

## Self-Selected Intensity and Discounting Rates of Exercise in Comparison with Food and Money in Healthy Adults

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**Abstract :** Background: Exercise is widely acknowledged as a highly important health behavior, which reduces risks related to lifestyle diseases like type 2 diabetes, cardiovascular disease. However, exercise adherence is low in high-risk groups and sedentary lifestyle is more the norm than the exception. Expressed reasons for exercise participation are often based on delayed outcomes related to health threats and benefits but also enjoyment. Whether exercise is perceived as rewarding is well established in animal literature but the evidence is sparse in humans. Additionally, the question how stable any reward is perceived with time delays is an important question influencing decision-making (in favor or against a behavior). For the modality exercise, this has not been examined before. We, therefore, investigated the discounting of pre-established self-selected exercise compared with established rewards of food and money with a computer-based discounting paradigm. We hypothesized that exercise will be discounted like an established reward (food and money); however, we expect that the discounting rate is similar to a consumable reward like food. Additionally, we expected that individuals' characteristics like preferred intensity, physical activity and body characteristics are associated with discount rates. Methods: 71 participants took part in four sessions. The sessions were designed to let participants select their preferred exercise intensity on a treadmill. Participants were asked to adjust their speed for optimizing pleasantness over an exercise period of up to 30 minutes, heart rate and pleasantness rating was measured. In further sessions, the established exercise intensity was modified and tested on perceptual validity. In the last exercise session rates of perceived exertion was measured on the preferred intensity level. Furthermore, participants filled in questionnaires related to physical activity, mood, craving, and impulsivity and answered choice questions on a bespoke computer task to establish discounting rates of their preferred exercise (kex), their favorite food (kfood) and a value-matching amount of money (kmoney). Results: Participants self-selected preferred speed was  $5.5 \pm 2.24$  km/h, at a heart rate of  $120.7 \pm 23.5$ , and perceived exertion scale of  $10.13 \pm 2.06$ . This shows that participants preferred a light exercise intensity with low to moderate cardiovascular strain based on perceived pleasantness. Computer assessment of discounting rates revealed that exercise was quickly discounted like a consumable reward, no significant difference between kfood and kex ( $kfood = 0.322 \pm 0.263$ ;  $kex = 0.223 \pm 0.203$ ). However, kmoney ( $kmoney = 0.080 \pm 0.02$ ) was significantly lower than the rates of exercise and food. Moreover, significant associations were found between preferred speed and kex ( $r = -0.302$ ) and between physical activity levels and preferred speed ( $r = 0.324$ ). Outcomes show that participants perceived and discounted self-selected exercise like an established reward (food and money) but was discounted more like consumable rewards. Moreover, exercise discounting was quicker in individuals who preferred lower speeds, being less physically active. This may show that in a choice conflict between exercise and food the delay of exercise (because of distance) might disadvantage exercise as the chosen behavior particular in sedentary people. Conclusion: exercise can be perceived as a reward and is discounted quickly in time like food. Pleasant exercise experience is connected to low to moderate cardiovascular and perceptual strain.

**Keywords :** delay discounting, exercise, temporal discounting, time perspective

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