



Introduction

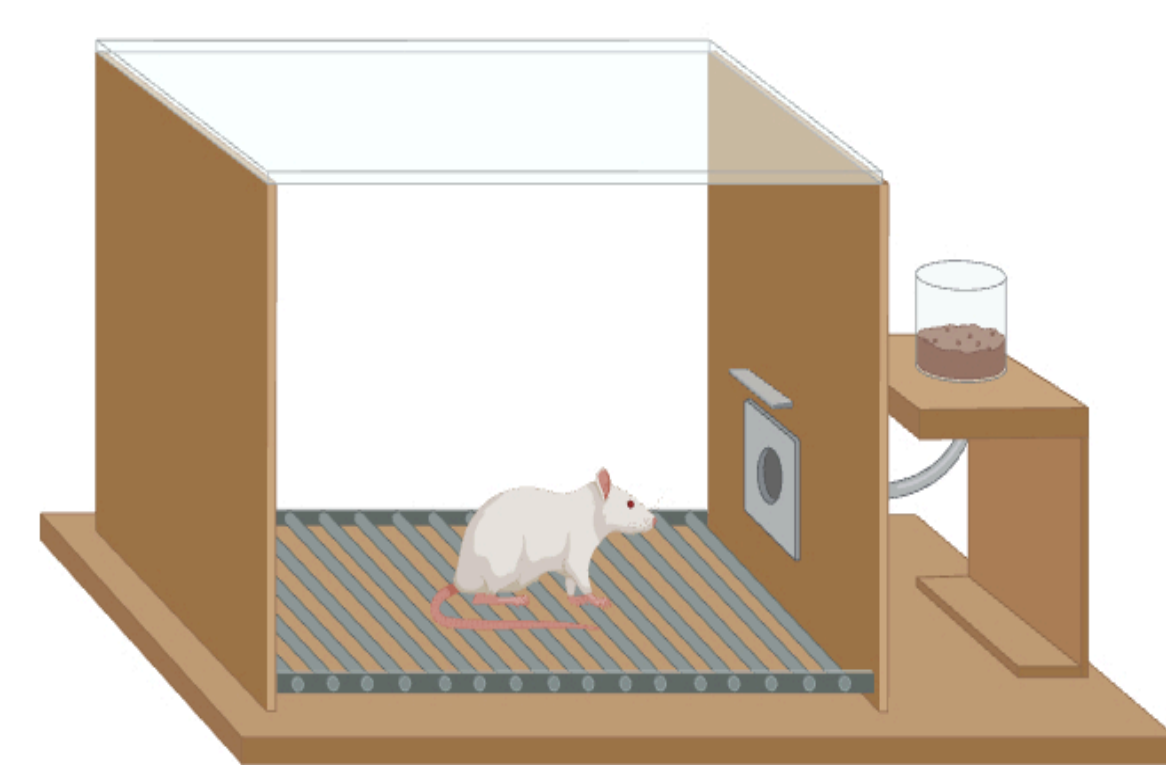
- The unexpected reduction in reward generates frustration (Amsel, 1992).
- Frustration is linked to **aggression, anxiety, depression, and addiction** (Green et al., 2026).
- Rats prefer a lever associated with a large reward (12 pellets) over a smaller reward (2 pellets).
- When the 12 pellet lever is **downshifted** to 2 pellets, while the unshifted lever remains at 2 pellets;
 - rats **switch their preference to the unshifted lever.** (Conrad & Papini, 2018).
- This shift is mediated by frustration due to violated reward expectations.
- Overtraining may increase expectancy and facilitate this switch in preference, or increase habit strength and reduce the shift to the unshifted lever.

Method

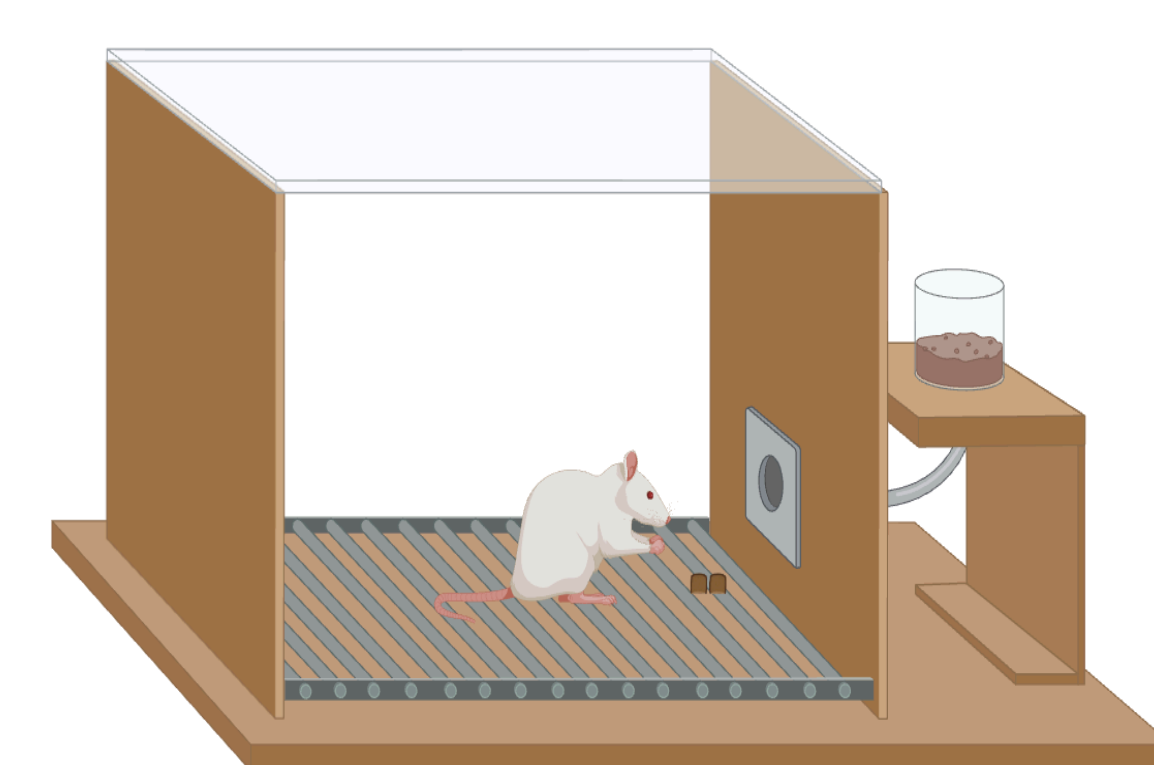
Part 1 - Forced-Choice Trials

- One lever was paired with 12 pellets, the other lever with 2 pellets, and food was delivered after lever presentation.
- Regular training group:** 10 sessions, 6 trials/session
- Overtraining group:** 30 sessions, 6 trials/session
- Control measures:** Half of all groups had 12 pellets assigned to the left lever and 2 to the right. The other half had the opposite assignment.
- Preference for the higher reward lever was confirmed in a magnitude test.

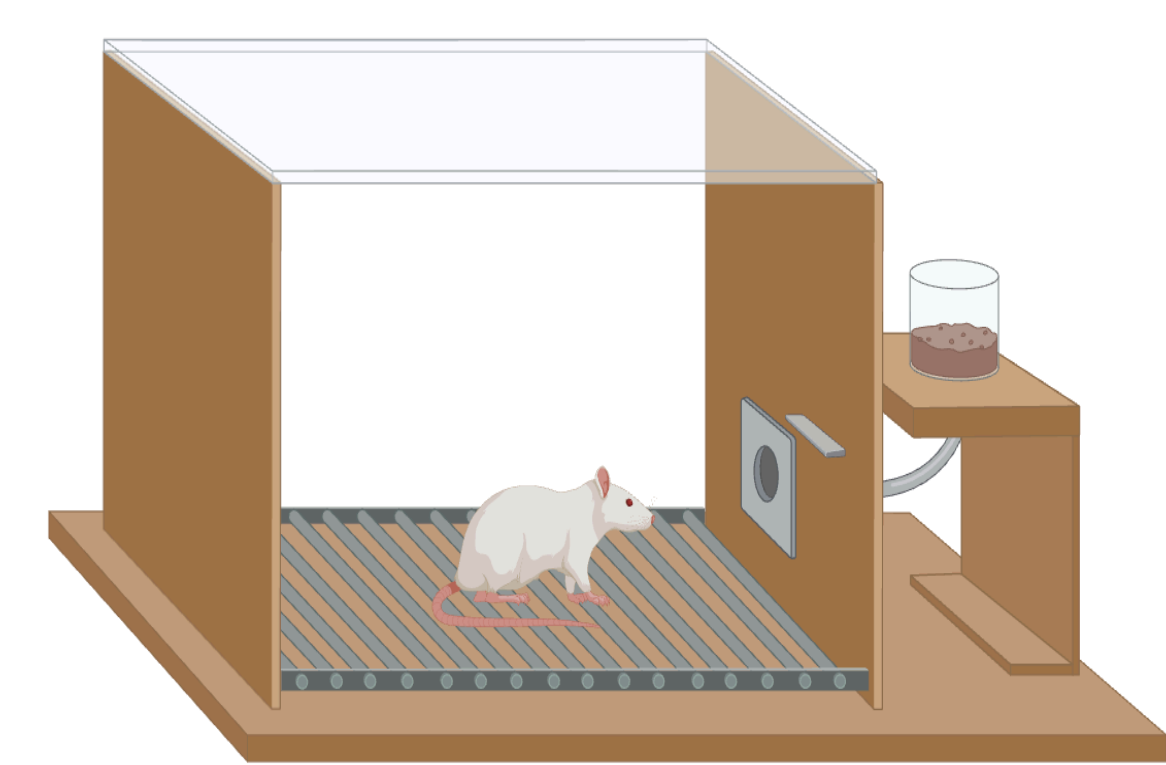
Left Lever Presented



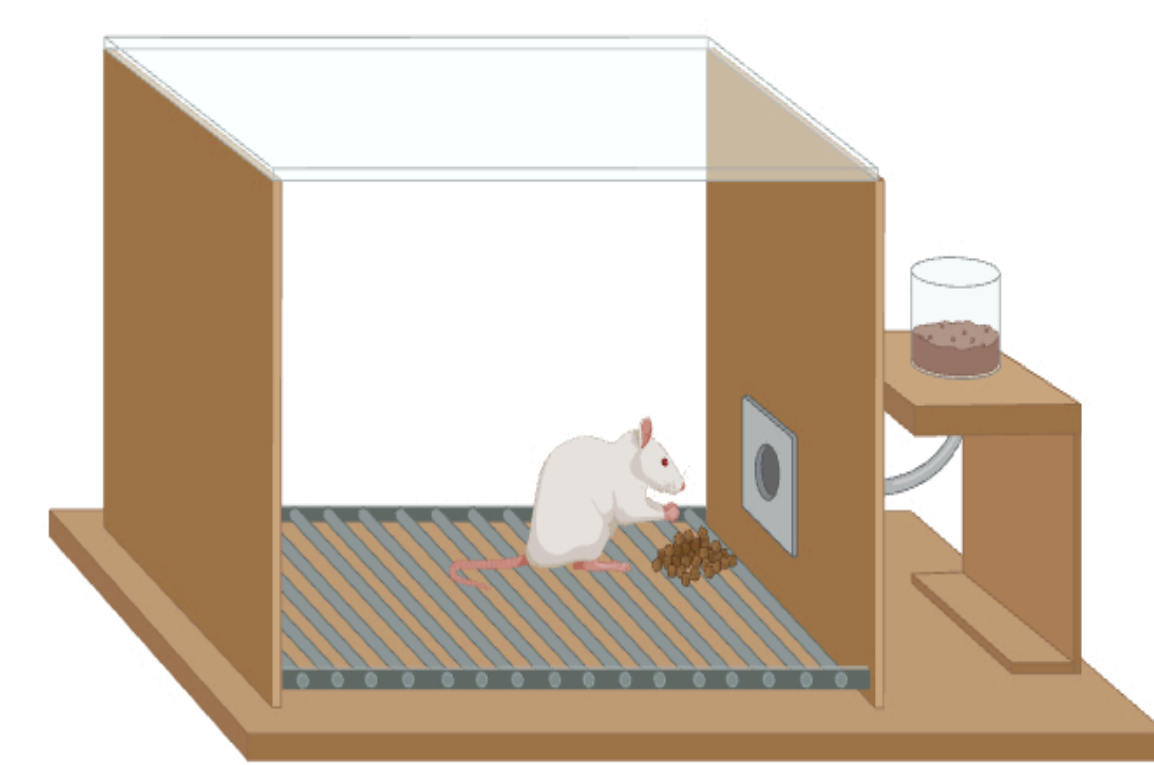
12 Pellets Administered



Right Lever Presented

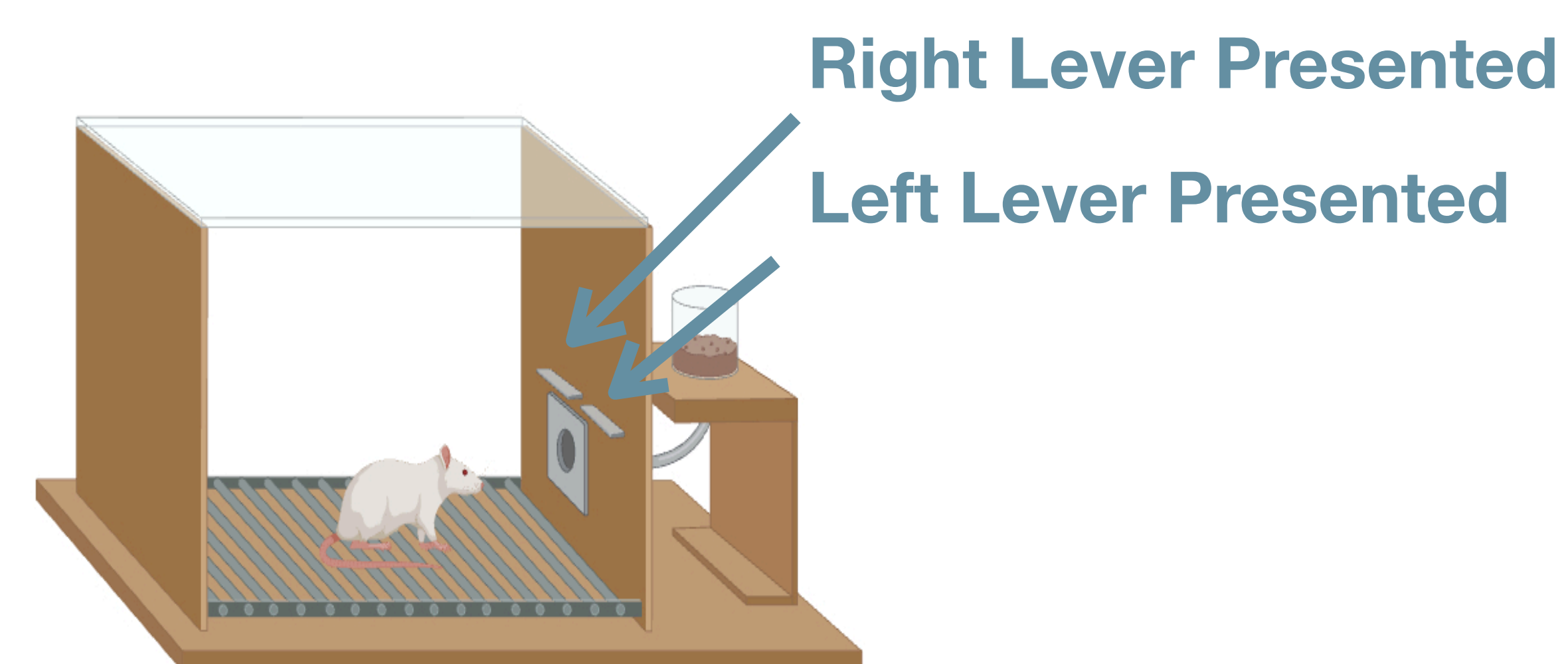


2 Pellets Administered



Part 2 - Free-Choice Trials

- The **12 pellet lever** was **downshifted** to 2 pellets.
- Free-choice trials** were then conducted.
- Both levers were presented at the same time, allowing the rat to **choose between them.**



Results - Overtrained Rats Rapidly Reverse Preference After Reward Downshift

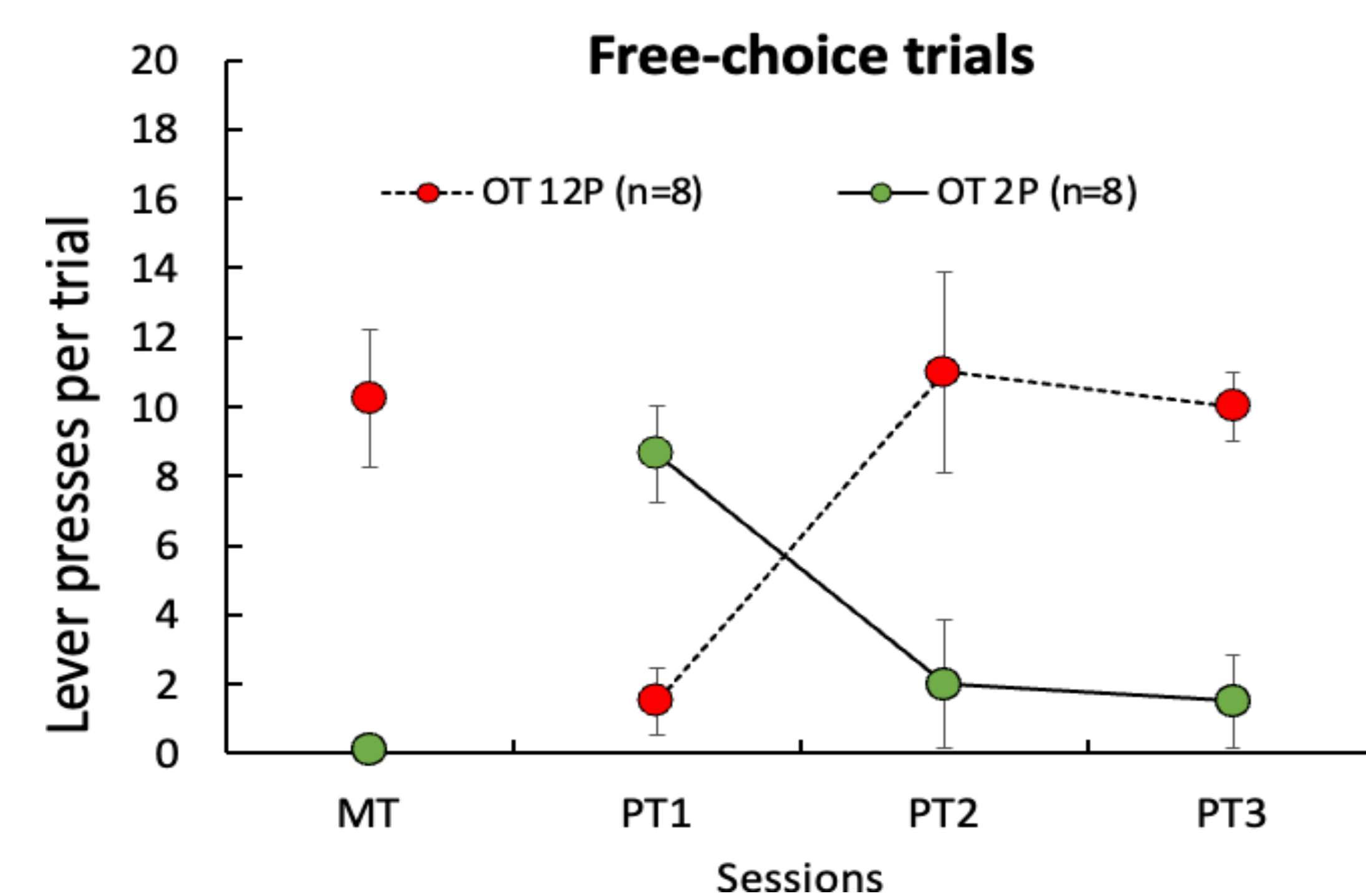


Figure 1. Mean lever presses for the overtraining (OT) group during magnitude test (MT) and free choice trials. 12P represents the downshifted lever, and 2P represents the unshifted lever. PT1 is the first day of preference switch to the unshifted lever, with PT2 and PT3 being the 2 following days.

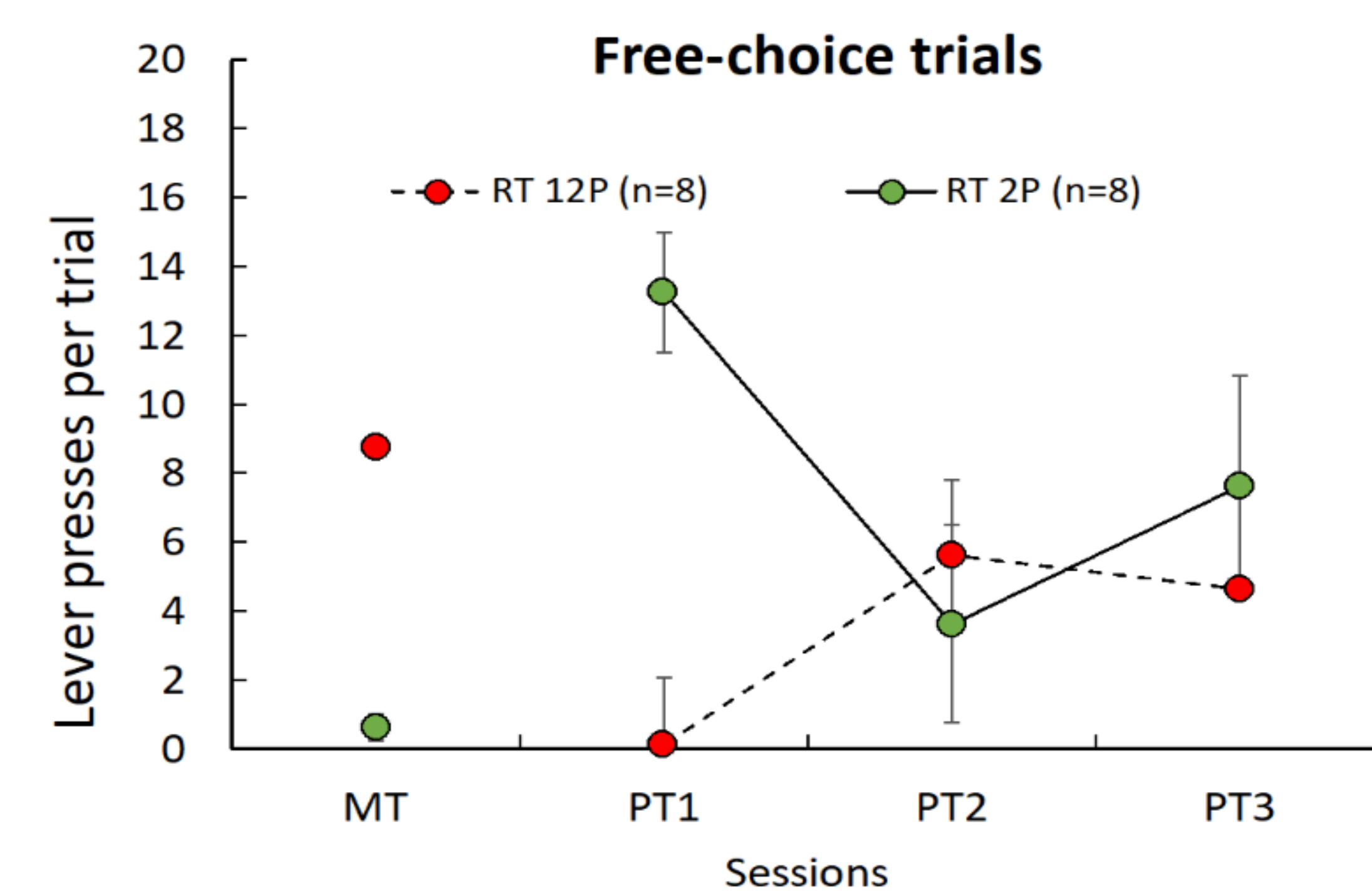


Figure 2. Mean lever presses for the regular training (RT) group during magnitude test and free choice trials. (Same conventions as Figure 1).

- Rats switched preference from the unshifted (2-pellet) lever back to the downshifted lever (12 -> 2 pellets) after **only one trial.**
- This rapid switch was **not observed in the regular training group.**
- OT reversed the preference to the pre-shift state.
- RT had an elimination of preference for either lever.

Discussion - Possible Habit Formation

- These results suggest that overtrained rats may have formed a **habit-like response** following reward downshift.
- This is likely due to an increased number of sessions exposed to the larger magnitude (12-pellet) lever.

Current Directions

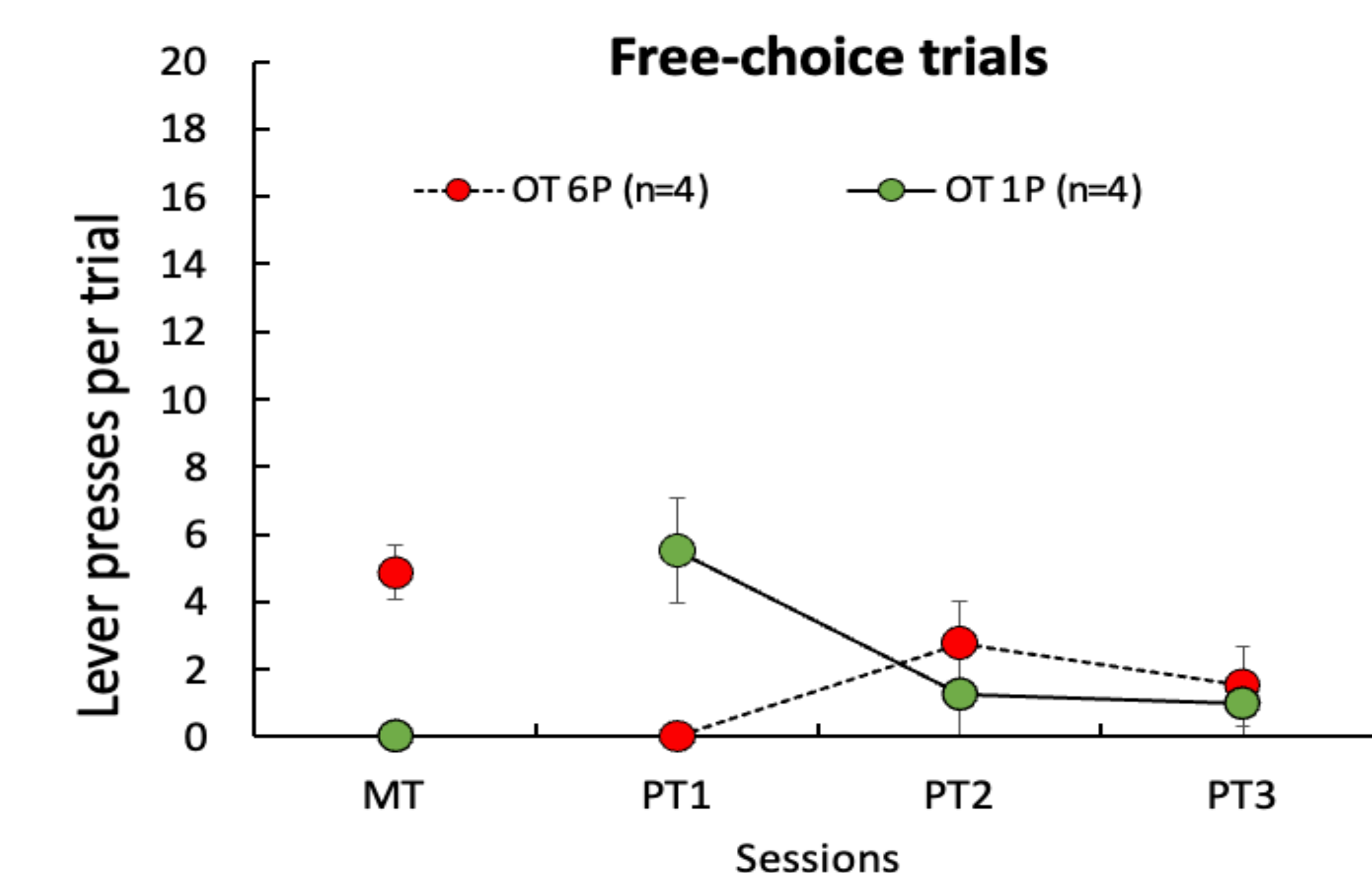


Figure 3. Mean lever presses for the overtraining group during magnitude test (MT) and free choice trials. The conventions are the same as Figure 1, although 6P represents the 6 pellet lever and 1P is the 1 pellet lever.

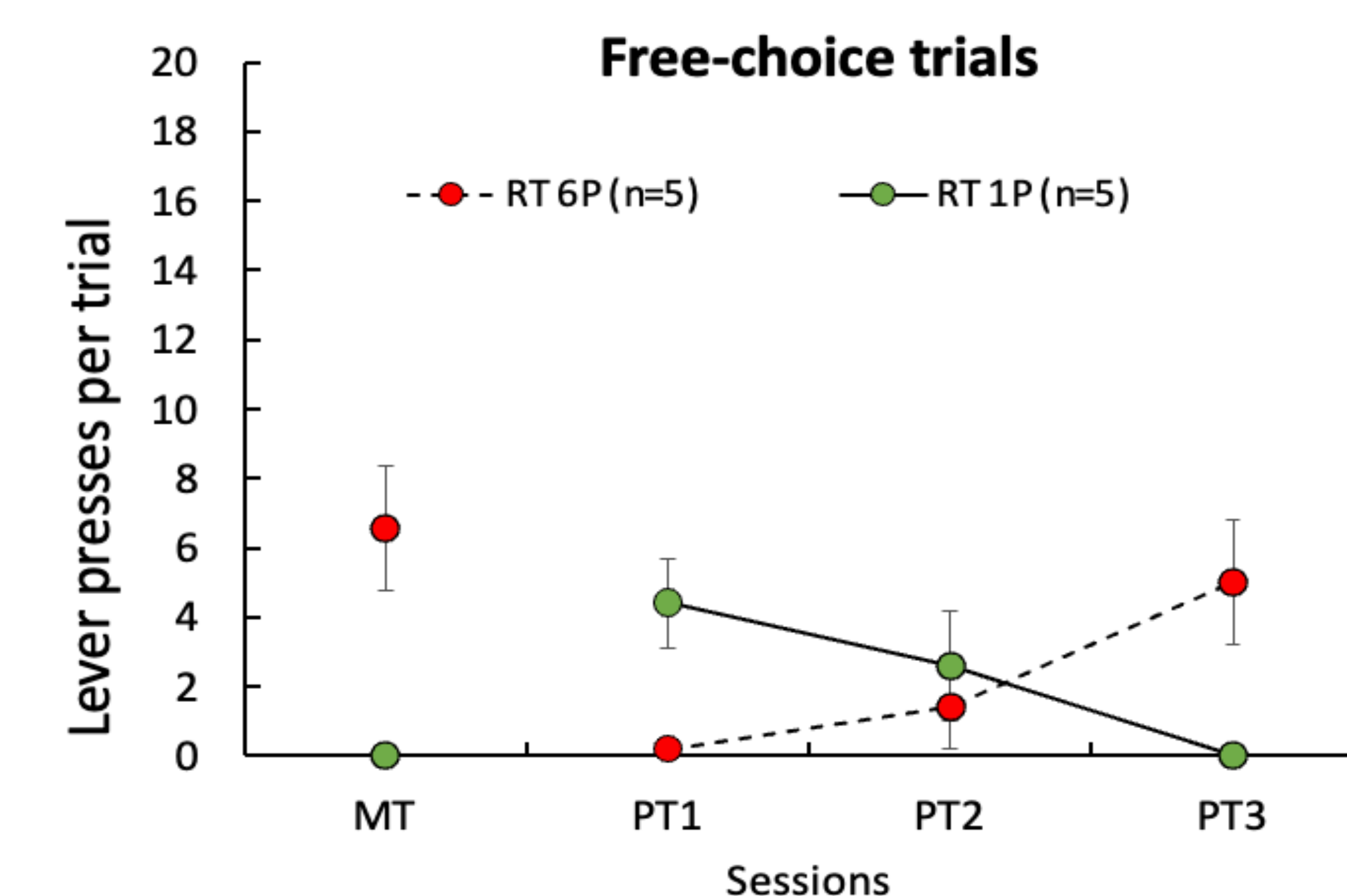


Figure 4. Mean lever presses for the regular training group during magnitude test (MT) and free choice trials. The conventions are the same as Figure 1, although 6P represents the 6 pellet lever and 1P is the 1 pellet lever.

- We are currently investigating overtraining done **differently:**
 - Regular training group:** 10 sessions, 6 trials/session
 - Overtraining group:** 10 sessions, 18 trials/session
 - Each lever is paired with either 6 pellets or 1 pellet.
- So far we are not seeing a potential habit formation response in the new paradigm.
- The number of sessions** may be an crucial factor in determining whether this behavior occurs.

Acknowledgments

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References

Amsel, A. (1992). *Frustration Theory*. Cambridge University Press.
 Conrad, S. E., & Papini, M. R. (2018). Reward shifts in forced-choice and free-choice autoshaping with rats. *Journal of Experimental Psychology: Animal Learning and Cognition*, 44(4), 422-440. <https://doi.org/10.1037/xan0000187>
 Green, T. A., Leibenluft, E., Li, Z., Ogawa, M., Sabariego, M., Marmol Contreras, Y., Bellaert, N., & Papini, M. R. (2026). Frustrative nonreward: A century of progress. *Neuroscience & Biobehavioral Reviews*, 185, 106651. <https://doi.org/10.1016/j.neubiorev.2026.106651>