

Popular Science Summary of the Project

The placebo effect – the psychological impact of participants' expectations regarding a substance's effects – can cause real, measurable changes in behavior, physical performance, and physiological responses. A growing body of research shows that simply believing one has taken an active substance – even when only a neutral compound has been administered – can enhance athletic performance, reduce perceived fatigue, and even affect mood and stress hormone levels.

This phenomenon is particularly noticeable in the case of well-known and socially accepted substances that are commonly associated with improved physical performance. One such example is caffeine – one of the most widely used legal ergogenic aids, utilized by both amateur and professional athletes. Its effectiveness has been confirmed in numerous studies: a standard dose of 3–6 mg/kg of body weight can enhance physical performance, primarily by blocking adenosine receptors, which increases alertness and delays the sensation of fatigue.

Interestingly, even the belief that caffeine has been consumed can produce similar effects – regardless of whether it was actually ingested. This makes caffeine an ideal model for studying the placebo effect in the context of physical exertion – its well-known mechanisms and strong social associations allow for controlled investigation into how expectations alone can influence bodily functions.

The project will involve a randomized, double-blind study with healthy adult participants. Each participant will take part in four test sessions – two with caffeine and two with a placebo – without knowing which substance they have received. This procedure will allow researchers to examine to what extent beliefs about the substance's effects influence performance, independent of caffeine's actual pharmacological impact.

The primary goal of the project is to develop a mathematical model estimating the magnitude of the placebo effect. This model could be applied across various fields – from sports to pharmacology – as a tool for assessing how much of the psychophysical changes can be attributed to participants' beliefs in a substance's effectiveness. The model will incorporate both behavioral data (e.g., physical performance, reaction time) and biological data (e.g., levels of stress hormones like cortisol and testosterone, as well as salivary amylase concentration as an indicator of sympathetic nervous system activation).

Although the research is conducted primarily in a sports context, its implications extend far beyond the field of athletics. In medicine and pharmacology, the placebo effect plays a particularly important role – patients' expectations, both positive (placebo) and negative (nocebo), can significantly influence therapeutic outcomes. A better understanding of placebo mechanisms in physical activity could contribute to improved design of clinical trials, therapeutic programs, and pain management approaches.

The project aligns with the broader field of research on the biopsychosocial mechanisms of the placebo effect, combining subjective data (expectations) with objective biological and behavioral markers. This comprehensive perspective allows us to view the placebo effect not as a scientific curiosity, but as a real, measurable, and potentially useful factor affecting human health, performance, and well-being.