Vegetable shortening diet induced binge eating behavior: role of the endocannabonoid system

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Binge eating disorder (BED) is characterized by recurrent and distressing binge eating episodes, defined by the uncontrolled consumption of a large amount of food (overeating) in a brief period of time (APA, 2013). The endocannabinoid system is documented to play a critical role in modulation of energy balance by controlling food intake through central and peripheral mechanisms. Animal and human studies indicate that CB1 cannabinoid receptors (CB1R) agonists possess orexigenic effects enhancing appetite and increasing the rewarding value of food. Conversely, CB1R antagonists have been shown to inhibit the intake of food and preferentially reduced the consumption of palatable food (i.e. butter cookies or chocolate-flavoured drink) (Carai et al., 2006). Several reports have led to hypothesise a link between a defect in the endocannabinoid system and the pathophysiology of BED. Thats, women with BED have elevated plasma levels of endocannabinoids (Monteleone et al., 2005). Binge eating behaviour can be modelled in validated animal protocols. In the limited access model, for example, binge eating behaviour is induced in rats by alternating sporadic, time-limited access to a dietary fat (vegetable shortening) with continuously available chow (binge group). Under these conditions, the intake of vegetable shortening escalate over several weeks, becoming significantly greater than in rats with daily access (no-binge group) (Corwin and Buda-Levin, 2004).
Using the limited access protocol, we showed that pharmacological manipulation of endocannabinoid transmission is effective in modulating the binge eating behaviour induced in female rats (Scherma et al., 2013). Specifically, chronic low dose of the CB1R receptor antagonist rimonabant reduces fat intake in the binge group, with a concomitant significant weight loss. Furthermore, we confirmed the effects of rimonabant in another animal model where binge eating behaviour was induced by a combination of food restriction/refeeding with both sugary and normal diets (Scherma et al., 2014). It has been shown that dietary conditions (specific dietary components as well as compulsive or restrictive feeding) influence CB1R expression in multiple brain regions (Carr et al., 2008). In agreement, we found a modification of CB1R density in the binge group compared to controls (in preparation).
Using this protocol we also evaluate whether the binge group would exhibit an altered emotional profile, such as depression, anxiety and/or compulsive-like behaviour, before and after the access to the diet on which they binge. In the forced swimming test we found that the binge group shows a decrease in depression-like behaviour after the binge episode. Moreover, in the elevated plus maze test, we found that the binge group is much more anxious before the access to vegetable shortening, this condition being significantly reduced after the consumption of the fat diet. Additionally, in the marble burying test the number of marbles buried by the binge group before the access to vegetable shortening was significantly higher compared to control groups suggesting a compulsive-like behaviour.
Taken together, all those investigations suggest that the modulation of the endocannabinoid system signalling might be effective in altering binge eating behaviour induced by a limited access to a high-fat diet, in animals showing an emotional profile comparable with the human condition.

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