

Is the Lewis (LEW) Rat an appropriate control for the Spontaneously Hypertensive Rat (SHR) on a delay discounting task?



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Abstract

The Spontaneously Hypertensive rat (SHR), the most widely accepted rodent-model of Attention Deficit/Hyperactivity disorder (ADHD), is compared with its normotensive control the Wistar Kyoto (WKY) rat looking for between strains differences in impulsive choice. But the WKY is not a proper control for the SHR when the procedure requires locomotion to choose. The SHR has deficiencies in dopamine activity in nucleus accumbens causing lower tolerance to delayed outcomes than the WKY. Locomotion and anomalies in dopamine in the Lewis (LEW) rat are like those in the SHR, suggesting that the LEW is a good control for the SHR. This possibility was analyzed with SHRs and LEWs responding to concurrent-chains procedures. Choice was measured in the initial link where two random interval schedules arranged entries to two terminal links, one delivering 1-food pellet immediately and the other delaying 4-food pellets 0.1, 5, 10, 20, 40, or 80 s. Impulsive choice increased with increasing training, but the SHRs shown faster changes in preference making more impulsive choices than the LEWs. The hyperbolic-decay model and the generalized matching law fitted the data well. Positive correlations between discounting rate and sensitivity of choice to the immediacy of reinforcement suggest compatibility between models of choice.

Introduction

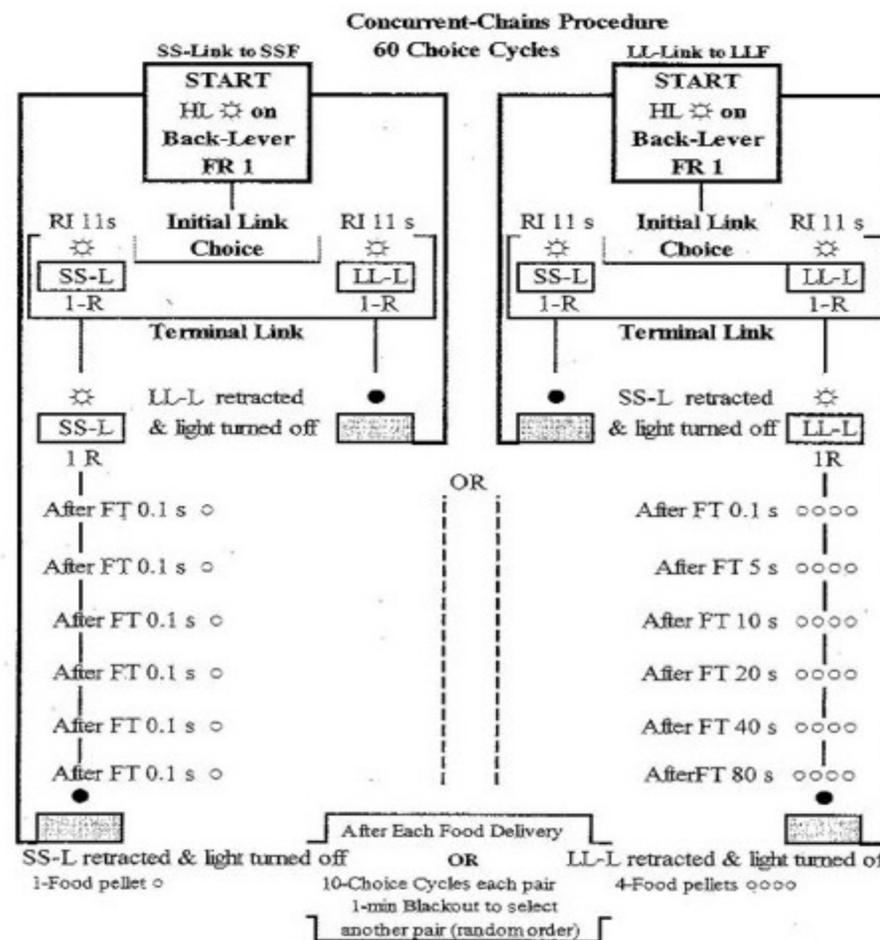
- Impulsivity is one of the symptoms characterizing Attention Deficit/Hyperactivity Disorder (ADHD) in children and adults. Impulsivity is associated with a preference for immediate rewards and unlikeliness to delay gratification (American Psychiatric Association, 2017).
- Impulsivity is studied by arranging a choice between a smaller sooner reinforcer (SSR) and a larger later reinforcer (LLR) (Logan, 1965), choosing the SSR over the LLR suggests impulsivity (Rachlin and Green, 1972) while LLR preference suggests self-controlled choice (Logue, 1988).
- Delay discounting refers to the finding that the LLR loses its value with the increasing delay to receive it (Chung and Herrnstein, 1967).
- The SHR is the most widely accepted animal model of ADHD (Sagvolden et al., 1992). The SHR was selectively bred from the WIS rats that had higher than normal systolic blood pressure, with the goal of developing a hypertensive strain of rats (Okamoto & Aoki, 1963).
- It has been shown that the SHR chooses more impulsively than its normotensive control the Wistar-Kyoto (WKY) rat (Aparicio et al., 2019; Fox et al., 2008; Orduña, 2015).
- Behavioral differences such as locomotor activity (Bergh et al., 2006; Clements, 2006; Ferguson et al., 2007; Grundt et al., 2009; Meneses et al., 2011). The WKY is hypoactive instead of normotensive (Alsop, 2007; Robertson et al., 2008).
- Genetic and neurochemical differences (Dasbanerjee et al., 2008; Drolet et al., 2002; Johnson et al., 1995). Differences in the expression of dopamine (Miller et al., 2012) and serotonin (Toot et al., 2004) in the nucleus accumbens which plays a role in reinforcement learning (Cardinal et al., 2001).

Objectives:

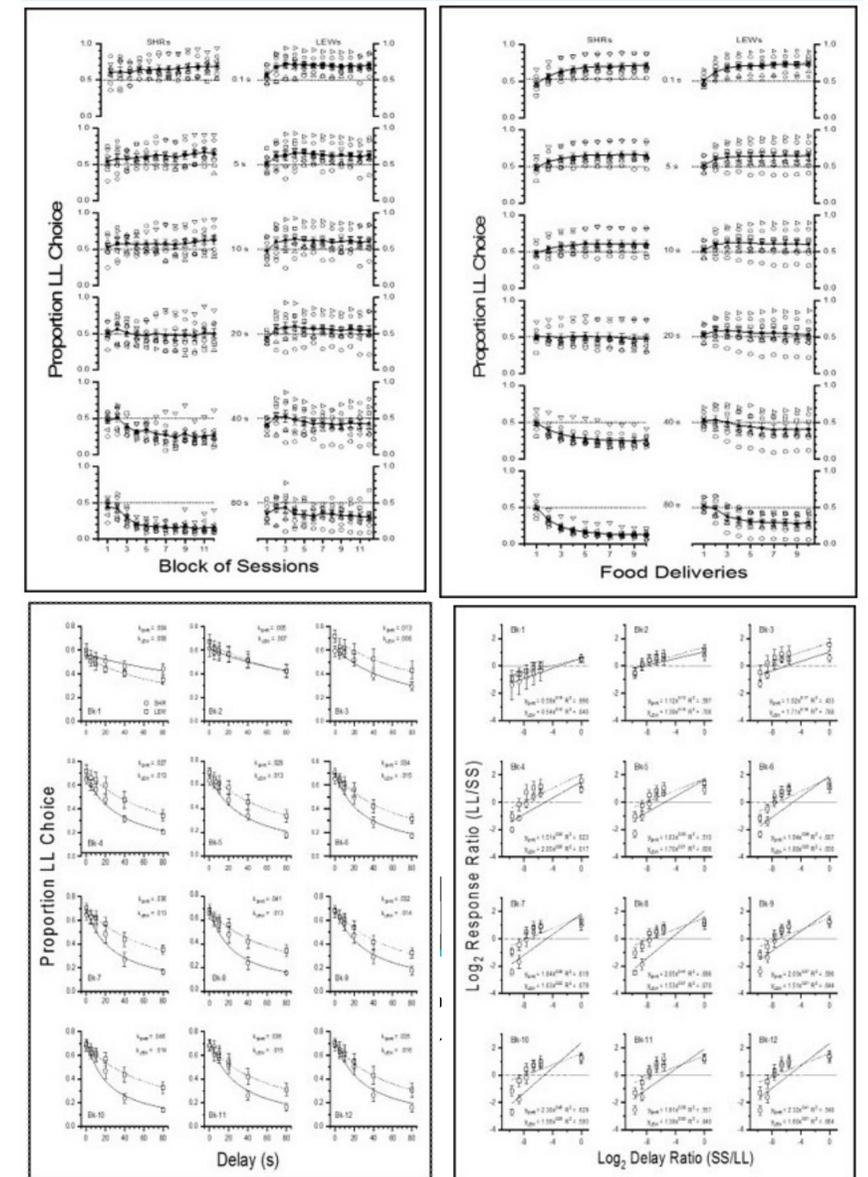
The purpose of this study is to determine whether the LEW rat would make an appropriate control for the SHR.

Since previous research has shown that the WKY rat chooses less impulsively than the SHR on concurrent chain procedures, the goal of this study is to use the same procedure to explore the possibility that the LEW rat also chooses less impulsively than the SHR.

Methods



Results



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