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Obesity-related nervous system injury: preliminary evidences in diet induced obesity (DIO) rats

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Increased food intake, reduced physical activity and altered metabolic processes are the variables that affect energy balance inducing obesity. Obesity is now considered an increasingly medical challenge. Actually, the prevalence of obesity has increased dramatically worldwide over the last decades and has now reached epidemic proportions. On the other hand, obesity is associated with the development of chronic diseases such as cerebrovascular disease promoting the cognitive decline. Caloric-dense diet induced obesity (DIO), provides a useful animal model sharing several common features with human obesity. DIO rats of 7 weeks of age are expose to high fat (45 %) diet ad libitum and after 5 weeks the obese phenotype starts to be develop. To clarify the possible relationships between obesity and nervous system changes, DIO rats were studied after 5 weeks and 17 weeks of hypercaloric diet compared to the control rats with not fat diet (Chow). Memory performance were measured using different cognitive tests. Moreover, ultrasonographic (US) and computed tomography (CT) evaluations were performed to detect adipose tissue changes. Magnetic resonance imaging (MRI) to highlight brain morphological alterations was used. Morphological changes of brain areas (frontal cortex, hippocampus) were evaluated by immunohistochemical analysis. The results confirmed the developed of obesity after 5 weeks of fat diet. At long-term (17 weeks) high fat diet exposure, rats increased significantly their body weight in comparison to the control group and the youngest DIO rats. The US and CT analysis indicated an increase of deposition of both visceral and subcutaneous adipose tissue and evidences a decrease of hepatic attenuation in the older DIO rats.MRI images did not show vascular and morphological alterations in brain. Instead, immuhistochemical and immunochemical analysis, revealed an increase expression of glial-fibrillary acidic protein (GFAP) in the older DIO rats compared to the age- matched Chow rats both in frontal cortex and in hippocampus. DIO rats showed a reduction of retention latency time in the emotional learning task. These preliminary findings indicate that the development of obesity, does not determined gross anatomy alteration in brain, but the occurrence of injury characterized by astrogliosis. The identification of neurodegenerative changes in DIO may represent the first insight to better characterize the neuronal involvement in obesity.

Keywords

Obesity; diet induced obesity rats; brain; astrogliosis.