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Placebo doping in sport: Overview and ethical considerations

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ABSTRACT

Placebo effects in sports imply favorable performance outcomes generated by one's cognition. Placebo use is a form of non-detectible doping for placebo responders. They can be delivered openly or by deceiving the athlete. The current analytical review discusses placebo effects and looks at them in sports and exercise settings. It expands the critical messages of extant review papers with the analyses of two articles looking at athletes' and coaches' attitudes towards using placebo doping for enhancing performance in sports. The report highlights that the conclusions of literature reviews might be 'diluted' because their studies involve 'placebo responders' and 'non-responders.' Hence, some effects measured in responders are lower due to no effects in non-responders. Further, the report also stresses that the nocebo effects are more potent than placebo effects; therefore, coaches should be especially cautious about their words with their athletes. Last, the paper examines ethical issues and discusses how coaches may get a green light to use placebo doping to exploit their athletes' mental power.

1. Introduction

The placebo and nocebo effects mirror the human mind's power to influence a future outcome. Jean Baptist Girard claimed that "by words, we learn thoughts and by thoughts, we learn life" (Mart, 2010, pp. 152). Indeed, words are powerful and influence us consciously and subconsciously. Spoken or written words can please or hurt. They are a primary channel of thought manipulation. Then thoughts influence our feelings and actions, the whole human behavior. Indeed, Epictetus thought that things (themselves) do not affect us but rather do the mental ideas (thoughts) we create about things (Toulmin, 1979).

A decade ago, a German team published a review paper on the power of words used by doctors in communicating with their patients (Häuser et al., 2012). Based on their systematic analyses, researchers concluded that doctors should receive special education in communication to complement their medical training because their words substantially impact the prognosis of the illness. Simplifying the message of the paper: Words can heal or kill.

Most people are familiar with various pain and inflammation-reducing pills. Some may use it regularly. So do athletes for multiple ailments and even for ergogenic aid (Warner et al., 2002). Like every medication, these drugs also come with a patient information leaflet listing all known potential side effects. Generally, those who have previously used them do not bother reading the leaflet because they *know* that the specific medication yields the desired result.

This practice exemplifies conditioning occurring via mental cause-and-effect associations established through experience. On the other hand, those who read the information leaflet describing the side effects may decide not to use the medication. However, if they still use it, the chance of experiencing side effects increases (Colagiuri et al., 2012). Why? The answer relates to *expectancy effects* associated with the unknown (yet unexperienced) for which the individual has not developed a mental schema.

Indeed, Watson, the father of behaviorism (Watson & Kimble, 2017), who Pavlov greatly influenced, claimed that all behaviors result from conditioning and the influence of past experiences. As such, Watson seemed to ignore the subjective mental schema, which is the unique cognitive neural network of the individual. However, this connection is essential because a *specific* stimulus (like an orange) can produce different responses in different people.

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1.1. Objectives

This theoretical overview has three objectives. The first is a brief presentation of placebo and nocebo effects in general. The second objective discusses placebo and nocebo effects in sport and exercise, focusing on how research data might be "diluted" by opposing responses to placebo interventions. Finally, the third objective is the ethical consideration of using or not using placebo interventions in sports and exercise settings.

2. First objective: The placebo and nocebo effect

A placebo is an inert pill that should not have any systemic effect, as described in medicine (Finniss et al., 2010). Instead, the results of placebo administration stem from individuals' experiences- and information-based thoughts (or mental schemas) determined by unique past life events and associated expectations. The term placebo comes from Latin, which translates as: 'I will please' or 'I shall please'; Nocebo is the opposite: 'I will harm,' or 'I shall harm' (Jilch et al., 2020).

A nocebo is an inactive substance/agent or ineffective intervention to induce negative expectations, such as giving a sham treatment and saying it will hurt (Häuser et al., 2012). The placebo and nocebo can be agents, events, or actions. The placebo effect surfaces in a pleasant outcome, while the nocebo effect yields a harmful result. In the medical dictionary, a placebo is defined as "an ineffective medicine but may help relieve a condition because the patient has faith in its powers" (Kellett, 2012, p. 46).

This definition is limited, but it contains two words that merit evaluation. These words "may help" and "faith." Faith reflects thought, belief, trust, or conviction. May help (in the context of faith) suggest that it is *conditional upon faith*. Very long ago, Hippocrates recognized that some patients got better because of their *faith* in their physician, even though their health condition was devastating (Potts, 2021). Some people may recall that once they felt unwell, they went to the doctor, and after a few minutes of consultation, they already felt better, relieved, and reassured. If so, the doctor probably used the right words to reduce the agony. People see their doctors because they *believe* that the doctor can help.

One's belief in the doctor's ability to help reflects a positive expectation. If the doctor helped successfully in the past, the cognitive association between seeking help and the resulting outcome generates a *conditioned* expectation. If a person holds a negative expectation about the doctor's ability to help her, that person won't bother to go back for another consultation. A bad experience with a particular doctor creates negative expectations and generates avoidance behavior; the person will likely seek the help of another doctor.

Expectations can be '*certain*' (equivalent to a conviction) or '*uncertain*' and range between these two ends of the spectrum. Ploghaus et al. (2003) produced robust neuroimaging evidence for *certain* expectations activating different areas in the brain in contrast to uncertain expectations. For a placebo effect to occur, one should hold certain expectations about the efficacy of the placebo agent. However, different expectations originate from a complex set of personal-situational interactions associated with the person's learning and experiences.

Figure 1 below illustrates how the placebo/nocebo effect surfaces in one's mind. The central point is the *situation* in the context of the placebo. The evaluation of the actual situation depends on the *unique* mental schemas of the individual. Hence, it is idiosyncratic. These schemas are conditioned – or created based on various information and related experiences – mental frameworks resulting from upbringing, formal and informal education, and vicarious and personal experiences. Nowadays, however, people's schema is primarily affected by the immediate social environment and media information, especially the internet. So, evaluating the efficacy of the potential placebo could yield high- or low-level certainty expectations. But high-level expectations can be positive or negative and thus produce placebo or nocebo effects. If this happens, the person is called a responder (Tetreault et al., 2016). Being a responder or non-responder is determined by genes, personality, and situational interactions. Thus, even predisposition does not make one a responder in all situations; however, like hypnotic susceptibility, some people are more predisposed to be placebo responders than others.

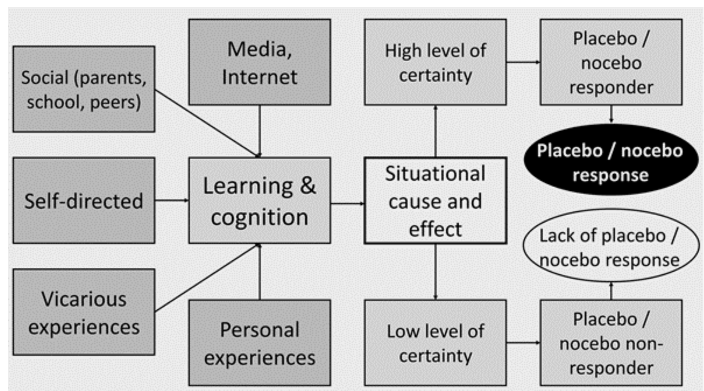

Figure 1: Diagrammatic illustration of the mechanism of placebo and nocebo effects.

A study used functional magnetic resonance imaging (fMRI) to detect the differences between placebo responders and non-responders to a placebo pain reliever. It showed a high level of brain activity in the mid-frontal gyrus in the placebo responders, absent in the non-responders (Tetreault et al., 2016). Therefore, there is robust neurophysiological evidence for the difference between placebo responders and non-responders.

Another study published earlier (Rief et al., 2011) induced thermal pain in healthy subjects, then provided them with a potent pain reliever under three conditions: 1) no expectation under a hidden treatment condition, 2) inducing positive expectation, and 3) inducing negative expectation. Subjects rated their level of pain on a zero to 100 rating scale. Hidden analgesia decreased the perceived pain compared to baseline. Analgesia associated with positive expectations doubled the effect of the analgesic. However, analgesia accompanied by negative expectations canceled out the impact of the analgesic agent. The authors also demonstrated that positive and negative expectations activated different areas in the brain. Earlier work suggests that expectations raise brain glucose metabolism by up to 50%, especially in the thalamus region associated with reward and conditioning (Volkow et al., 2003).

3. Second objective: Placebo and nocebo in sport

In sports science, scholars often use randomized control trials (RCT) in which participants are allocated to active treatment and placebo and, preferably, a no-treatment control group. This intervention can be combined with a double-blind design in which neither the experimenter nor the subject is aware of group allocation. Alternatively, a deceptive strategy can be used in which the participants think they receive an active treatment but receive a placebo.

Although argued for inclusion (Kayser, 2020), placebos are not on World Anti-Doping Association (WADA) prohibited list. The reason is simple: they cannot be detected. Therefore, a coach can almost freely use a concealed placebo administration in applied sports settings, which could be considered unethical (Beedie & Foad, 2008). Since placebo administration is a form of doping that is undetectable, many coaches still use it (Szabo & Müller, 2016). However, an open, active treatment is also possible. In this case, the coach offers legal ergogenic aids to the athletes, who know they are receiving it. Beedie and Foad (2009) wrote the first narrative review in the area based on 12 intervention studies, 11 of which surfaced after 2000. Accordingly, this research area in sports sciences is relatively young. After reviewing the 12 studies, the authors concluded that the placebo effect is present in sports. Bérdi et al. (2011) conducted a meta-analysis to examine the *magnitude* of the placebo effects disclosed by Beedie and Foad (2009). This first meta-analysis in the area included 14 studies encompassing 196 participants. The placebos were caffeine, oxygenated water, carbohydrates, and amino acids. The measures were physiological- or performance-related (e.g., muscle power, heart rate, running speed) and psychological attributes (perceived exertion, post-experiment self-evaluation of performance). The effect sizes varied from very low to very high, with an unweighted mean effect size of 0.40 and a variance-weighted effect size of 0.31, according to Cohen (1988), reflecting a low to medium effect. So, our meta-analysis confirmed Beedie and Foad (2009) conclusions and showed placebo *interventions* produce a small to medium effect on physiological, performance, and psychological measures.

Here comes an important point. The reviewed studies in Bérdi et al. (2011) paper included responders and non-responders. Indeed, none of the studies distinguished between placebo responders and non-responders. Thus, what is the logical conclusion? The 'possible' presence of non-responders dampens the results. Hence, we can safely posit that the effect sizes would be more significant in placebo responders (i.e. when controlling for non-responders).

These results prompted Szabo (2013) to think about the psychological effects of a single bout of exercise, which are almost exclusively positive. Many models exist for immediate positive psychological changes after a single training episode (Szabo & Demetrovics, 2022). They can be physiological, such as the thermogenic hypothesis (Koltyn, 1997), the sympathetic arousal hypothesis (Thompson & Blanton, 1987), the beta-endorphin hypothesis (Grossman, 1984), etc. Alternately there are psychological models such as the distraction hypothesis (Morgan, 1985) or cognitive appraisal hypothesis (Szabo, 1995). Still, none of these can fully explain the acute psychological effects of exercise (Szabo & Demetrovics, 2022). Therefore, Szabo (2013) proposed that the placebo effect could also be present in the immediate feeling states generally reported after an exercise workout.

There are several logical arguments for this hypothesis. First, physiological effects during exercise (i.e., increased sympathetic arousal and circulating β-endorphins; Szabo & Demetrovics, 2022) produce a pleasant feeling. Second, regular exercisers could get hooked on feelings, such as stress relief, that they experience after exercise (Chen, 2016). Consequently, they anticipate these feelings in response to their exercise training over time (Szabo, 2013). Finally, this expectancy may be *certain* (granted) due to prior conditioning. Therefore, a placebo (or at least a partial placebo) effect will likely occur. Substantiating this conjecture, Lindheimer et al. (2015) performed a meta-analysis on nine studies that used a randomized training protocol. Their results indicated that the mean placebo effect size was 0.20, and the observed effect of exercise training was 0.37. Consequently, they concluded that the *placebo effect accounts for approximately half of the psychological benefits of exercise* training.

Studies of ultra-short duration and low exercise intensity also corroborate the possible role of placebo effects in feeling states after an acute exercise session. For example, Szabo et al. (2013) conducted two studies. The first within-participants study examined young participants performing light, warm-up type exercises (consisting of arm, neck, and shoulder rotation and stretching) for three minutes. The second study replicated the first but also included a control group. In both studies, the short and light workouts triggered a statistically significant improvement in the perceived well-being of the exercise groups. Furthermore, the effect sizes were between moderate to large.

Another recent study (Ábel et al., 2022) showed that even after 50 m swimming lasting *less than one minute*, in either breaststroke or freestyle, the adult participants' feeling states, arousal, and positive affect increased statistically significantly, and the effect sizes were large. Unfortunately, this study did not gauge expectancy effects. Nevertheless, the fast-occurring significant psychological changes after less than one minute of swimming could be partially related to expectancy and placebo effects.

Bérdi et al. (2011) meta-analyses included less than 200 participants in 14 studies. Hurst et al. (2020) located 31 studies with over 1500 participants in a more recent meta-analytic review. These authors classified ergogenic aids into: 1) nutritional and pharmacological, 2) mechanical, and 3) psychological categories. Their results revealed that the effect size for nutritional and pharmacological placebos was 0.32; for mechanical placebos, it was 0.37; and for psychological placebos, it was 0.87. The pooled effect size revealed a small to moderate effect size of 0.35 across all studies, comparable to the effect size reported in the earlier meta-analysis by Bérdi et al. (2011). Again, these studies included both *placebo responders* and *non-responders*. Because the latter group could have diluted the effect sizes, the actual effects within the placebo responders might be more significant.

3.1. The power of words

Although based on only one work, Hurst et al. (2020) showed that the most significant effect occurred for psychological placebo. Indeed, psychological placebos, such as information priming, may be effective. For example, in a thought-manipulation study

(Szabo & Kocsis, 2017), researchers examined the effects of expectancy priming on the psychological effects of deep breathing lasting for only 3 minutes. Sport Science students were randomized into three groups. Two groups performed 3 minutes of deep breathing before their regular lecture. Deep breathing consisted of inhaling slowly over 6 seconds, holding their breath for 6 seconds, and exhaling slowly over 6 seconds. The difference between the two groups was that one received *misleading information* that 3-minutes of these practices could trigger similar mental results to a 30-minute intensive aerobic exercise. The other group performed the activity as a warm-up for the class but received no information. Finally, a control group sat quietly for 3 minutes. All three groups completed the positive affect negative affect schedule (PANAS) and a single-item momentary well-being feeling scale before and after the 3 minutes of deep breathing and the control condition. The results revealed that the expectancy-primed group increased statistically significantly in all measurements compared to the control group. Their scores differed from the non-primed group in positive affect and feeling states but not negative affect, which decreased by about 20% in both breathing groups. The non-primed group only differed from the control group in negative affect; even though they showed an overall 15% increase in well-being, this rise was statistically not different from the control group (Figure 2). Still, it was statistically significant from the baseline. Therefore, the authors concluded that information priming significantly augmented the effect of deep breathing by eliciting a placebo effect.

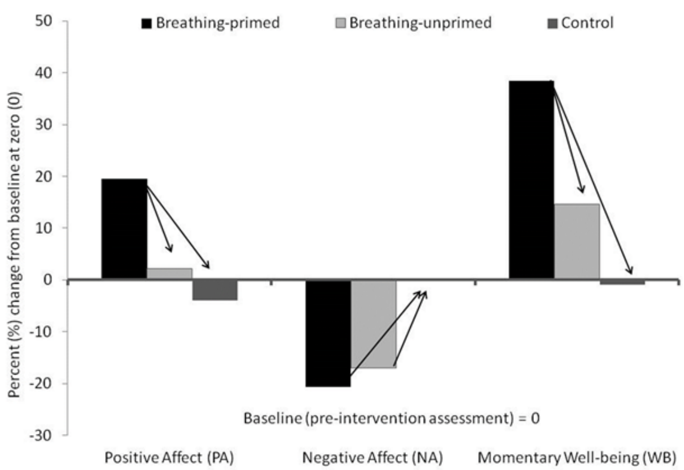

Figure 2: Differences between groups in three measures (Szabo & Kocsis, 2017).

In another study (de la Vega et al., 2017), researchers used a psychological placebo associated with a fictive green energy drink and tested its effects on 200 m running sprint performance. Initially, 60 long-distance runners were timed for their best run on a 200 m sprint. One week later, they were randomly assigned to three groups. The first group received *no specific instruction* and was told that the energy drink may or may not increase performance. The second group was told that the energy drink was laboratory tested to *increase performance*. Finally, the third group was told that the energy drink *had no effect on performance*, but its taste was good. After drinking the fictive energy drink that was only green-colored water, participants performed a gentle warm-up and reran a 200 m sprint. The experimenter who timed the sprint time was blind to the condition to which a given participant was assigned. The result replicated those obtained by Szabo and Kocsis (2017). A group-by-time interaction revealed that the positive instruction group showed the largest improvement in the 200 m sprint time. The 2.4 seconds average decrease (Figure 3) compared to the baseline was statistically significant. The slightly faster times in the neutral and negative instruction groups could reflect a habituation or practice effect; however, the *additional decrease* (change in these groups – change in the intervention group) in the positively primed group could show the effect magnitude of the positive information provided to the runners. These studies show how words affect human feelings and exercise performance.

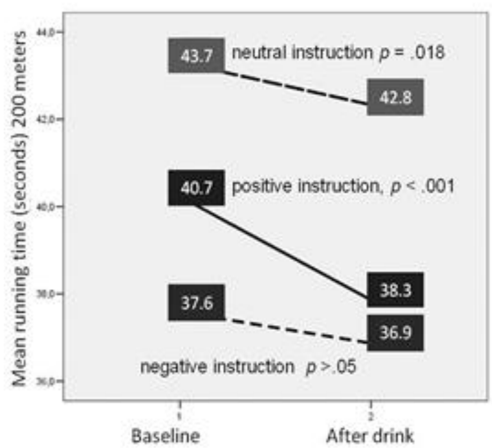

Figure 3: Decreases in seconds (s) in 200 m sprint time in three groups receiving different information associated with a fictive energy drink (de la Vega et al., 2017).

One may ask me why de la Vega et al. (2017) chose a green drink in the above study, not a red liquid or a white or red tablet. The answer might be connected to earlier work that found that green drinks were rated as the most efficient (placebo) for strength, endurance, and concentration (Szabo et al., 2013). This study presented nearly 300 undergraduates with *unlabelled* images of nine fictive ergogenic aids: green drink, green gel, red drink, white powder, white lotion, energy bar, red pill, white pill, and white capsule. Their task was to rank them separately (three times) in order of expected efficacy for sports *endurance, strength, and concentration* while simply thinking about the *perceptual characteristics* of the presented agents and not trying to associate them with any commercially available products. Results revealed that the green drink was perceived as the most influential on all three performance indices. This finding may not only justify the choice for the placebo in the 200 m sprint study but also shows that people's expectancy varies with the potential placebo agent's form, shape, and color. This finding has implications for the placebo agent's physical appearance and efficacy. For example, two identical experiments could yield different results if the placebo differs only in shape, size, or color. Further, scholastic evidence suggests that the more invasive a placebo intervention is, the greater its efficacy (Wartolowska et al., 2014).

However, the impact of nocebo effects on motor performance is *nearly double that of the placebo effects*. For example, Horváth et al. (2021) showed that ten out of 12 studies using a between-participants research design in nocebo intervention research reported a nocebo effect. Furthermore, the mean effect size was medium to large (0.60), which is almost double that of placebo effects reported by Bérdi et al. (2011) and Hurst et al. (2019). The authors concluded that nocebo effects influence motor performance and can be evoked by negative words. This finding has substantial implications for coaching in that coaches should consciously choose their words in communicating with their athletes to avoid inducing a nocebo effect. In line with Häuser et al. (2012), like doctors, coaches should also receive education in communication.

3.2. Athletes and coaches

Knowing from the literature and our earlier studies that a placebo could influence athletic performance, Bérdi et al. (2015) studied 79 *elite* athletes' attitudes toward placebo use in sports. The first question asked participants if they had experienced a placebo effect in the past (placebo was defined for uniform interpretation before delivering the survey). Nearly half (i.e., 47%) of the respondents answered 'yes.' The second question was whether placebos could affect their performance, and 82% answered 'yes.' Then, they indicated the extent to which they believed placebos could be used in sports. Again, the answers to this question were related to previous experiences. Those who had already experienced placebo effects on their performance scored statistically significantly higher than those who did not have such experience. This tendency in the answers mirrors the effects of conditioning. The results also revealed that most athletes would accept a performance enhancer from their coach conditionally upon legality and absence of health hazards (and about 10% unconditionally). Less than 10% of the elite athletes indicate that they would feel unhappy about the deception. Finally, about two-thirds of the athletes indicated that they did not mind being deceived as long as the placebo intervention served their objectives.

Consequently, the authors concluded that there appears to be a green light for 'green drinks' in elite sports. This conclusion is based on the results that around 90% of the examined athletes conditionally or unconditionally would accept a placebo deception as long as it serves their performance. The implication is that placebo doping seems to be endorsed by elite athletes.

A later study (Szabo & Müller, 2016) replicated Bérdi et al. (2015) survey with 93 coaches working at regional, national, and international levels. Again, the first question was whether they experienced a false expectation or belief influencing an athlete's performance. Over 90% of the coaches responded yes. The second question asked whether they have provided a placebo to their athletes with the message that it would enhance performance. Again, about 44% of the coaches answered yes to this question. Among those who responded yes, 93% said that their action improved the athlete's performance, and only 7% observed no change, but *none reported worsened performance*.

Similar to athletes, coaches who experienced positive results with placebo administrations scored higher on the question about the broader use of placebos in sports than coaches who did not use a placebo in the past. Next, when asked what they think about the athletes' reaction if they would offer them a new performance-enhancing agent or intervention, their responses almost mirrored those of athletes. For example, 12.5% believed that athletes would accept the agent unconditionally, over 75% conditionally, and only about 10% would not accept it under any condition. It appears that coaches are not only aware of the benefits of placebo interventions and the openness of their athletes towards receiving such an intervention, but a significant proportion of them, especially those working at a higher level of competition, use placebo treatments in their coaching practice.

3.3. Superstition

Placebo effects also drive superstition in sports (Dömötör et al., 2016). A superstition is a form of self-administered placebo. A literature review reveals that elite athletes are the most superstitious (Dömötör et al., 2016). The superstitious ritual helps an athlete's confidence and guards against potential negative thoughts associated with not performing the superstitious routine and its consequences. It often sets the stage by helping the athlete feel relaxed, confident, and focused on the upcoming performance. Dömötör et al. (2016) concluded that the mental benefits of superstitious behavior in sports surface from the placebo effects. Conversely, not performing a mentally conditioned ritual could make the athlete feel uneasy and anxious and thus evoke a nocebo effect on performance. Therefore, superstition could be comprehended as a form of self-administered placebo in athletes.

4. Third objective: Ethical consideration

In their first review, Beedie and Foad (2009, pp. 325) posed a valid question: "Could the placebo response be used to enhance performance in competition, and if so, would it be ethically acceptable to do so?" Of course, there is no problem if the placebo is self-administered like a superstitious ritual or presented openly to the athlete as a placebo (Colloca, 2015; Dömötör et al., 2016). For example, 'Take this sugar pill and think it gives you wings.' Open placebos work. For instance, Szabo et al. (2018) showed that an ordinary tic-tac (a mint) had a more significant positive psychological effect than a placebo pill delivered as a super mood-enhancer. There are no ethical issues when a preferred outcome occurs through an agent that is harmless and honestly (openly) presented to the target person (Colloca, 1995).

However, based on current international ethical standards and regulations, there is a problem when another misleads a person. But is deception always harmful? Let's illustrate the point with two fictive examples. In the first example, a doctor shares terrible news with a patient concerning her health. The doctor tells her the pathology test results; she has cancer. The patient's mental framework, or schema network, is running the cognitive program, concluding that she will die since her cancer is deadly. The mind's conclusion is a horrible subjective verdict that influences the neuropsychoimmunological system via a negative schema. Indeed, research shows that negative thoughts may further damage one's already fragile health (Thomsen et al., 2004). And who knows what the consequences of the self-fulfilling prophecy will be?

In the second example, a coach gives a super placebo pill to an athlete suffering from knee pain during a crucial game with the message that it will help relieve the pain. The athlete is deceived, but the placebo works, and the athlete can finish the game. The mental response to swallowing the pill is the *activation of pain regulatory pathways*, as shown earlier by Rief et al. (2011), which then alleviates discomfort and permits the continuation of the play. Knee pain has also been resolved through sham surgery (Sihvonen et al., 2013); therefore, placebo effects in knee pain regulation are not hypothetical but appear empirically supported.

In the first scenario, the truth can harm, which may induce further damage. In the second scenario, deception may heal or inspire. So, one should think for a moment and examine the personal attitudes concerning *goal- or desired outcome*-serving deception and harmful or *debilitative truth*. In doing so, one may ask why a child is receiving a vaccine comforted with deceptive words like 'it won't hurt' or 'you will feel a small peck only' for a moment. Can deception provide comfort and reassurance or avoid emotional harm in some situations?

Should ethical views, rules, or regulations that have the potential to harm be challenged? In addition to the philosophical principle '*first do not harm*,' perhaps ethical practices should consider the individual's will, well-being, and experience(s). Nations that have legalized euthanasia have considered these issues. In sports and exercise, the same factors are not a life and death matter but could account for determinants of success like time in which even a slight improvement can differentiate the gold from the silver medalist.

We know that coaches often use placebos in sports (Szabo & Müller, 2016), including deception. But apparently, most athletes *do not mind being deceived* as long as it helps them achieve their goals (Bérdi et al., 2015). However, does the coach indeed manifest a 'good' intention in supporting the athlete through this act? The success of the athlete is also the success of the coach. Therefore, some 'selfish' incentives may also be behind the seemingly supportive action. Some athletes may lose confidence in their coach if the act surfaces. Others may feel like victims of manipulation. Finally, one's athletic career may suffer due to the coach's actions.

Thus, when and how is it appropriate to employ a *hidden* placebo in sports and exercise settings? First, athletes' attitudes should be known in advance. They, like medical patients, should be informed that they will receive a placebo but may not necessarily be informed about the form and administration time (Colloca, 2015). Second, there must be a means to assess the possible change in attitude over time. Athletes who clearly and confidently affirm that they agree to be deceived as long as the deception serves their goal/performance and also consent to exposure to hidden placebo interventions may benefit from such actions.

Placebo doping, whether internal or external, concealed or open, resorts to the *power of the mind* to modify one's thoughts which could favorably influence performance (Szabo, 2013). In this sense, a placebo is a form of mental doping available to all and not detectable by doping tests. Hidden placebos should only be used after obtaining consent from the athlete, while open placebos can be used at any time but still only with the athlete's permission (Colloca, 2015). Coaches should never induce a nocebo effect and, like doctors, must be careful with their words when communicating with their athletes to avoid causing an unwanted nocebo effect.

5. Take-home message and research questions

5.1. What we know:

1. Sports coaches extensively use placebos with their athletes.
2. Most athletes have a positive attitude towards placebo use by coaches as long as that helps their athletic performance.
3. Placebo interventions are objectively undetectable.
4. Placebo interventions could help in sports/exercise performance.
5. A positive placebo experience reinforces approving attitudes toward placebo doping.

5.2. What we do not know:

1. What is the effect of open-label placebos on sports/exercise performance?
2. Does being a placebo-responder provide an unfair advantage to athletes exposed to placebo?
3. How resistant are placebo interventions to extension (i.e., weaken over time)?
4. Which forms of placebos are the most efficient in a typical sport/exercise?
5. Can a placebo be self-administered, and if yes, is it still a placebo (open-label placebo)?

Conflict of Interest

The author declares no conflict of interest.

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