related genes. * P <0.05; n = 4

Conclusion

Compared to palmitic acid, the treatment of combined EPA + DHA in differentiation culture of C2C12 cells can enhanced the deposition and decomposition of adipose.

EPA + DHA combination is more likely to cause brown adipogenesis, compared to palmitic acid..