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The impact of acute stress on reinforcement learning among people with problem gambling

What this research is about

According to the reinforcement learning (RL) theory, people make decisions based on two parallel learning systems. The systems are called the Model-Based (MB) and Model-Free (MF) systems. Previous research has found that people with gambling disorder make decisions more reactively based on habits (i.e., MF). Moreover, they are less likely to respond using a purposeful and goal-directed approach (i.e., MB).

Similarly, people who are stressed make decisions based more on their MF system. People who have gambling disorder may face chronic stress. It is possible that repeated exposure to stress during gambling may reinforce MF learning and lead people to develop gambling disorder. This study examined how acute stress affects reinforcement learning in people with gambling disorder.

What the researchers did

Participants were recruited through advertisement. Participants had to be over 18 years and could not have any history of neurological or psychiatric diseases. A total of 116 people participated. This included 58 men with problem gambling who scored 6 or higher on the South Oaks Gambling Screen. Another 58 men without problem gambling were recruited to be the healthy controls. The two groups of participants were matched for age and education. Only men were recruited to avoid the effect of menstrual cycles on cortisol response to stress.

Participants answered questions about their demographics and gambling habits (if applicable). They completed a task measuring fluid intelligence (i.e., ability to reason and deal with new information). Then, participants completed a working memory task.

What you need to know

According to the reinforcement learning (RL) theory, people make decisions based on the Model-Based (MB) and Model-Free (MF) systems. People with gambling disorder and those who are stressed often make decisions based on the MF system. The researchers examined how acute stress affects reinforcement learning in people with gambling disorder. They recruited 58 men with problem gambling and 58 men without problem gambling for the study. Half of the participants completed an acute stress task and half completed a control task. Participants then completed a task measuring MB and MF learning strategies. Participants with and without problem gambling showed similar levels of stress in response to the acute stress task and control task. In the control task, participants with problem gambling showed more MF learning than those without problem gambling. Stress resulted in a shift towards MF learning only among those without problem gambling.

Half of the participants completed the Socially Evaluated Cold Pressor Task (SECPT). In this task, participants placed one arm in cold water for three minutes while being observed and video-recorded. The purpose of the SECPT was to acutely stress participants. The other half of participants completed the control procedure, the Warm Pressor Task (WPT). They placed their forearm in lukewarm water for three minutes. No camera or observation was used. All participants then completed the Two-Step Markov Task (the RL-task). This task measured MF/MB strategies in decision making.

Participants' stress response was measured at multiple times. Participants rated their desire to gamble, feeling of stress, and pain on visual analog scales. They did this before and after the stress test. Samples of saliva were taken at the following times: (1) 10 minutes after arrival; (2) after receiving the RL-task instructions; (3) 10 minutes after the stress test; and (4) after the RL-task. These samples were tested for cortisol levels to measure stress levels.

What the researchers found

On average, participants with problem gambling were 29 years old and those in the control group were 31 years old. Most participants did not smoke (62% of those with problem gambling and 67% of the control group). Participants with problem gambling scored lower on working memory and fluid intelligence than the controls. They also had more co-occurring mental health issues, state-anxiety, and depressive symptoms. In addition, they showed higher sensitivity to rewarding outcomes.

Participants who completed the stress test (SECPT) were more likely to have higher cortisol levels afterwards when compared to their baseline cortisol levels. Participants with and those without problem gambling had similar ratings of stress after completing the SECPT. Both groups also had similar cortisol levels in response to the SECPT. But the increase in cortisol levels after being stressed was linked to a shift from MB towards MF learning only among those without problem gambling.

Even after controlling for verbal working memory performance, participants with problem gambling who completed the WPT were more likely to show MF learning than the control group.

Together, these results suggest that an increase in stress level does not affect the learning strategies of people with problem gambling as much. This is likely because of their general bias towards MF learning.

How you can use this research

This study provides insight for researchers to conduct future research on stress and problem gambling.

About the researchers

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Citation

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