Neural Effects of Nicotine during Auditory Selective Attention and the Stimulus-Filter Hypothesis: An Event-Related Potential Study

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Abstract

Acute nicotine has been found to improve task performance in smokers; however, the attentional processes mediating these improvements are unclear. According to the stimulus-filter hypothesis, nicotine facilitates cognitive performance through the creation of a stimulus barrier, which screens out irrelevant stimuli and thus aids in the attending to relevant stimuli. Event-related potentials (ERPs) have been shown to be sensitive indicators of selective attention. The effects of acutely administered nicotine were examined on ERPs and concomitant behavioural performance measures in an auditory "oddball" task requiring selective attention. 22 (11 males) non-smokers received nicotine gum (6 mg) in a placebo-controlled, double-blind, randomized crossover design. In a dichotic listening task, participants were required to attend and detect deviant stimuli in one ear and to ignore similar stimuli in the other ear. The task allowed for the measurement of ERP component amplitudes and latencies, as well as behavioral response speed and accuracy indices. Nicotine shortened reaction times to targets, but failed to alter amplitudes of ERP components sensitive to selective attention (reflected in the N100 and negative difference [Nd] components) or to pre-attentive detection of acoustic change (reflected in the mismatch negativity [MMN] component). However, nicotine did impact the speed of selection, as evidenced by shortened latencies of the N100 component (elicited by attended stimuli). These findings are discussed in relation to the stimulus filter theory of smoking, and with respect to nicotine's actions on involuntary and controlled aspects of selective attention processes.