

ORIGINAL ARTICLE

Acute psychological benefits of exercise: Reconsideration of the placebo effect

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Abstract

Background: The psychological benefits of exercise are repeatedly and consistently reported in the literature. Various forms of exercise, varying in duration and intensity, yield comparably positive changes in affect, which sheds doubt on the significance of exercise characteristics in the acute mental health benefits resulting from physical activity.

Aims: Based on research evidence, it is argued that the placebo effect may play a key role in the subjective exercise experience. This report is aimed at highlighting those aspects of the extant literature that call for the reconsideration of the placebo effect in the understanding of the acute mental benefits of physical activity.

Method and results: This narrative review focuses on research evidence demonstrating that the duration and intensity of physical activity are not mediatory factors in the mental health benefits of acute exercise. Current research evidence pointing to the roles of expectancy and conditioning in the affective benefits of exercise calls for the reconsideration of the placebo effect.

Conclusion: The present evaluation concludes that new research effort ought to be invested in the placebo-driven affective beneficence of exercise.

Keywords: *acute exercise, expectation, mental well-being, physical activity, theory*

Introduction: exercise is medicine

A bulk of research reveals that physical activity yields numerous health benefits (Bellocco et al., 2010; Blair et al., 1993; Lee et al., 2011; Powell & Blair, 1994). There is also scholastic evidence linking regular exercise and/or sport with positive mental well-being (Biddle, 1995; Biddle et al., 2000; Biddle & Mutrie, 2001; Brown et al., 2000; Tseng et al., 2011) as well as lower psychophysiological reactivity to mental stress (Norris et al., 1990, 1992; Rosenfeldt et al., 2011; Stein & Boutcher, 1992). The acute psychological benefits of exercise on various measures of affect and state anxiety are consistently demonstrated in the literature (Anderson & Brice, 2011; Berger & Motl, 2000; Biddle & Mutrie, 2001; Dasilva et al., 2011; Fontaine, 2000; Hoffman & Hoffman, 2008; O'Connor et al., 2000; Paluska &

Schwenk, 2000; Raglin, 1990; Szabo, 2003). Since a single bout of acute exercise yields immediate psychological benefits, it may be seen as a suitable non-pharmaceutical antidote to stress and various mood disorders, in addition to other health benefits. It is not surprising then that the American College of Sports Medicine (ACSM) has recently launched the “Exercise is Medicine” program initiative (Jonas & Phillips, 2009) to make physical exercise part of both prevention and treatment of various morbidities.

Psychological benefits of exercise: Does the form or dose of exercise matter?

In addition to the numerous physical health benefits of physical activity, research has also revealed that several different forms of exercise trigger identically positive psychological benefits: walking (Dasilva et al., 2011), cycling (Petruzzello et al., 2009), swimming (Valentine & Evans, 2001), yoga (Lavey et al., 2005; Streeter et al., 2010; Vancampfort et al., 2011), dance aerobics (Rokka et al., 2010), shadowboxing (Li & Yin, 2008), tai chi (Wang et al., 2010), running (Hoffman & Hoffman, 2008; Nabetani & Tokunaga, 2001; Szabo, 2003), etc. Several theories, attempting to explain the mechanism by which a single bout of exercise triggers improvement in affect and lowers state anxiety, are based on volume or duration and intensity of exercise as central mediator of the psychological effect. Popular physiological theories are the endorphin hypothesis (Dunn & Dishman, 1991; Hoffmann, 1997), the amine hypothesis (Dunn & Dishman, 1991; Morgan & O'Connor, 1988) and the thermogenic hypothesis (Koltyn, 1997; Petruzzello et al., 1991). However, there is growing research evidence that sheds doubt on physical explanations, because it is becoming clearer that exercise characteristics have minimal role in mediating the subjectively reported mental benefits of exercise (Szabo & Ábrahám, 2012).

Earlier, Ekkekakis and Petruzzello (1999) have reviewed over 200 studies examining whether the intensity of activity is instrumental in demonstrating psychological benefits after exercise. Their work showed that high intensity exercise has negative impact on affect, and when exercise intensity is kept at a constant intensity its duration does not matter in gaining mental benefits. Later, Szabo (2003) and more recently others (Minjung et al., 2010; Rokka et al., 2010) have produced strong evidence showing that the intensity of exercise is unimportant in eliciting psychological benefits. In a relatively recent review, Ekkekakis (2009) examined over 100 reports and concluded that exercise performed at self-selected intensity may be the most appropriate from a public health perspective. Therefore, in accord with earlier research (Berger & Owen, 1992; Szabo et al., 1998), currently there is substantial evidence showing that several modes of physical exercise, performed at different workloads, could trigger similar or identical positive psychological changes.

In considering the dose of the activity, which is the gist of the physiological models linking exercise to psychological benefits, apart from intensity the duration of exercise is also an important component. For psychological changes to occur, a 10 min brief exercise session appears to be sufficient (Anderson & Brice, 2011; Hansen et al., 2001; Sullivan et al., 2010). Consequently, the results stemming from studies on exercise intensity and duration lend support to Stoll's (1997) suggestion that physiological models are insufficient to account for the positive psychological changes reported after exercise.

An overlooked neuropsychological mechanism: the placebo effect

In medicine and pharmacology, the placebo effects were often seen as annoying to the treatment conditions. However, in the past decade, substantial evidence has emerged for neural responses to expectancy and conditioning. The latter two act as stimuli that may trigger strong brain activities (responses), which are responsible for diverse behavioral outcomes

(Petrovic et al., 2002). Therefore, placebos have neurobiological underpinnings and actual effects on the brain and body (for a review, see Price et al., 2008).

Psychological benefits of exercise: placebo effect revisited

In case of low volumes of exercise, it is possible that psychological models could be the most appropriate in explaining the acute psychological benefits of exercise. However, currently there are few psychological models that could fully account for the phenomenon. The distraction hypothesis (Morgan, 1985) suggests that some time off from the daily hassles and challenges yields psychological benefits. For short duration exercise, the time-off or the distraction is too short to expect a notable effect. Further, research also shows that exercisers report experiencing affective benefits after a single bout of exercise while non-exercisers do not (Hoffman & Hoffman, 2008). Possibly, exercisers *expect* positive psychological changes as a result of past positive experiences, whereas non-exercisers do not. Therefore, expected or conditioned responses to exercise may be more plausible explanations for the psychological benefits than the distraction theory, since both groups have had equal amount of time off in Hoffmans' study.

Stewart-Williams and Podd (2004) claim that expectancy is at the core of the placebo effect, which is based on two key mechanisms: expectancy theory and classical conditioning. According to these scholars, the placebo effect is a mind-set based on classical conditioning and trusted information from social resources or the media. Both of the latter are components of exercise. The invigorating feeling after exercise and the abundant media information about the benefits of exercise could jointly shape the individuals' expectancy and mind-set related to exercise. Indeed, a series of inquiries have shown that expectancy mediates the psychological effect of exercise. In a recent work, a 10 min bout of exercise has improved the mood of the participants and the observed effect was augmented by the biased recall of pre-exercise mood (Anderson & Brice, 2011). The report concluded that individuals' expectations regarding the acute psychological benefits of exercise are instrumental in maximizing the observed effects, thus linking the outcome to the placebo effect. Earlier, Desharnais et al. (1993) have conducted an experimental study with 48 healthy adults enrolled in a 10-week exercise program. Half of the participants were told that the exercise program was designed to improve psychological well-being, while the other half received no information pertaining to the mental benefits of exercise. Instead, they were informed about the physical benefits of the program. While both groups have improved in fitness, the former group also showed a significant increase in self-esteem. The authors have concluded that the placebo effect is a powerful psychological mechanism that underpins their findings. In spite of this awakening work, researchers have neglected the investigation of the role of the placebo effect in the psychological changes resulting from exercise for almost two decades.

Placebo is a mind-setting psychological mechanism that could yield to not only psychological but also physiological health benefits. In a relatively recent study, by Crum and Langer (2007), 84 female hotel room attendants were given a physical examination. Forty-four of them were told their work yields sufficient physical exercise – in accord with the Surgeon General's recommendation – for active lifestyle. The remaining 40 women did not receive such information. While the daily routine of the women and the level of physical activity did not differ between the groups – and did not change over time – 4 weeks later the informed group showed statistically significant decreases in weight, blood pressure, body fat, waist-to-hip ratio and body mass index. Based on the results, the authors have concluded that exercise affects health – either in part or in whole – via the placebo effect. However, recently Stanforth et al. (2011) attempted to replicate these results with 53 university building service workers. Participants in the intervention group were told how their work qualifies as adequate

exercise while the other group was taught about job safety. Several measures were taken 4 and 8 weeks after intervention. No differences were found between the groups in any of the outcome variables, with the exception of blood pressure that was lower in the intervention group. The researchers concluded that their study did not support the placebo effect. Notable is the fact that both of the above studies have only manipulated the expectancy rather than presenting an actual exercise intervention to the participants. Doing something to achieve a positive and expected result is different from changing the view about an aspect of life and, therefore, expecting changes in several other areas as well.

Building on Desharnais et al.'s and Crum and Langer's work, Wullimann (2010) conducted a double-blind study with 64 healthy sedentary adults to test the role of the placebo effect in the benefits of physical activity. Participants were randomly assigned into positive expectancy and negative expectancy groups, as well as a no-information-bias control group. They were asked to complete a battery of psychological and physiological measures three times: (1) at the beginning of the study, (2) after tracking participants' activity using a pedometer for 2 days (at this time they were given the positive information (meeting the ACSM guidelines for active lifestyle), negative information (not meeting the ACSM guidelines) and unbiased information about their level of physical activity, depending on which group they were selected) and (3) 1 week later to follow up the effects of the expectancy manipulation. The findings revealed that the positive expectancy group has reported increased levels of physical activity and psychological well-being. However, the subjective reports were incongruent with any of the psychological or physiological outcome measures. Wullimann concludes that expectancy manipulation could have an effect on perceived levels of activity and psychological beneficence of exercise. This work is important, because most published research is based on subjective reports reflecting the perceived psychological states of the participants, which – as demonstrated by Wullimann (2010) – also include expectancy effects. However, similarly to Crum and Langer (2007) and Stanforth et al. (2011), Wullimann only manipulated the expectancy associated with the actual level of physical activity, without introducing an exercise intervention program. Therefore, these inquiries should be cautiously compared to the studies in which an exercise intervention has resulted in mental and physical benefits. When participants *do something* (invest special effort) in what they believe, the subjective perception of the expected effects may be different from situations where *no action is taken* apart from a change in the mind-set. In the former situation, the work invested in achieving the desired result prompts individuals to expect the merited reward in exchange for their hard work.

In the everyday life, exercisers most often self-select both the duration and intensity of their activity. These two aspects of exercise could be influenced by a number of factors such as feeling in shape, level of fitness, available time for exercise, social environment, equipment or facility at disposition, weather or – if applicable – tempo of the music attended during exercise (Karageorghis et al., 2006). This self-selection represents a mental evaluation of the dose of exercise one needs in a given time. Thus, scientists deal with a mental programming or a mind-set that helps the exerciser to achieve the expected results from her/his exercise. Those who exercise to “run away” from stress may need increasingly more exercise to cope with the problem and slowly may get on the self-destructive path of exercise addiction (Szabo, 2010).

Indeed, the acute affective benefits of exercise (and some other passive treatments) may be linked to the mental interpretation (Lazarus, 1988) of the activity that the participant is engaged in. In light of this thought, the engagement in a pleasant activity is *expected* to yield positive effects. Consequently, all life experience perceived as pleasant or beneficial may trigger positive changes (Sandlund & Norlander, 2000). This expectation-based effect is a form of self-fulfilled prophecy that matches the expectation model forwarded for the placebo effect (Stewart-Williams & Podd, 2004). Accordingly, some exercisers who

pursue their rigorous exercise programs often seek information about how to maximize the effect of their training. This information shapes their exercise behavior and eventually yields health and performance benefits that could be related to both altered training routine (action) and the placebo effect stemming from thought-shaping information (expectancy).

Conclusion

There is growing research evidence showing that the acute psychological effects of exercise cannot be explained solely through physiological mechanisms. The most plausible psychological mechanism that may explain benefits noted even after very short duration of exercise is the placebo effect. Physical and placebo effects may jointly contribute to the acute mental benefits of exercise. The latter, based on the strength of expectancy, varies among individuals. Consequently, the mediating effects of expectation and conditioning – and their relationship to the self-selection of the exercise volume – should be actively investigated to determine in what situation and to what extent is the placebo effect responsible for psychological improvements after exercise.

The key message of this review is that several mechanisms, including placebo effects, may jointly be responsible for the consistently demonstrated acute mental benefits of exercise. Therefore, by measuring the extent to which the placebo effect is present in various exercise situations, the nature and contribution of other possible mechanisms could be untangled.

Declaration of Interest: The authors report no conflict of interest.

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