Evidence in reality: the athlete's brain, placebo effects, and the emerging neurobiology of the coach-athlete relationship

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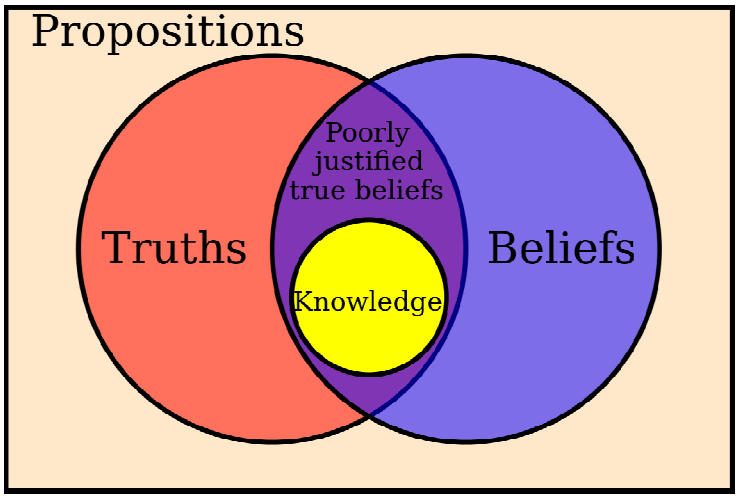
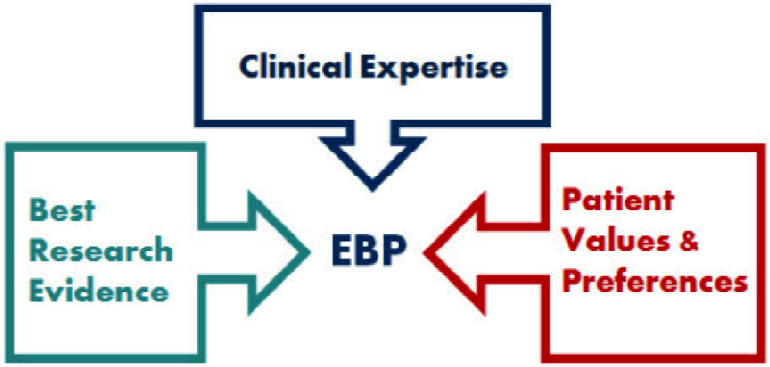
Overview: evidence and evidence-based practice

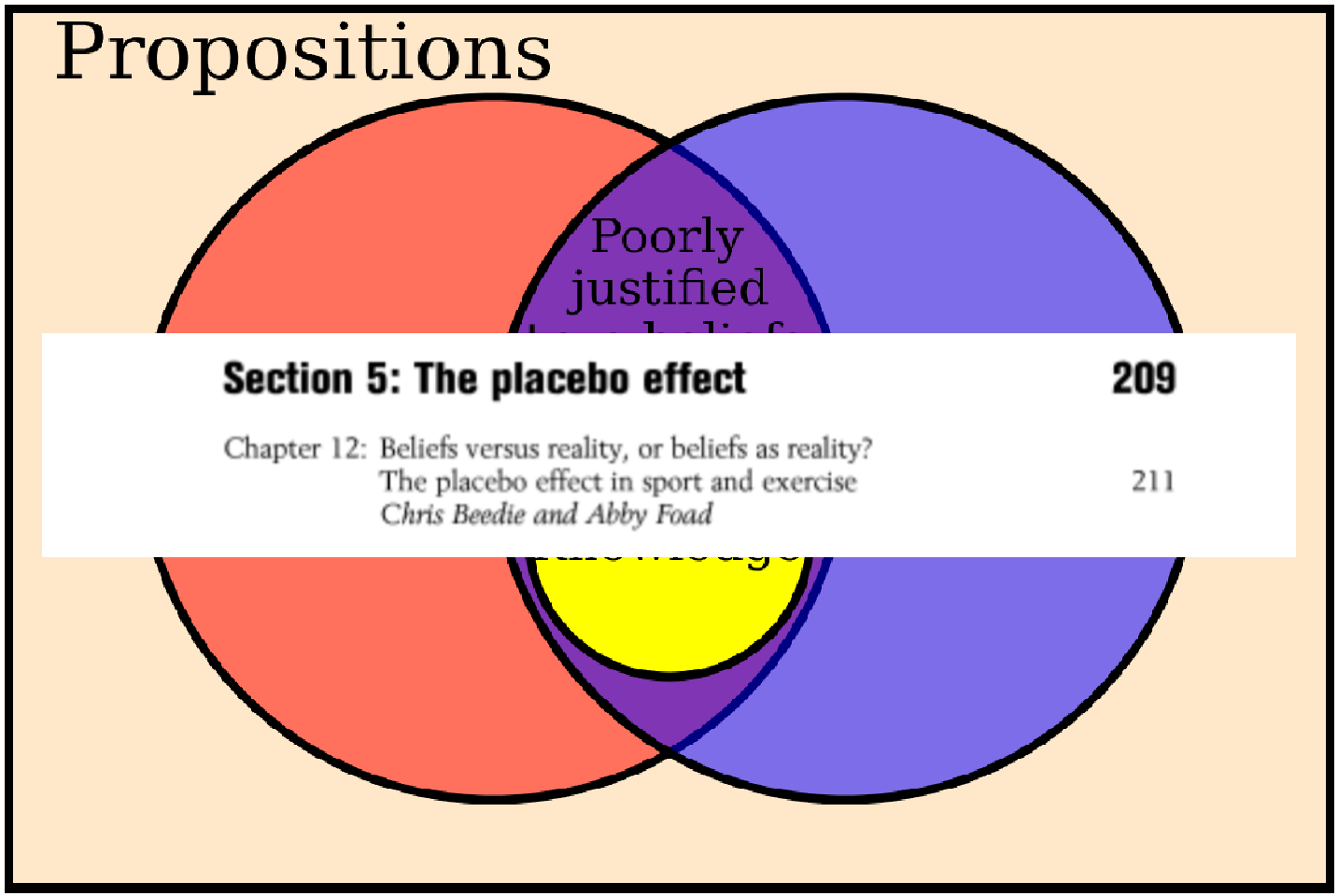
- Evidence: the available body of facts or information indicating whether a belief or proposition is true or valid





- Evidence-based practice (EBP): the integration of clinical expertise, patient values, and the best research evidence into the decision making process for patient care

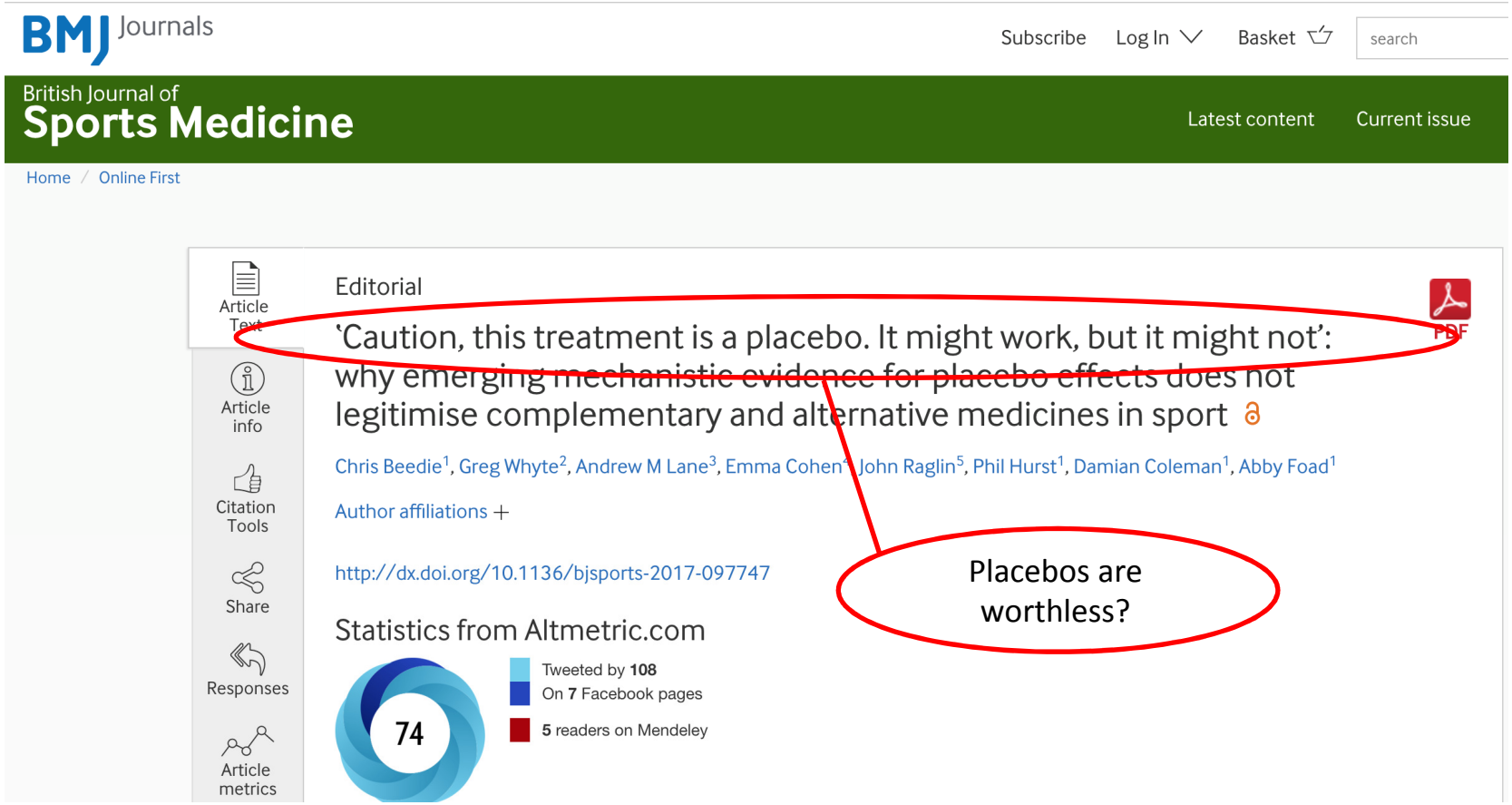
Evidence, beliefs, truths and knowledge



Section 5: The placebo effect **209**

Chapter 12: Beliefs versus reality, or beliefs as reality?
The placebo effect in sport and exercise 211
Chris Beedie and Abby Foad

If an intervention is a placebo, does that mean it is worthless….?

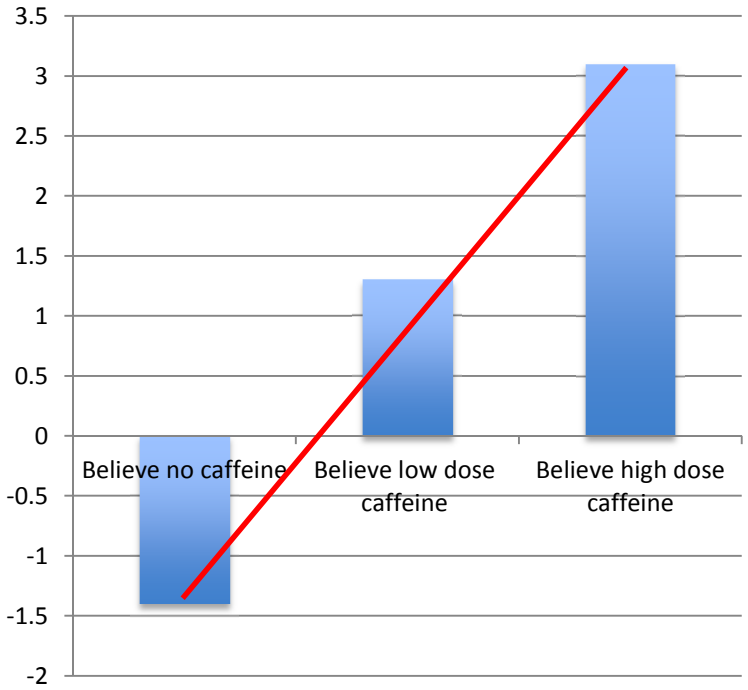


Evidence for placebo effects in sports performance

- I will describe to you evidence for placebo effects that enhance sports performance
- In each case, these effects are the result of verbal communication
- In any verbal communication scenario, you have the opportunity to enhance, maintain, or reduce the placebo effect

Evidence for placebo effects in sports performance

- **Beedie et al. Placebo effects of caffeine on cycling performance.** ***Med. Sci. Sport. Ex. 2006***
- Participants informed one each of
  - Placebo
  - Low dose caffeine (4.5 mg/kg)
  - High dose caffeine (9.0 mg/kg)
- Placebo administered in each condition
  - Believed placebo -1.5%
  - Believed low dose caffeine +1.5%
  - Believed high dose caffeine +3.0%
- Dose response effect of placebo?

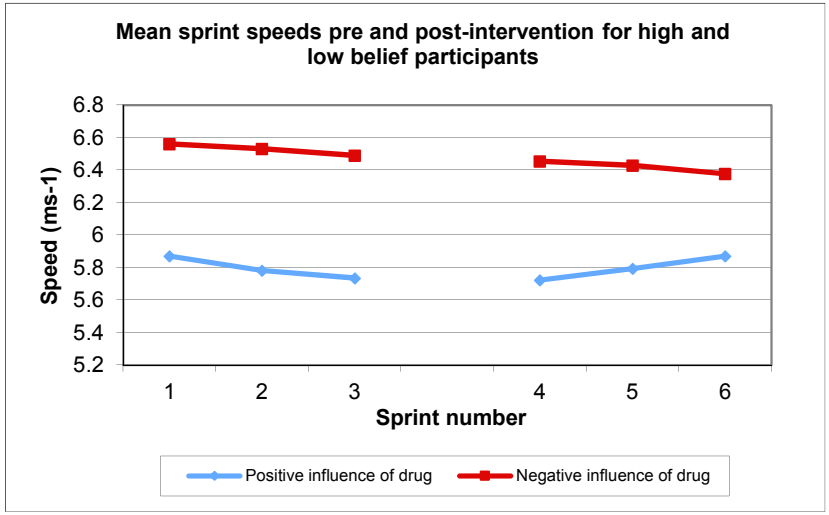


Athlete set up their own *implicit* expectations

- We informed cyclists that they would receive treatments randomly assigned (repeated-measures design)
- After T1:
  - "What do you think you had today"?
  - They all answered "It felt as hard as baseline, so placebo….."
- After T2:
  - "What do you think you had today"?
  - All but one answered "Felt easier, but not too easy, so low dose caffeine..."
- Prior to T3
  - All but one participant was *expecting* high dose caffeine...
- Greater implicit expectation of effect related to greater effect
- Dose-response effect was for expectation, not for placebo

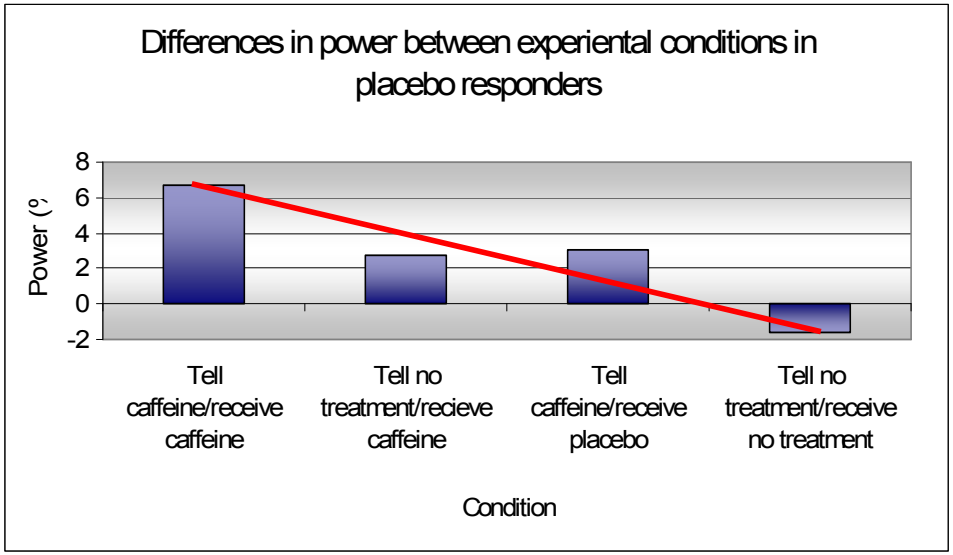
Evidence for placebo effects in sports performance

- **Beedie et al. (2007). Positive and negative placebo effects resulting from the deceptive administration of an ergogenic aid. *Int J Spo Nut Ex Met, 2007***
- Athletes told positive and negative stories about the same ‘drug’
- Between-subjects repeat sprint protocol
- Performance in line with story, not ‘drug’
- Nocebo effect on performance



Evidence for placebo effects in sports performance

- **Foad et al. Psychological & pharmacological effects of caffeine on 40km cycling performance.** ***Med. Sci. Sport. Ex. 2008***
- Cyclists informed/given
  - Caffeine/caffeine (C/C)
  - Caffeine/placebo (C/P)
  - No-treatment/caffeine (P/C)
  - No-treatment/no-treatment (P/P)
- Findings
  - (C/C) +6.0%
  - (C/P) +3.0%
  - (P/C) +2.5%
  - (P/P) -1.5%



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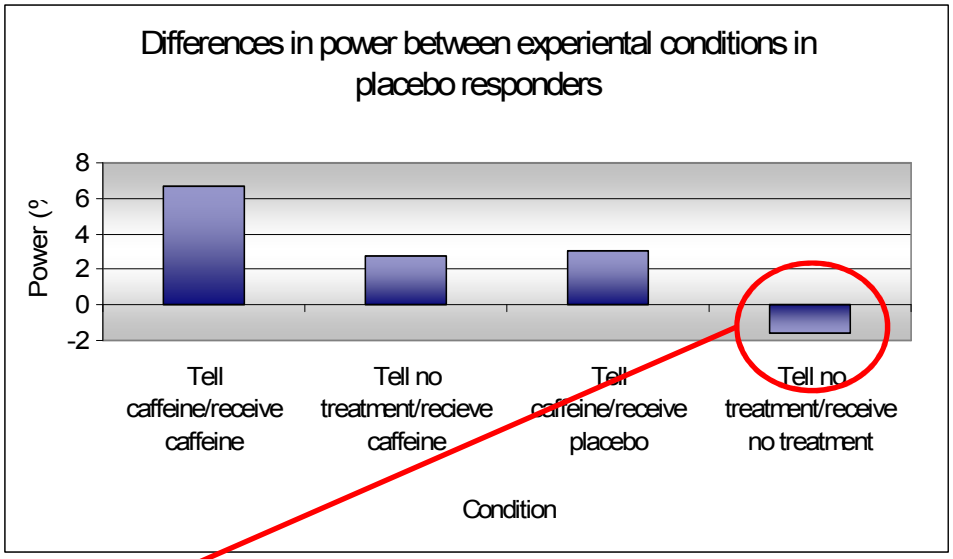
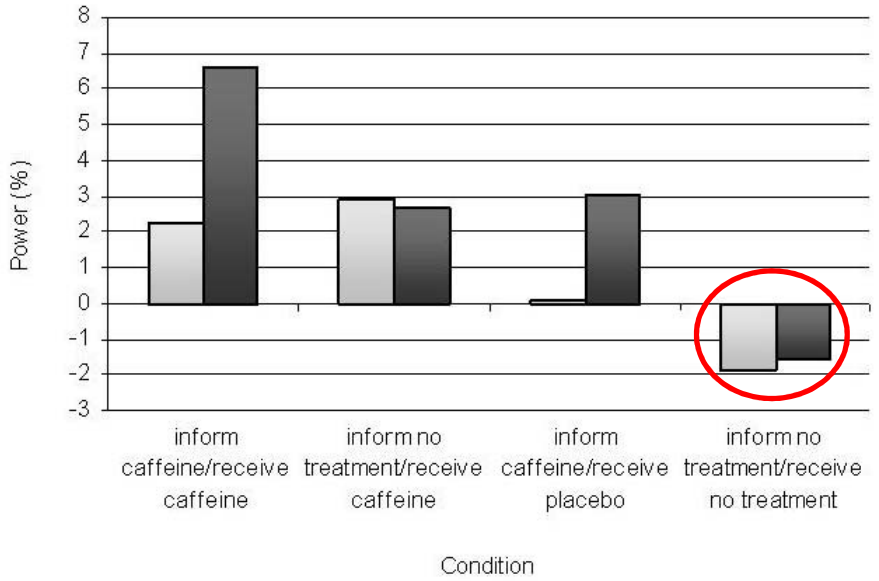


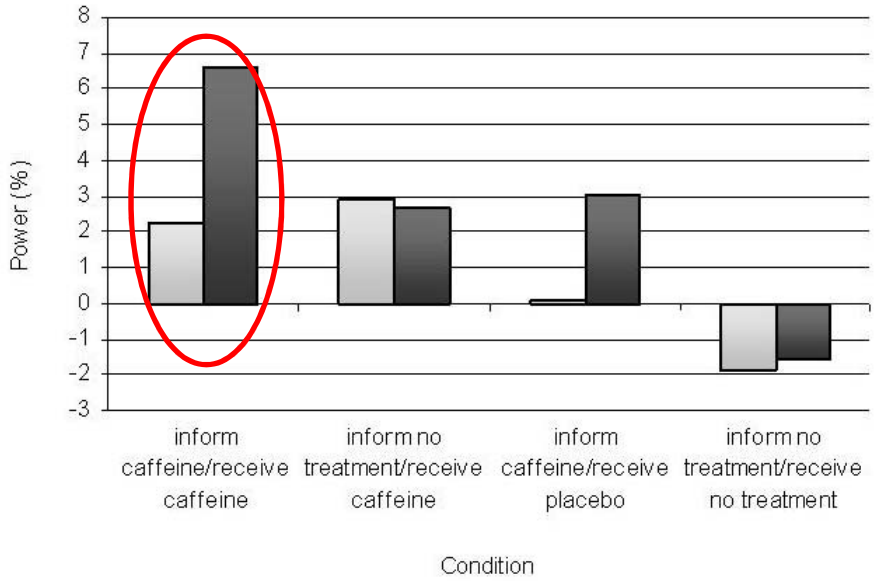
Some athletes appeared to respond to expectation, whilst others did not…?

- **Beedie et al. Identification of placebo responsive athletes in 40-km cycling performance. *J. Sport. Sci. Med. 2008***
- Responders and non-responders both performed below baseline when they correctly believed they had received no caffeine



Some athletes appeared to respond to expectation, whilst others did not…?

- **Beedie et al. Identification of placebo responsive athletes in 40-km cycling performance. *J. Sport. Sci. Med. 2008***
- Placebo responders responded better to real caffeine than did placebo non responders

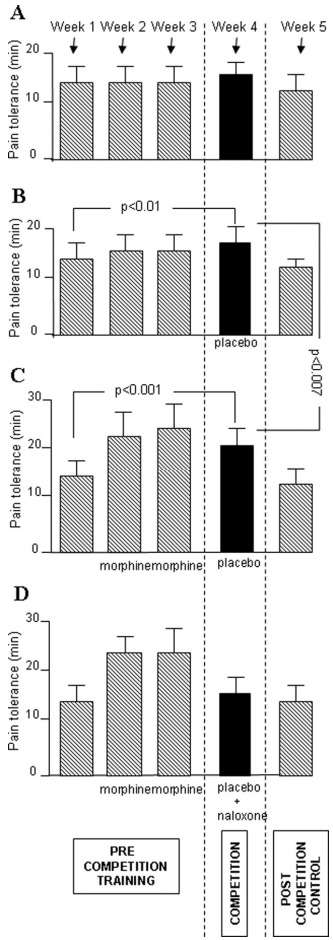


The question I’m asked more than any other:

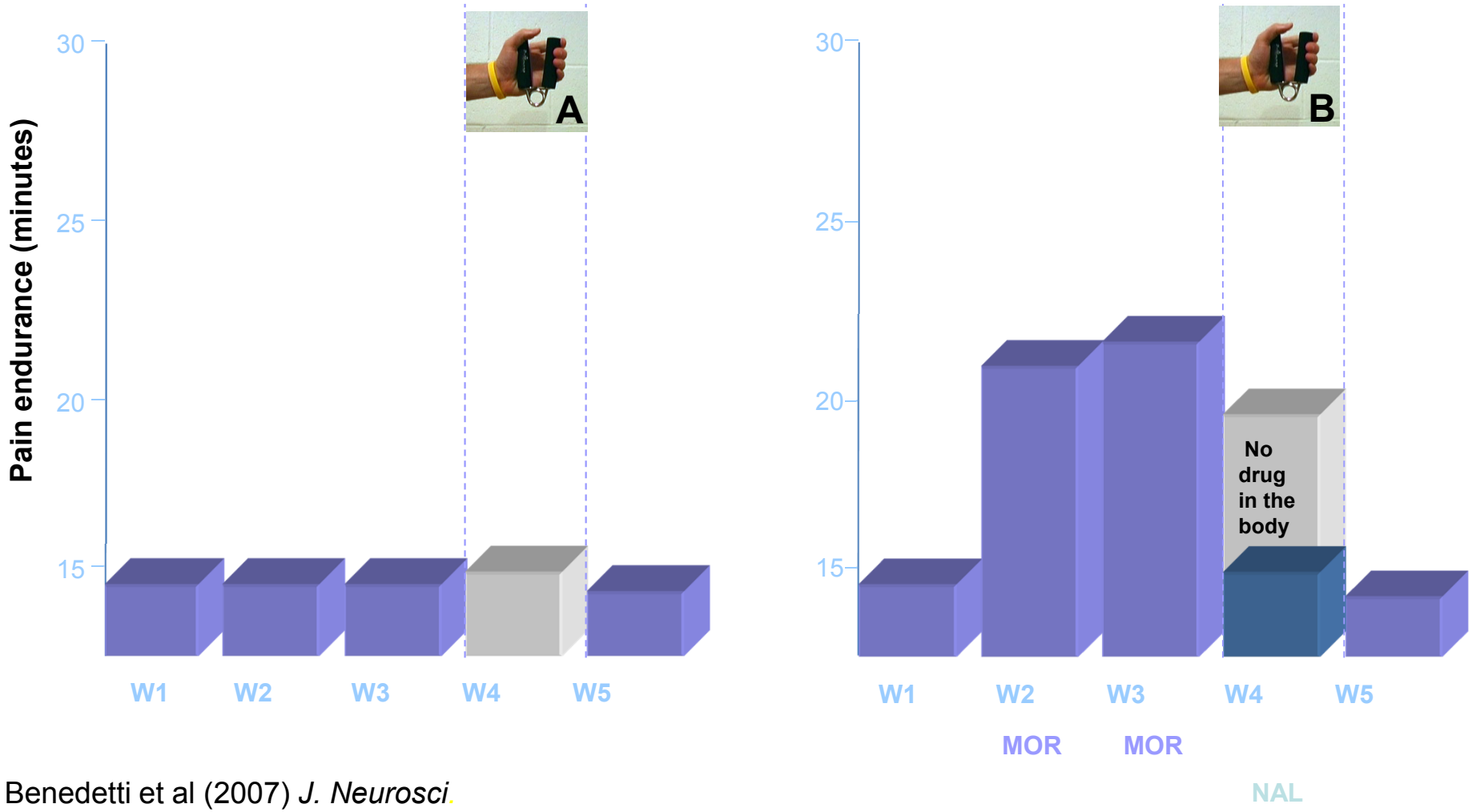
Is it possible to create a placebo responsive athlete?

Can we ‘create’ a placebo responder? Conditioned effects of morphine in a muscle task

- **Benedetti et al. Opioid-mediated placebo responses boost pain endurance and physical performance: is it doping in sport competitions*? J. Neurosci. 2007***
- Hand grip task. Repeated injections of morphine in training phase
- Replacement of morphine with injection of placebo on the day of competition
- Opioid-mediated increase of pain endurance and physical performance observed



Can we ‘create’ a placebo responder? Conditioned effects of morphine in a muscle task



Benedetti et al (2007) *J. Neurosci*.

But……

- Despite suggesting that the ‘athlete’ would not be doping on the day of competition…
  - The study used a drug
  - The study used injections
  - The process is unethical and banned in sport

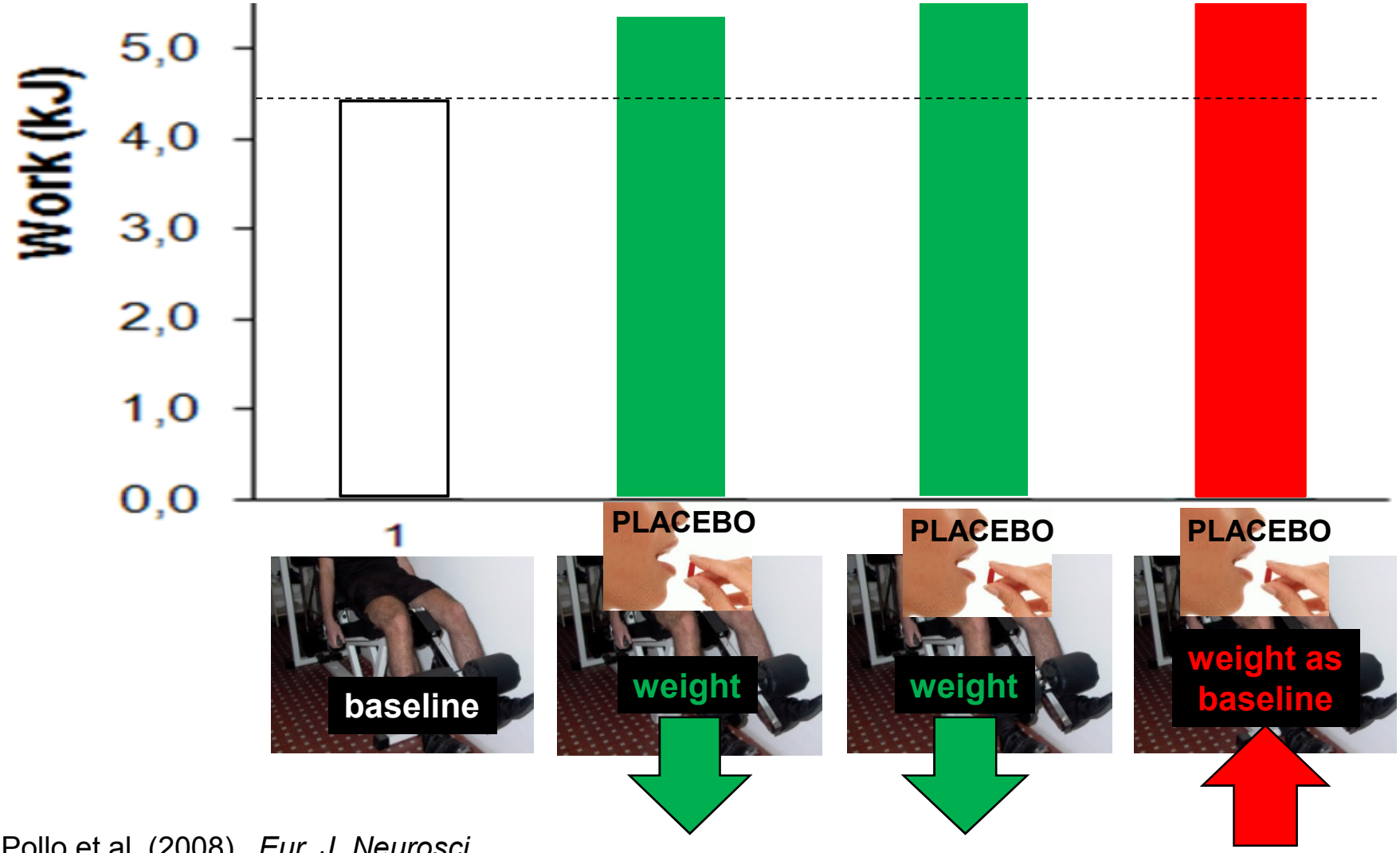
Can athletes learn a placebo effect using no drugs and no injections?

- **Pollo et al. The top-down influence of ergogenic placebos on muscle work and fatigue. *Eur. J. Neurosci. 2008***
- Experiment 1
  - Following baseline, placebo caffeine was administered with verbal expectation of enhanced performance (leg extension).
  - Resulted in increased performance.

Can athletes learn a placebo effect using no drugs and no injections?

- **Pollo et al. The top-down influence of ergogenic placebos on muscle work and fatigue. *Eur. J. Neurosci. 2008***
- Experiment 2
  - Following baseline, placebo caffeine administered prior to two weight-training sessions (leg extension).
  - Resistance was reduced deceptively to set up expectation that the ’caffeine' was ergogenic.
  - In a final trial, the load was restored to the original weight.

Can athletes learn a placebo effect using no drugs and no injections?



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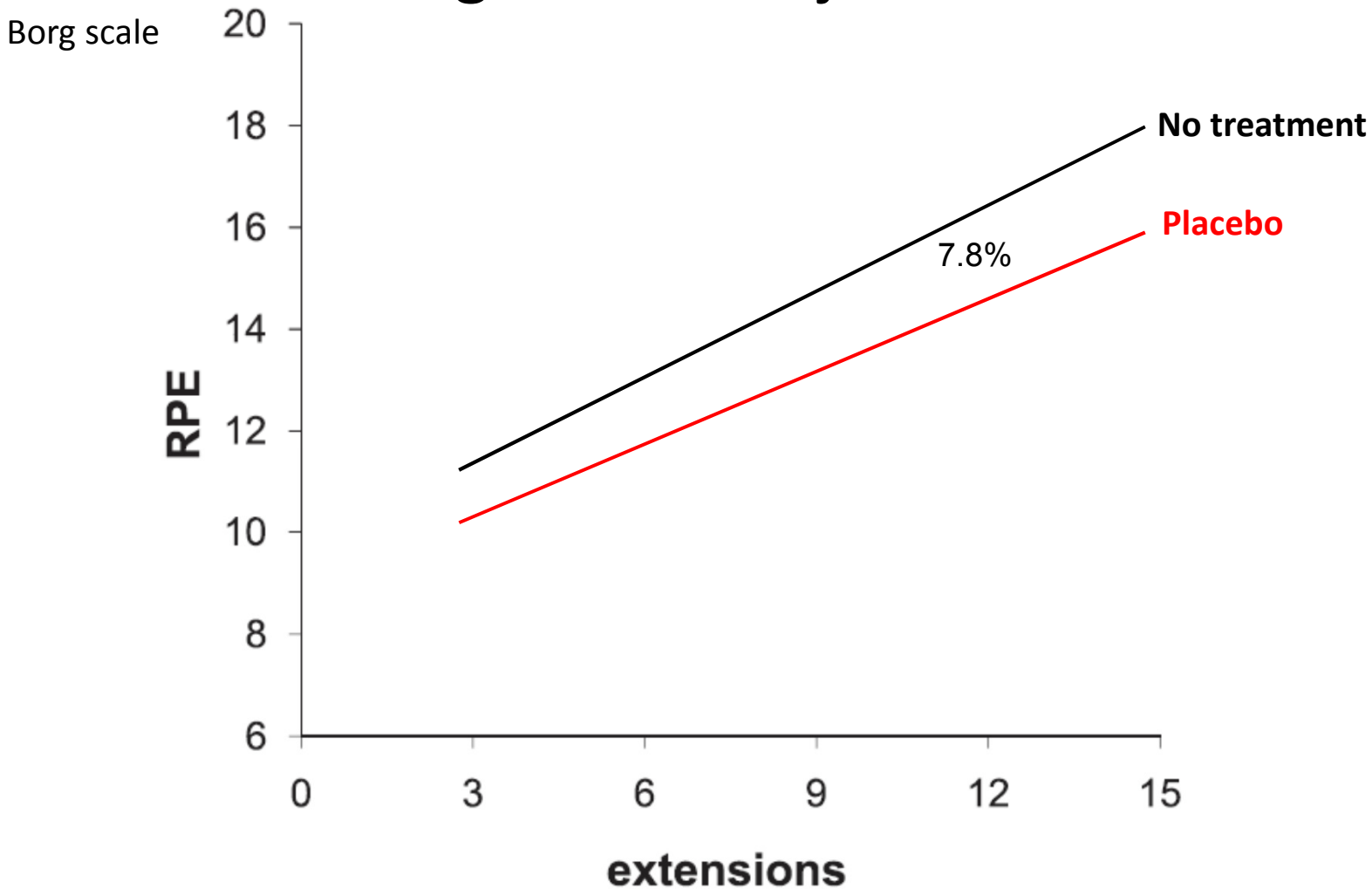

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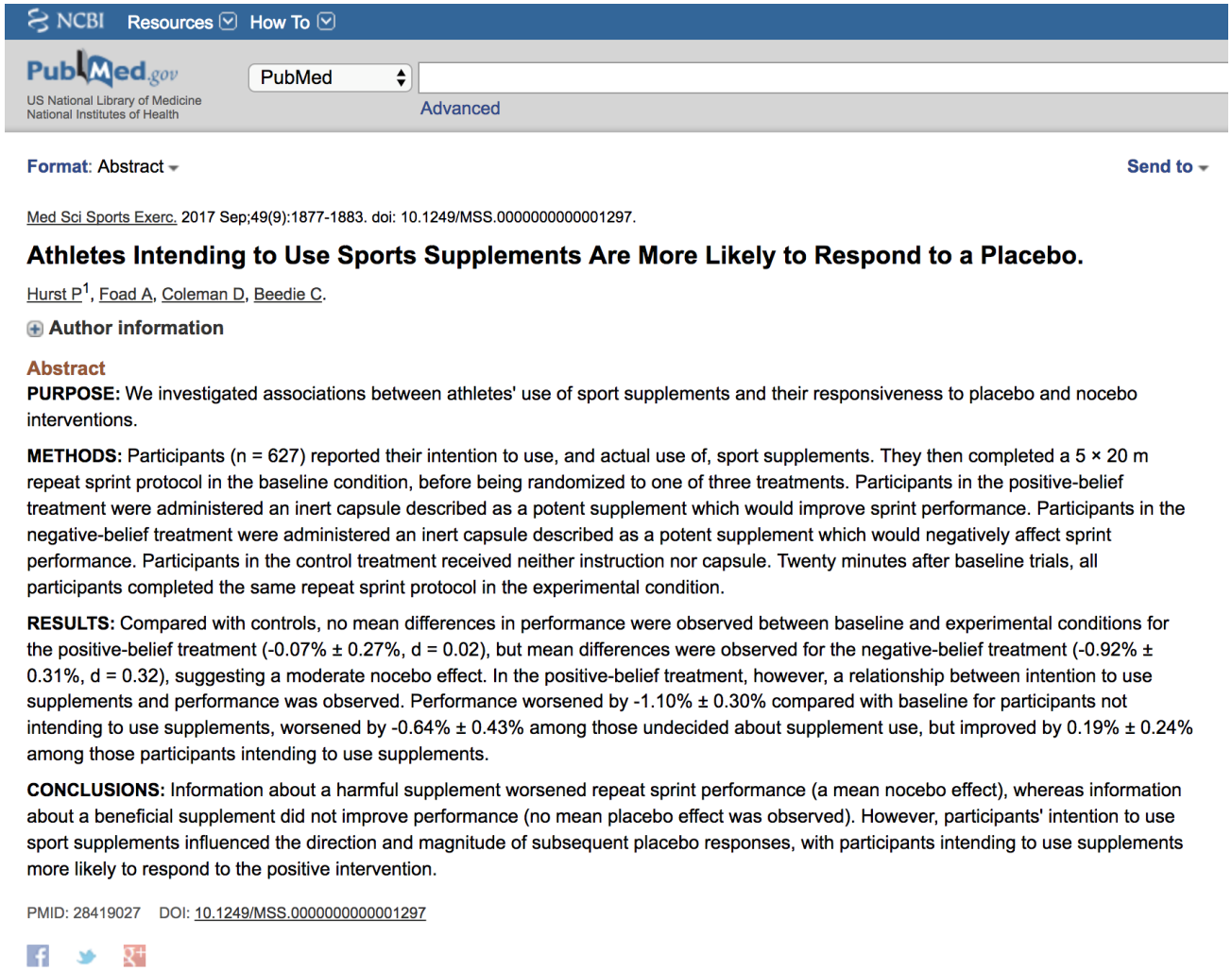
Can athletes learn a placebo effect using no drugs and no injections?

- **Pollo et al. The top-down influence of ergogenic placebos on muscle work and fatigue. *Eur. J. Neurosci. 2008***
- Results
  - Significant increase in muscle work and decrease in perceived muscle fatigue.
  - Greater effects observed following conditioning than earlier expectation-only treatment
  - Underscores the role of *learning* in increasing muscle performance with placebos.

What do these studies tell us?

- Placebo effects
  - Are common in sport
  - Can occur in the absence of obvious physiological stress
  - Can be negative (nocebo effect)
- Placebo effects are the result of
  - Expectation
  - Conditioning
- Both mechanisms
  - Are manifest in the neurobiological processes of athletes
  - Can be interrupted by standard blockade protocols (e.g., naloxone)
  - Can be learned

Real world evidence: Athletes who use supplements are more likely to experience placebo effects



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Med Sci Sports Exerc. 2017 Sep;49(9):1877-1883. doi: 10.1249/MSS.0000000000001297.

Athletes Intending to Use Sports Supplements Are More Likely to Respond to a Placebo.

Hurst P[1], Foad A, Coleman D, Beedie C.

Author information

Abstract

PURPOSE: We investigated associations between athletes' use of sport supplements and their responsiveness to placebo and nocebo interventions.

METHODS: Participants (n = 627) reported their intention to use, and actual use of, sport supplements. They then completed a 5 × 20 m repeat sprint protocol in the baseline condition, before being randomized to one of three treatments. Participants in the positive-belief treatment were administered an inert capsule described as a potent supplement which would improve sprint performance. Participants in the negative-belief treatment were administered an inert capsule described as a potent supplement which would negatively affect sprint performance. Participants in the control treatment received neither instruction nor capsule. Twenty minutes after baseline trials, all participants completed the same repeat sprint protocol in the experimental condition.

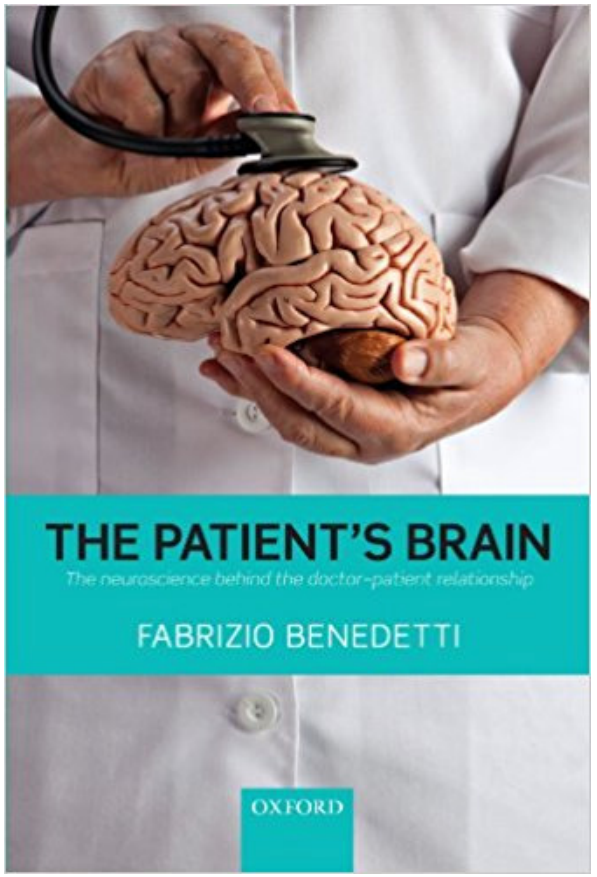
RESULTS: Compared with controls, no mean differences in performance were observed between baseline and experimental conditions for the positive-belief treatment (-0.07% ± 0.27%, d = 0.02), but mean differences were observed for the negative-belief treatment (-0.92% ± 0.31%, d = 0.32), suggesting a moderate nocebo effect. In the positive-belief treatment, however, a relationship between intention to use supplements and performance was observed. Performance worsened by -1.10% ± 0.30% compared with baseline for participants not intending to use supplements, worsened by -0.64% ± 0.43% among those undecided about supplement use, but improved by 0.19% ± 0.24% among those participants intending to use supplements.

CONCLUSIONS: Information about a harmful supplement worsened repeat sprint performance (a mean nocebo effect), whereas information about a beneficial supplement did not improve performance (no mean placebo effect was observed). However, participants' intention to use sport supplements influenced the direction and magnitude of subsequent placebo responses, with participants intending to use supplements more likely to respond to the positive intervention.

PMID: 28419027 DOI: 10.1249/MSS.0000000000001297

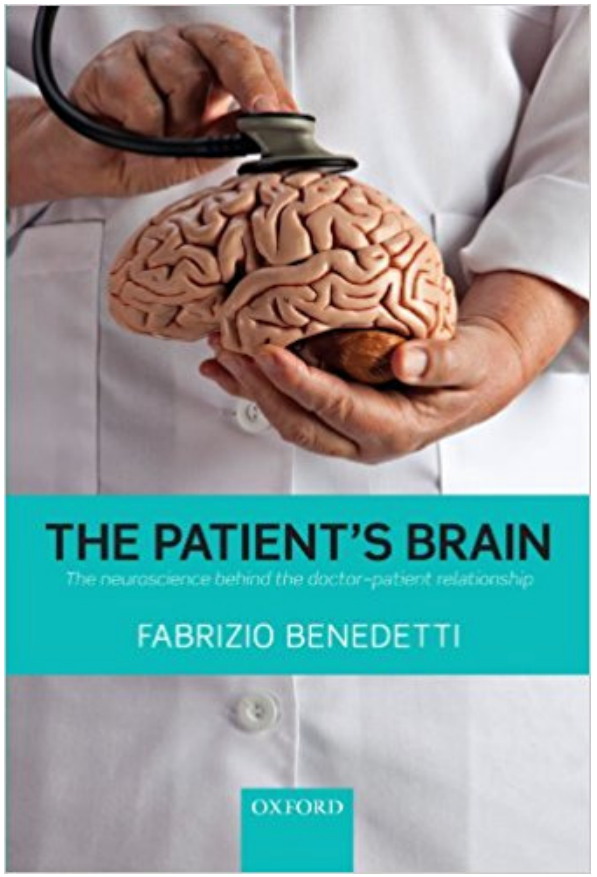
Why are athletes who use supplements more likely to experience placebo effects of supplements?

- Because
  - Athletes who use supplements *expect supplements to be effective*
  - Athletes who use supplements are often *conditioned to the effects of supplements* (caffeine)

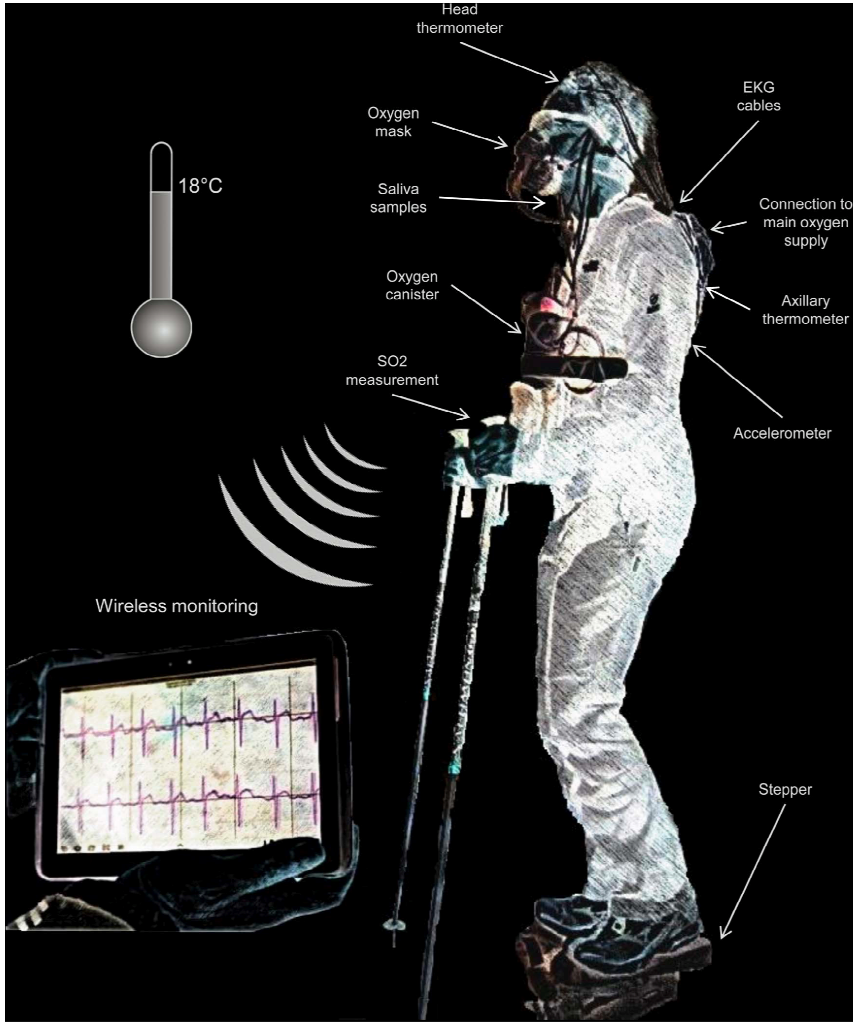


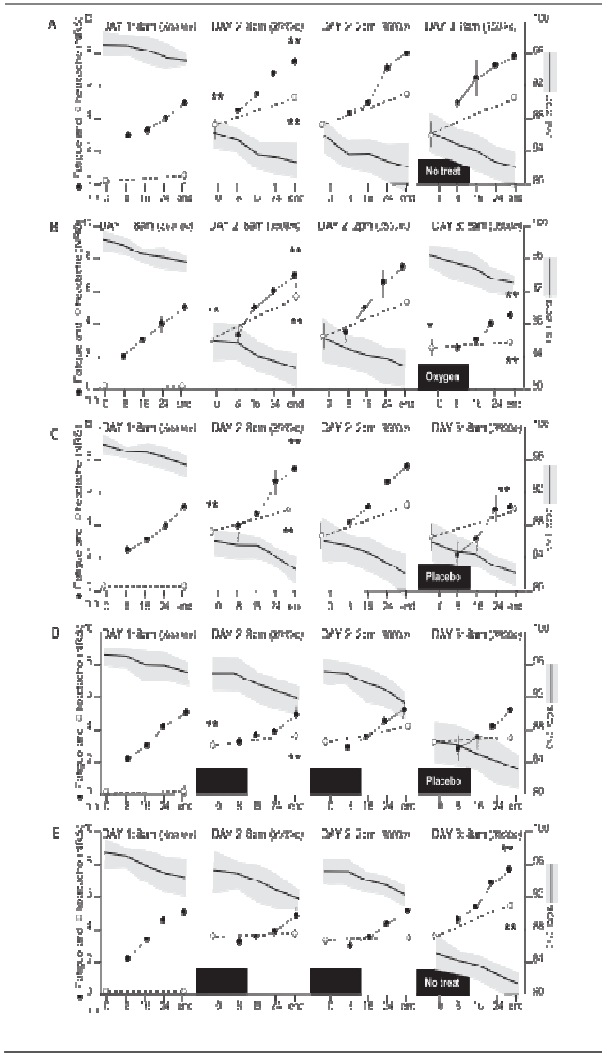
The neurobiology of the coach-athlete relationship

- Neurobiological events and processes in the athlete's brain underlie
  - Pain
  - Fatigue
  - Reward (effort/motivation)
- All are susceptible to expectation and conditioning
- But emerging evidence suggests far more powerful effects



The neurobiology of extreme performance





What determines the effectiveness of a coaching strategy

- The active ingredients
  1. The strategy itself
  2. The athlete's belief in the strategy
  3. The coach's belief in the strategy
  4. The athlete's belief in the coach
  5. The organisational culture

Summary: A potentially powerful neurobiological tool for coaches

- The placebo effect
  - Happens in the brain before it happens in the body
  - Can be enhanced, reduced or antagonised via coaching behaviours
  - Can be enhanced, reduced or antagonised by organisational structures and processes around the athletes

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