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Research Progress of Decision-making Deficits in Population with Drug Abuse

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Abstract

Population with drug abuse generally have decision-making deficits, which are manifested by obvious risk decision preference, higher impulsivity, higher risk-seeking, loss of somatic signals, and disordered reward. The Iowa Gambling Task (IGT) is the most commonly used experimental paradigm to explore this kind of decision deficit. In the future, we can explore the mechanism of decision-making deficits in the population with drug abuse by using the classical experimental paradigm, and develop corresponding training intervention methods on this basis to improve the decision-making performance in the addicted population.

Keywords

population with drug abuse; decision-making deficits; risk decision

成瘾人群决策障碍的研究进展

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摘　要

成瘾人群普遍存在决策障碍，表现为明显的风险决策偏好，并具有冲动性水平高、风险寻求高、躯体信号缺失、奖赏失调等特征。爱荷华博弈任务（the Iowa gambling task，IGT）是探究这种决策障碍最常用的实验范式。今后研究可以利用经典实验范式探究成瘾人群决策障碍的机制，在此基础上开发相应的训练干预方法，以改善成瘾人群的决策表现。

关键词

成瘾人群；决策障碍；风险决策

1 引言

药物成瘾（drug addiction）是一种过度药物寻求和获取（encompasses excessive drug seeking and taking）以及认知和情绪加工发生功能性变化的障碍[1]。一般认为是一种冲动性、强迫性的行为[2,3]，并认为药物成瘾者的决策障碍是一种情感认知障碍[4]，Everitt 和 Robbins[3] 则认为药物成瘾是一种习惯的转变——从自愿的、娱乐的药物使用到强迫性的药物寻求的转变，从前额皮质到纹状体控制的转变，从腹侧到背侧纹状体的转变。

2 成瘾人群决策障碍及其表现形式

药物成瘾的本质尚有争议，像成瘾是一种大脑疾病还是一种选择障碍的问题[5,6]。比较清楚的是，药物成瘾和冲动性、强迫性是联系在一起的，并且前额叶皮层与成瘾密切相关。但是药物成瘾和决策障碍之间的关系仍有待研究，究竟是药物成瘾导致决策障碍还是决策障碍导致药物成瘾呢？另外，虽然冲动性和对冲动的控制不足可能影响了药物成瘾则为人所接受，但冲动性既是药物成瘾的风险因子又是药物成瘾的结果，因此冲动性和药物成瘾之间的关系、冲动性的表现形式也并没有取得一致结论[2]。

长期非法药物使用会导致身心健康水平降低、社会功能受损、失业率企高[7]。这些问题与认知功能受损有关联，其中决策能力受损应该是最持久和最严重的影响之一[8,9]。成瘾人群普遍存在决策障碍[8,10-12]：决策时偏好短时获益而不顾长期损失[13-15]；相对大额延迟奖赏更倾向于小额及时奖赏；选择大额不可能的奖赏而非小额极有可能的奖赏；更多受奖赏预期而非损失的影响；缺乏躯体内感信号的引导，在意识中

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知道正确选择，却在行为上做错误选择 [16]。奖赏 / 情绪加工系统（腹内侧前额叶 / 眶额叶、岛叶、纹状体、杏仁核等）和认知控制系统（背外侧前额叶、前扣带回等）异常在成瘾行为的形成发展中起重要作用，但这两个系统在成瘾中的变化机制尚不明确 [17]。目前尚不清楚哪些个体会有更大的决策障碍风险，接受治疗之后决策障碍的轨迹是怎样的，尤其是在戒断期间是不是会减少 [8]。

3 成瘾人群决策障碍的特征与机制

良好的决策功能需要认知与情感的互相配合，成瘾人群认知加工与情感加工的相关脑区会因吸食药物而有不同程度损伤 [16]。认知加工脑区受损导致冲动性和风险寻求，情感加工脑区受损导致躯体内感信号缺失，而这两类脑区又共同导致奖赏失调。

冲动性是指倾向于做出某些行为的特性，是追求奖赏和消费的强烈动机，会导致冲动性行为。冲动性行为并不一定是病态的，很可能只是反映了个体对获得高显著性结果（high-salience outcomes）的渴望和动机。因此，冲动性行为是适应性行为，很可能是因为 selection forces 鼓励快速探索或冒险行为，而不是缓慢、慎重和规避风险的选择 [18]。冲动性在寻求和吸食毒品的起始、维持和复发本质以及在临床药物使用障碍方面发挥着重要作用 [19,20]。成瘾人群对冲动性抑制失败并且经常短视、寻求及时满足，缺乏对决策目标的整体性把控能力是造成决策障碍的一大原因。成瘾人群的冲动性，会影响他们参加康复活动的能力 [21]，还会增加寻求和再次使用药物的可能 [16]。

风险寻求是指个体在风险决策中的风险偏好程度，风险寻求高表明更偏好风险，态度和行为上更冒险；风险寻求低则表明更倾向规避风险，态度和行为上更保守 [22]。偶发的焦虑会增加前额叶皮层中细胞外多巴胺的分泌，从而导致更多药物寻求 [23]。成瘾人群在风险决策中，前扣带回和岛叶出现了异常激活 [24]，这使成瘾人群表现出更多风险寻求行为。成瘾人群在决策中十分明显的风险寻求特征，可能是成瘾人群使用药物并且难以戒断的重要原因。

躯体信号并没有一个统一的心理学定义。对情绪信号的生理响应是适应性选择的重要条件，而情绪状态与成瘾行为具有广泛联系，二者都给成瘾人群带来风险并促进了持续使用药物 [25]。成瘾人群决策时脑岛活动减弱了，是因为成瘾行为与脑岛的内感信号减弱有关（interoceptive signal）[26]。杏仁核损伤的个体对奖赏和损失所引发的情绪反应减弱，这些情感信息不能用来引导随后的决策行为，导致他们出现决策障碍 [27]。而腹内侧前额叶（VMPFC）可以通过把认知信息与脑岛、杏仁核、前扣带回以及躯体感觉皮层整合，帮助个体作出优势决策 [28]。因此，成瘾人群相关脑区的异常激活导致认知功能下降，进而造成决策障碍。

成瘾者的决策更受奖赏预期而非损失的影响，奖赏对他们的行为引导能力增加，损失对他们的行为引导能力减弱，表现出奖赏加工失调的特征 [29]。这种奖赏加工失调主要是由纹状体功能障碍带来的，成瘾者的纹状体在奖赏预期（reward anticipation）时是低激活，而奖赏结果（reward outcomes）时是高激活 [30]。成瘾人群相关脑区的损伤造成奖赏加工失调，表现出对奖赏的异常期待和对损失的异常钝化，根据奖惩结果来调整自己行为选择的能力减弱从而无法持续优化选择，造成决策障碍 [16]。

4 成瘾人群决策障碍的常用实验范式

决策障碍的三种主要实验范式——延迟折扣任务（delay discounting task，DDT）[31]、剑桥博弈任务（the Cambridge gamble task，CGT）[14]、爱荷华博弈任务（the Iowa gambling task，IGT）[28]。DDT 广泛应用于成瘾人群冲动性决策研究中 [32-35]，CGT 主要用于评估被试的风险行为（risk-taking）。而爱荷华博弈任务（IGT）[36-38] 主要用于考察成瘾人群的决策短视，是目前应用最广泛的成瘾人群决策障碍考察范式 [11,39]。IGT 通过模拟纸牌游戏提供了一个评估个人决策过程的框架，其中风险和奖赏因选择的纸牌而不同 [40]。

DDT 仅在单纯的获益或损失情境下评估决策，可能无法完全揭示成瘾者的现实决策过程，CGT 主要考察的冒险行为并不一定是决策障碍的表现 [41]，而 IGT 将时间维度和结果维度结合起来，重点考察在短时的获益和长期的损失之间个体如何抉择，这较好地模拟了药物成瘾者的现实决策过程 [42]，这使得 IGT 的应用更加广泛。

5 总结与展望

总体来说，成瘾人群普遍存在决策障碍，表现为偏好短期获益而忽略长期损失，具有冲动性强、风险寻求高、躯体信号缺失、奖赏失调等特征，常用的实验范式是 DDT、CGT 和 IGT，其中 IGT 的应用更加广泛。今后研究要注重使用经典实验范式探究成瘾人群决策障碍的发生机制以及可能的训练干预方法，改善成瘾人群的决策表现。

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