The Effects of Exercise on Cognitive Impairment due to Metabolic and Epigenetic Dysregulation

Puzhakkaraillath, Aysha (School: duPont Manual High School)

The purpose of this experiment was to test whether exercise could mitigate neuroinflammation, epigenetic dysregulation, and memory loss caused by high-fat diet. Diets high in fat cause decreases in BDNF, GLUT-1, and GLUT-4 expression which can be linked to diabetic conditions. HDAC-1 is key in epigenetic regulation. TNF-alpha is a key regulator of inflammatory processes. High-fat diet (HFD) and high-fat diet plus exercise (HFD+EX) groups consumed a diet with 42% milk based fat, and the control (CTRL) and exercise groups (EX) consumed a diet with 6% fat. They exercised 5 days a week for 16 weeks. When Western Blotting expression of TNF-alpha, GLUT-1, and GLUT-4 was performed, both GLUT-1 and GLUT-4 expression increased in EX and HFD+EX groups and decreased in HFD showing improved metabolic regulation. TNF-alpha, an inflammation regulator, showed increased levels in HFD groups and lower levels in HFD+EX groups, indicating recovery of neuroinflammation. To measure memory loss, the spontaneous alterations test was completed, analyzing spatial memory. The novel object recognition test tested visual memory. Both showed a decreased cognitive ability in HFD groups and increased cognitive ability in both exercise groups (HFD+EX and EX), showing recovery of memory loss. After completing immunohistochemistry of BDNF and HDAC-1 expression, BDNF, a critical protein in recovery through exercise, showed an increase in HFD+EX groups, after decreasing in HFD groups. HDAC-1 levels decreased in HFD groups and increased in HFD+EX groups. Exercise positively promotes gene expression, mitigating memory loss, neuroinflammation, and epigenetic dysregulation due to a high-fat diet.

Awards Won: