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ABSTRACT

The Association between Dopamine Score and Feedback-Based Learning in Healthy Undergraduates

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People vary in their cognitive performance. In particular, evidence shows that the neurotransmitter dopamine plays an important role in modulating feedback-based learning. Enhanced dopamine levels are related to better learning from positive feedback. Decreased dopamine levels mediate learning from negative feedback. Naturally-occurring differences in dopamine genes contribute to individual differences in feedback-based learning. In the brain, dopamine exerts its actions via receptors located pre and post synaptically. There are several genes involved in regulating the function of the dopaminergic system. Dopamine transporter (DAT1) and dopamine D2 receptor (DRD2) regulate and modulate dopamine signaling presynaptically, whereas the dopamine receptor (DRD1) and (DRD2) transmit dopaminergic signals postsynaptically. In our study, we created a dopamine score based on the effects of functional polymorphisms in the aforementioned dopamine genes to consider a pathway-based analysis of individual differences in dopamine functionality based on naturally-occurring polymorphisms. We recruited a sample of 423 healthy undergraduate students from Al-Quds University. All participants completed a battery of psychopathology tests. Furthermore, subjects were administered a computer-based probabilistic categorical feedback-based learning task that dissociated learning from positive and negative feedback. We found that the value of the dopamine score is positively correlated with the efficiency of dopamine neurotransmission. Subjects with higher dopamine scores showed better learning accompanied by the shortest response time for both reward and punishment. These results highlight the importance of examining the collective variations in the dopamine circuitry in the brain. Such scores can be significant in understanding the pathophysiology of psychiatric disorders that are related to dopamine such as major depressive disorder and attention-deficit hyperactivity disorder.

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