Chronic Caffeine Prevents Changes in Inhibitory Avoidance Memory and Hippocampal BDNF Immunocontent in Middle-Aged Rats

Sallaberry, C.1,2, Nunes, F.1, Costa, M.S.1, Fioreze, G.T.1, Ardais, A.P.1, Bottino, P.H.S.1, Souza, D.O.1, Elisabetsky, E.2,3, Porciúncula, L.O.1,2.

1Department of Biochemistry, ICBS, UFRGS, Porto Alegre, RS, Brazil; 2PPG-Neurociências, ICBS, UFRGS, Porto Alegre, RS, Brazil; 3Department of Pharmacology, ICBS, UFRGS, Porto Alegre, RS, Brazil.

Introduction: Beneficial effects of caffeine on memory processes have been observed in animal models relevant to neurodegenerative diseases and aging, although the underlying mechanisms remain unknown. Brain-derived neurotrophic factor (BDNF) is associated with memory formation and BDNF’s actions are modulated by adenosine receptors, the molecular targets of caffeine. In this sense, the purpose of the present study was to investigate whether chronic caffeine alters the predictable age-associated decline in inhibitory avoidance memory in middle-aged rats and assess changes in hippocampal proBDNF, BDNF, TrkB, and CREB immunocontent. Material and Methods: We compared the effects of chronic caffeine (1 mg/mL drinking solution for 30 days) on short- and long-term memory in the inhibitory avoidance task and on levels of hippocampal proBDNF, mature BDNF, TrkB and CREB in young (3 month old) and middle-aged (12 month old) rats. Results and Discussion: Caffeine did not modify either the short- or the long-term step down avoidance memory performance of young rats. The control (water) middle-aged animals had a loss of short-term (p = 0.50; training vs. test scores; n = 13-16) and long-term memory when compared to control young adult rats (p = 0.008; n = 13-16); however, this impairment was prevented by caffeine administration (p < 0.05; n = 13-16). Western blot analysis of hippocampus from caffeine-treated rats revealed that BDNF increased by aging and that caffeine treatment prevented it (p < 0.05; n = 9-10). In addition, caffeine increased proBDNF and CREB immunocontent, and decreased TrkB levels, in hippocampus regardless of age (p < 0.05; n = 9-10). Conclusion: These data provide new evidence in favor of the hypothesis that modifications in BDNF and related proteins in the hippocampus contribute to the pro-cognitive effects of caffeine on age-associated losses in memory encoding.

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