Serum Metabolic Signature in an animal model of binge eating by Nuclear Magnetic Resonance Spectroscopy

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In order to investigate Binge eating (BE) behaviour in female rats, for the first time, we analysed the metabolic profile obtained from biological fluids of BE rats, through the Nuclear Magnetic Resonance Spectroscopy. The NMR spectra constitute a 'fingerprint' of the NMR detectable part of the whole metabolome. The metabolomic research is a consolidated area aimed to detect the pool of metabolites in biological systems [1]. The metabolomic profile is due to low-molecular weight compounds that are products in various metabolic pathway. These small molecules include compounds such as lipids, sugar, aminoacids, nucleodides and a number of different organic molecules that are reactants, intermediates or products of biochemical reactions as well as building blocks for all other biochemicals species including proteins, nucleic acids and cell membranes. Most metabolomic profile involved common biological fluids as urine and serum/plasma that are obtainable in a non- or minimally-invasive way and are easily available.
BE episodes are characterized by uncontrollable, distressing eating of a large amount of highly palatable food (HPF). These episodes represent a central feature of bingeing related eating disorders, such as binge eating disorder, bulimia nervosa, and binge/purge subtype anorexia nervosa. Considerable evidence suggests that BE may be caused by a unique interaction between dieting and stress. In the model adopted by our group [2] BE for HPF is evoked in rats by the combination of cyclic food restrictions and stress. The model uses female rats in relation to the higher prevalence of BE disorders in women.
Two groups of female Sprague-Dawley rats were used in this study: 1) NR+NS was normally fed and not stressed on day 25 and 2) R+S was exposed to 3 cycles of yo-yo dieting and stressed on day 25. All groups were fed HPF for 2 h on day 5-6 and 13-14. Stress was induced by preventing access to HPF for 15 min, while rats were able to see and smell it. After the stressful procedure the rats were sacrificed and blood samples were collected. 300 µl serum of rats were used for the NMR analyses. We acquired one- and two- dimensional experiments from the two groups for the characterization of the metabolic profile.Thirty metabolites were detected and assigned. Significant differences were found in small metabolites such as glutamine, lactate and glycerolphosohorylcholine. Another important difference is in the amount of lipids, more evident in the R+S group respect to the NR+NS group.

[1] Fiehn O. 2002 Plant Mol Biol 48: 155-71
[2] Cifani C. et al. 2009 Psychopharmacology 204(1):113-25