



RESEARCH SYNOPSIS

Rivalan, M., Ahmed, S. H., & Dellu-Hagedorn, F. (2009). Risk-prone individuals prefer the wrong options on a rat version of the Iowa Gambling Task. *Biological Psychiatry*, 66,743–749.

RESEARCH QUESTIONS

Can a valid animal model of maladaptive decision making be developed to allow for direct comparison to human studies?

PURPOSE

Experimental investigation of poor decision making is somewhat impeded by a lack of a valid animal model of maladaptive decision making and procedural differences between the tasks used for humans and rodents. In contrast to the Iowa Gambling Task (IGT), which tracks within a single session the ongoing decision process in a complex situation, most studies in animals instead look at the decision process after long periods of training and/or in simpler choice situations. In an attempt to resolve these issues, the current study used a single session rat gambling task (RGT) analogous to the IGT to evaluate decision making and risk taking.

HYPOTHESIS

None stated.

PARTICIPANTS

One hundred fifty eight Wistar Han rats (100% males; aged 12 to 13 weeks).

PROCEDURE

The chamber consisted of four circular holes available on a curved wall that could be dimly illuminated with an LED located at their rear. A food magazine was connected to an external dispenser delivering food pellets. A clear vertical Plexiglas partition with a central opening was placed across the middle of the chamber. Training. Rats had to associate a nose poke in one of the four illuminated holes with the delivery of one food pellet in the magazine. The procedure continued daily until rats obtained 100 pellets within a session (30-min cutoff). The training phase usually lasted 5 to 7 days. Sensitivity to Penalties. A group of nine rats could freely choose between the four holes (A–D) during a 1-hour test session, but each choice was associated with different outcomes. All choices allowed delivery of one pellet immediately, but choices A and B could be followed by longer,

unpredictable penalties (time-out) compared with choices C and D. The maximum gain was the same for choices C and D and 10 times higher than for choice A or B. During the penalty, the chosen hole remained illuminated to facilitate association between each choice and its consequences. A brief extinction of this light (1 sec) signaled the end of the time-out. Decision-Making in Standard Conditions. Fifty-seven rats were tested in conditions similar to those above, except that each disadvantageous choice allowed the immediate delivery of two pellets simultaneously. The maximum gain for choices C and D was five times higher than for choice A or B. Effects of time, food deprivation and enhanced task difficulty were also tested (see original article for specific description of modification to task). Risk Taking. Good (n = 20) and poor (n = 7) decision makers were tested two months after the decision making task in a box with two equal compartments. A door enabled the rats to pass from one compartment to the other. One compartment was completely enclosed by black sides, with a lid of the same material, while the other was white, had no lid, and was illuminated. The rat was placed in the illuminated compartment facing the wall opposite the door. The time to emerge from the dark to the brightly illuminated light compartment was recorded during a 10-min session. Good (n = 12) and poor (n = 8) decision makers were also tested 1.5 months after the decision making task in the elevated plus-maze (i.e., apparatus made of opaque PVC with 2 two open arms alternating at right angles with two arms enclosed by high walls. The four arms opened onto a central area. The whole maze was elevated 60 cm from the ground). Each rat was placed facing a closed arm in the central area of the plus-maze and was allowed to freely explore the maze for 5 min. Risk taking was evaluated for time and number of visits in the more risky area of the open arms.

MAIN OUTCOME MEASURES

Decision making and risk taking in rat maze.

KEY RESULTS

Within a single session, the rats were capable of discriminating between different post-reward timeouts when choices were equally rewarded. All rats rapidly developed a marked preference for the shorter time-

outs and, to a lesser extent, for the less probable penalties. Overall, the rats clustered into three distinct categories: a majority (58%) of good decision makers with a strong preference for the advantageous options; fewer (25%) poor decision makers with a paradoxical preference for the disadvantageous options; and a minority (17%) with intermediate scores (no preference). Over time, good decision makers progressively developed a preference for the advantageous options, whereas poor decision makers quickly developed a strong and stable preference for the disadvantageous options. As a result, good decision makers gained more pellets than poor decision makers. The rats in the intermediate subgroup failed to exhibit a strong preference for either option. Because of the small size of this group, it was not included in further analyses. Increasing the level of food restriction by decreasing body weight from 0% to 20% had no significant impact on either the proportions of good and poor decision makers or the evolution of their behaviour. Increasing the task difficulty had no consequences on the proportions of good and poor decision makers. Whereas the behavior of poor decision makers was unchanged, good decision makers took more time to select advantageous options. Risk Taking. The time to emerge from the dark to the light compartment was shorter in poor decision makers compared with good decision makers. Poor decision makers visited and stayed in the open arms of an elevated plus-maze as

often as good decision makers; however, poor decision makers explored the extremity of the open arms more than good decision makers. Conversely, good decision makers spent less time in these risky areas than poor decision makers.

LIMITATIONS

None stated.

CONCLUSIONS

As in healthy humans, most healthy rats, faced with a complex and conflicting array of choices, were able to refrain from the drive for immediate gratification to rapidly select the options giving the best final payoff. Good decision makers were sensitive to enhanced task difficulty that delayed the development of a preference, as if the evaluation and the comparison of options had become more demanding. Conversely, the capacity of evaluation and deduction seems to be lacking or not employed in poor decision makers. This minority of healthy rats systematically persisted, like humans, in selecting the worse available options and in similar proportions.

KEYWORDS: animal model, decision making, gambling task, interindividual differences, reward sensitivity, risk taking

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