

Measuring motivation in Parkinson's disease through the eyes response to money

Apathy or a lack of motivation is a disabling condition making patients feel that they “just can’t be bothered to do things”. Apathy is very common in Parkinson’s disease, affecting up to 70% of patients and causing a significant health burden to patients and their care givers. Alterations in brain areas that process how much we value rewards may contribute to apathy. However, exactly how is poorly understood, limiting treatment options. Despite apathy being a very big problem for patients, we know very little about the underlying mechanisms and have limited methods of objectively measuring it.

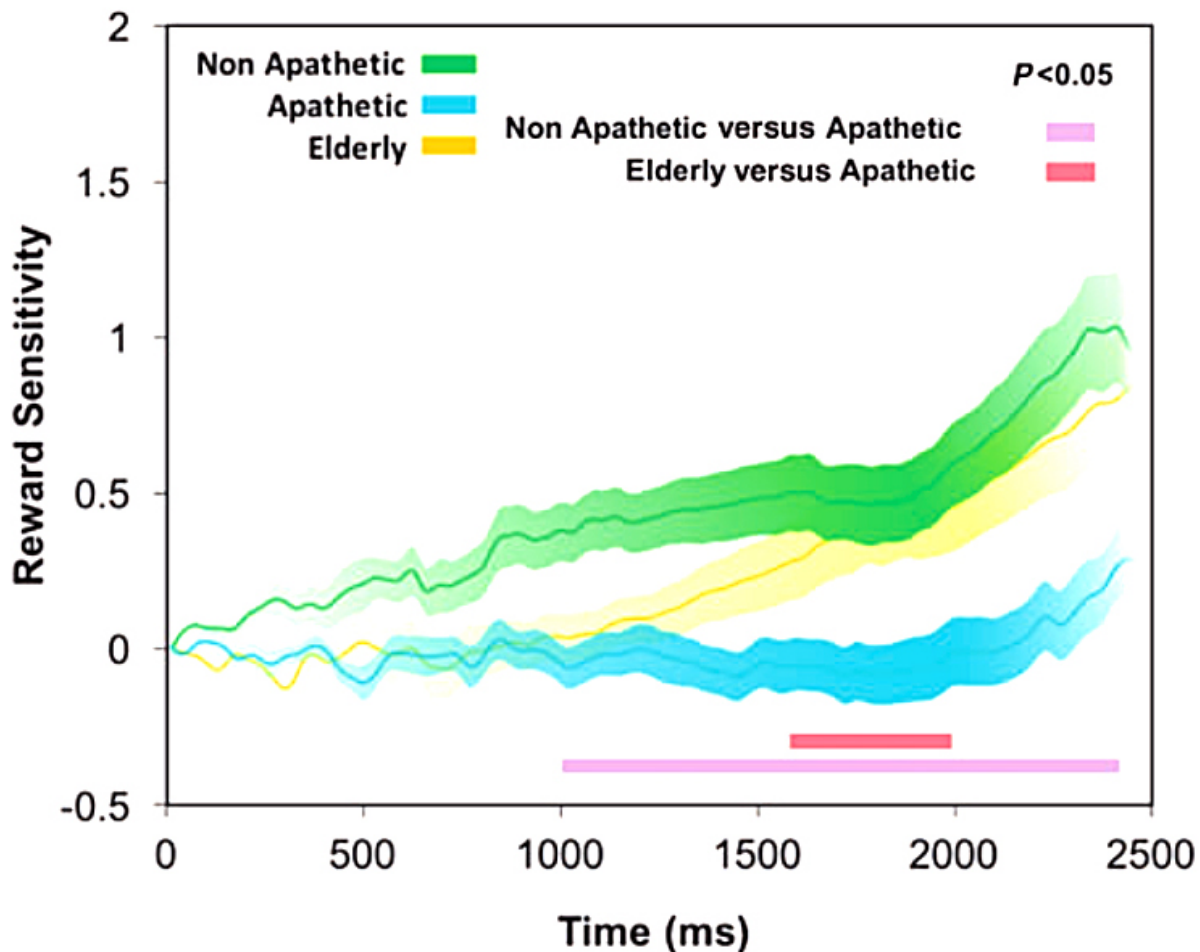


Fig. 1. Those patients with Parkinson’s disease and clinical apathy (blue line) have a blunted response in their pupil to the money on offer in comparison to those who are more motivated and not apathetic (green line). Age matched healthy participants are shown in yellow and have greater reward sensitivity than patients with apathy.

Using an infrared eye-tracker we were able to objectively measure how much Parkinson's disease patients value rewards based on the speed of their eye movement and the change in pupil diameter for monetary incentives. On hearing an auditory monetary incentive over a loud speaker, patients move their eyes to a target on a computer screen while their eyes are tracked using an infrared camera. The faster they move their eyes towards the targets the more money they receive. While they do this their pupil response to the money on offer is measured.

Twenty young participants, thirty-one elderly controls and forty patients with the neurodegenerative brain condition Parkinson's disease took part in the study. In order to assess the role of the brain chemical dopamine on pupil responses to reward, thirty of the patients with Parkinson's disease were assessed over two separate sessions, once ON their normal dopamine medication and once when they were OFF their drugs.

The findings from this study show that apathetic individuals with Parkinson's disease have significantly less pupillary response during the evaluation of reward compared to non-apathetic patients. The brain chemical dopamine was also found to play a key role in this valuation, with blunting of the pupil response to reward when patients were OFF their drugs and restoration of reward sensitivity when ON dopamine medication. Dopamine also had an effect on the speed of eye movements, making patients move faster for bigger rewards on offer, while also becoming more accurate in their movements.



Fig. 2.

The individual differences in the pupil response to reward showed an association with motivation levels, providing a potential new detection and monitoring method for apathy and allowing us to understand its mechanisms in greater detail.

We also show in this study that drugs that modulate the brain chemical dopamine, may be an effective treatment for apathy by increasing reward sensitivity in Parkinson's disease patients.

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Publication

[Reward sensitivity deficits modulated by dopamine are associated with apathy in Parkinson's disease.](#)

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