Gene Transcriptional and Proteome Level Investigation into Coffee Aroma and Rat Brain Responses

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Coffee is the most widely consumed beverage by a large proportion (approximately 70-80%) of the human population world-wide. Since coffee has been a part of the human diet for over a thousand years, the effects of coffee on the human species have been investigated by numerous researchers. However, the beneficial or adverse effects of brewed coffee on human health are still controversial as discussed in the literature. Some beneficial effects of coffee on behavior and neuroactivity have been reported. For example, improvements in alertness and performance, the potential reduction of suicide risk and depression, relaxation or alleviation of stress, and the stimulation of mood have been seen. These "beneficial" effects may be due to caffeine, a key ingredient studied in most of the cases. Despite numerous studies, most of the experiments have focused on non-volatile compounds of brewed coffee, especially caffeine. Although, more than 800 volatile compounds with a wide variety of functional groups have been identified in roasted coffee, there are few studies that deal with the beneficial effects of "coffee volatiles" or aroma. Our group is interested in the effects of roasted coffee bean aroma. Why? Because, 1) coffee is consumed for its pleasing and attractive aroma, which is the result of roasting, 2) in spite of being the most popular beverage, approximately 20-30% of population does not drink the coffee due to several reasons. Interestingly, one study using rats revealed their (rat) preference for coffee aroma; the study employed an artificial aroma experiment.

With the above stated objective – effects of coffee bean aroma –, we designed an experiment to investigate the potential effects therein, by using an animal model and molecular "omic" approaches, namely genomics (transcriptional profiling of gene expression) and proteomics (protein complement of the genome). As aroma deals with the sensory response and emotion in the brain, the rat brain was chosen as the experimental material in the present study. It was reasoned that by examining the molecular (gene expression and protein levels) responses in the brain of rat exposed to the aroma of coffee bean, it may be possible to get insight on the aroma-induced changes associated with brain function. Moreover, as coffee is also considered as a stress reliever, we incorporated a stress condition in our experimental design with or without the presence of coffee aroma to see whether coffee can counteract the effects of stress at the level of gene/protein expression.