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ORIGINAL ARTICLE

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Acute effects of light exercise on subjectively experienced well-being: Benefits in only three minutes

Authors' Contribution:
A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection

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Key words: *acute exercise, arousal, expectation, mental well-being, placebo.*

Abstract

Background: *In the context of sedentary lifestyle as a major contemporary health issue, this study examined how an ultra brief exercise bout affects perceived subjective well-being.*

Material/Methods: *Two studies were conducted. In the first study, young participants performed light exercises for 3-minutes. The second study replicated the first, but a sitting-quietly control group was also included to account for possible habituation or order effects. On a single item 10-point Likert scale, conceptualized as core affect, participants rated their well-being immediately before and after the exercise bouts and rest, respectively.*

Results: *In both studies the exercise triggered statistically significant ($p < .001$) improvement in the perceived well-being (effect sizes (d) = .62 in Study I, and d = .75 in Study II), while no statistically significant change was noted in the control group.*

Conclusions: *These findings are the first ever in the scholastic literature to demonstrate that only 3 minutes of light exercises could trigger subjective experience of improved well-being. The practical implication of these findings is that an instant boost in subjective feeling states can be achieved through very short, light, and undemanding exercises that could be repeated several times a day in different life settings.*

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Introduction

Research shows that physical activity yields numerous health benefits [1]. Apart from long-term gains from regular workouts, single bouts of exercise yield instant improvements in subjective feeling states [2, 3, 4]. Research shows that various forms of exercises result in acute and positive psychological changes [3, 5, 6, 7]. Beneficence on the feeling states are ascribed to the volume – duration and intensity – of the exercise thought to be the mediator of the mechanism involved. The popular theories are the endorphin hypothesis [8], the amine hypothesis [8], and the thermogenic hypothesis [9]. However, these theories have recently been challenged, since it became evident that the intensity of workout has a small or no role in acute psychological benefits of exercise on the feelings states [10].

Ekkekakis [10] has reviewed over 100 research reports and concluded that the exercise performed at self-selected intensity triggers effects in well-being and may be appropriate from a public health perspective. In considering the duration of exercise, research has shown that a number of positive psychological changes occur even after brief 10-minute bouts of physical activity [2, 11, 12]. Therefore, relatively short exercise sessions appear to be enough to trigger instant psychological benefits. It is also known that the intensity of exercise has little role in generating acute psychological benefits [10, 13]. What is not known in the literature is weather the combinations of *ultra-short and light intensity* exercises are also able to yield subjectively experienced positive changes in well-being.

From a public health perspective, concerning the problem of increasing sedentary behaviour throughout the world, in the current inquiry a simple and straightforward question was posed: Does a very brief low-intensity exercise session result in detectable changes in the subjective feeling states or people's momentary well-being? The latter was conceptualized as the "core affect" as based on Russell's [14] work. Core affect is conceived as a basic process of conscious neurophysiological state accessible as a simple non-reflective feeling state such as feeling good or bad, feeling lethargic or energised [15]. It is a manifestation of the overall momentary well-being. The theoretical foundation of the paper stemmed from the orthogonal model of affect [15, 16] with two main dimensions of pleasure and activation. It was proposed that – since orthostatic changes induce increased arousal [17] – a very brief and light exercise session could result in an improved core affect or overall feeling state, by affecting the activation dimension of the subjective affective state.

Based on recent evidence from the literature that both short duration and low intensity exercises trigger improved well-being, the current working hypothesis was that undemanding exercise sets lasting only 3 minutes will yield subjective experiences of improved well-being.

STUDY I

Materials and Method

The study was performed at a large urban university. One undergraduate class was randomly selected from among a number of potential classes having lectures on certain days of the week. The exercise-intervention was initially presented as a warm-up to the lectures to the attendees, and no cues for measuring feeling states were given to avoid possible biases in the responses. Upon completion of the study, the actual research question and the hypothesis was disclosed to the participants. Consent for participation was obtained in accord with local and international regulations concerning the ethical guidelines for conducting research with human participants [18]. Those attendees who could not exercise for any reason, or did not wish to participate for any reason, were excused from the class for the duration of the testing. In this way the remaining – and, hence, consenting – participants were 24 men and 30 women (19.8 yrs, SD=1.5 yrs) speaking the same mother tongue and sharing a similar socio-cultural identity. Study I was an exploratory "within-subjects" design, in which participants acted as their own controls.

Core affect – as the measure of subjectively experienced momentary feeling state – was the only variable of interest. This measure was determined by using a single-item Likert scale [19]. Participants had to indicate how they felt in that moment on a 10-pt scale, ranging from miserable (1) to excellent (10). The scale was completed immediately before and after 3-min of exercise. The

test took place during the morning hours. The exercise intervention consisted of eight repetitions of the following set of exercises: extend the arms and reach for the ceiling, rotate the neck left and right, rotate the shoulders forward and backward, rotate the trunk left and right, stretch both hands sideways and rotate the arms forward and backward, move head forward and backward, and shake the arms. The rhythm dictated by the experimenter (without reliance on music or a metronome) was synchronized with the time to ensure that the exercise routine is completed in 3-minutes.

Results and Discussion

Data were analysed with time (pre-, post-exercise) by gender (men, women) repeated measures analysis of variance using the Greenhouse-Geisser correction method for degrees of freedom. This test yielded a statistically significant main effect for time only ($F(1,52) = 26.5$, $p<.001$), due to increase (effect size (d)=.62) in well-being from pre- (mean = 6.66, SD = 1.21) to post-exercise (mean = 7.44, SD = 1.51). No gender main effect or time by gender interaction was revealed. The current results, yielding a moderate to large effect size, demonstrate that 3 minutes of light exercises trigger measurable improvement in self-perceived feeling states. A moderate to large effect size [20] substantiates the meaningfulness of the results beyond mere statistical significance. In spite of the anticipated results, in light of extant scholastic evidence and theory, an issue of concern was that habituation or order effect in self-appraisal of feeling states may have contaminated the findings. Therefore, a second study was designed to employ the same experimental protocol as Study I and also to include a non-exercising, sitting quietly (time-elapse) control-group.

STUDY II

Materials and Method

To replicate Study 1, two undergraduate classes were selected by draw from among a number of larger classes, having early morning-lectures during the study-week. The method of participant selection and procedure was identical to that in Study 1, with the exception that in the second group (n = 48, 12 men, 36 women) a 3-minute quiet sitting acted as control for the exercise bout undertaken by the intervention group (n = 54, 18 men, 36 women). Participants' mean age was 20.3 (SD = 1.3) yrs. All the consenting volunteers spoke the same language and shared a similar socio-cultural background. Study II used a repeated measures mixed-model design.

Both groups were tested in the morning. The exercise group performed the same set of exercises, in the same sequence, as did the participants in Study I. The volunteers in the quiet-rest or time-elapse control group were requested to sit quietly and do nothing for 3 min. After both sessions, the participants were informed about the details of the study.

Results

Data were analysed with time (pre-, post-3-minutes) by gender (men, women), by group (exercise, control) repeated measures analysis of variance with Greenhouse-Geisser correction method for degrees of freedom. This test yielded only a statistically significant group by time interaction ($F(1,98) = 15.73$, $p < .001$) showing that while well-being increased in the exercise group ($t(53) = -8.72$, $p<.001$, $d = .75$) it did not change statistically in the control group ($t(47) = -0.81$, NS, cf. Fig. 1.). There were no initial differences between the groups ($t(100)=1.7$, NS), but after the 3 minutes of exercise and quiet rest the groups' means differed in a statistically significant way ($t(100) = 5.4$, $p < .001$). These findings reveal, again, that even 3 minutes of light exercises improve subjective experiences of well-being, while this change cannot be observed after a session of quiet sitting.

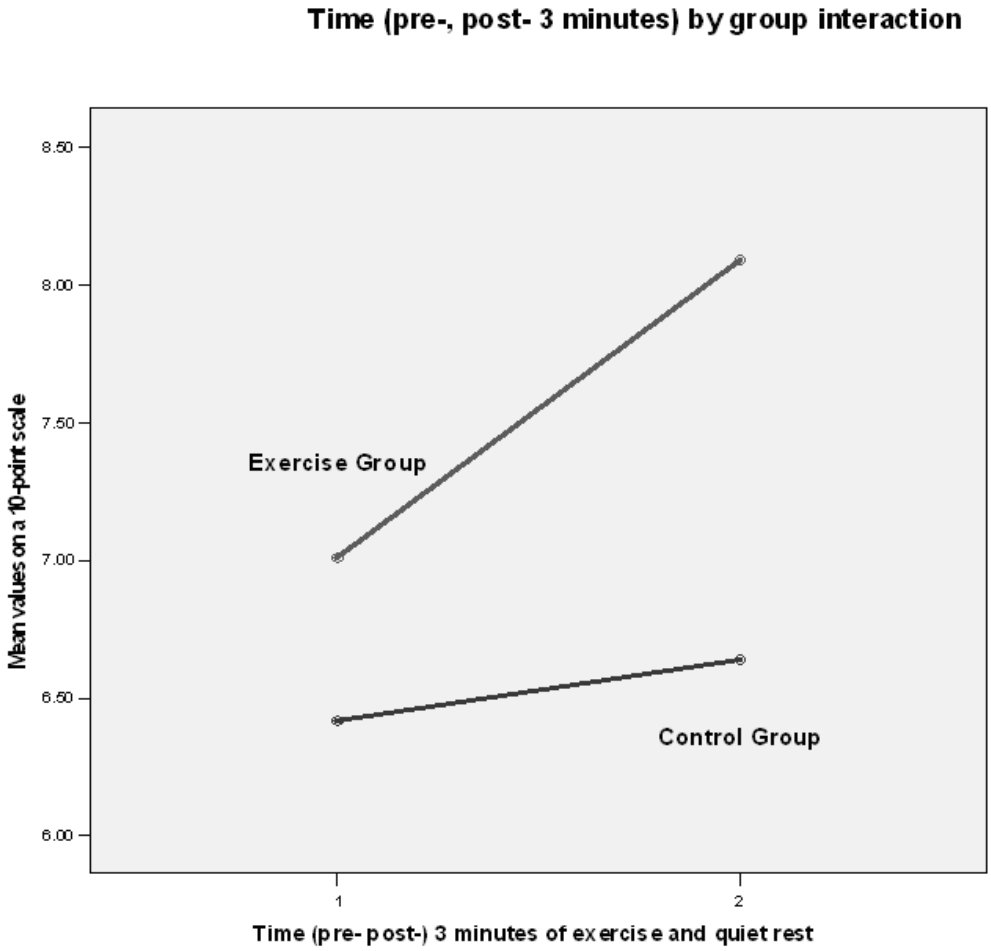

Fig 1. Changes in the reported momentary feeling state (measured on a 10-point Likert scale) after 3 minutes of exercise in the intervention group and after three minutes of quiet rest in the control group in Study II.

Discussion

The present findings, to the authors' best knowledge, are the first to demonstrate that a set of undemanding exercises lasting for only 3 minutes trigger notable changes in subjective feeling states. Clearly, the 3 minutes of exercises used in the current work could be less than warming-up efforts before fitness or athletic workouts [21]. These simple but robust findings have both theoretical and practical implications.

Considering the very brief duration of exercise, only two mechanisms could account for the observed changes. The first one is increased levels of arousal that could be generated even by short bouts of light exercise. Thayer [22] showed that a short brisk walk, augmenting the level of arousal, yields positive changes in subjective feeling states. The current investigation employed a very brief and certainly light bout of exercise that, nevertheless, raises the level of arousal, since even simple changes in body position augments arousal [17]. Therefore, in spite of the fact that arousal was not measured in the current research, it is most likely that changes in arousal in the exercise group have led to improved feeling states.

The second plausible mechanism is based on expectation associated with exercise. The expectation may stem from conditioning (i.e., past positive experience) or simply information-based expectancy (i.e., exercise is good for us). Not long ago it was shown [4] that exercisers experience greater psychological benefits after the *same* exercise as non-exercisers. While in this inquiry [4] both groups exercised and, consequently, experienced an augmented level of arousal, the results show that changes in arousal alone may not fully explain the acute positive improvements in well-being following exercise.

From a practical/applied perspective, this study clearly substantiates the usefulness of planned or adopted interventions of *ultra brief* exercises at workplace, schools, and also other environments for immediate improvements in subjective well-being. The effects of repeated short and light exercises during the day could be additive and yield more positive well-being.

Limitations and future directions

While the results obtained in Study I and then replicated in Study II show clearly that positive changes in core affect or momentary well-being do occur after 3-min light exercises, some issues may be raised and addressed right away. First, it may be argued that the findings cannot be generalized to the population level because a stratified sample was used. However, if positive changes in this relatively young and healthy sample could be seen, improvements in other segments of the population could be even stronger. Indeed, future studies should look to the magnitude of changes after brief and light exercises in several healthy age groups and then do the same with the psychologically challenged population with a view to prevention or treatment of morbidity. Further, in this study core affect was the sole variable examined as a mirror of the subjective feeling state. Future studies should take a wider look to effects of ultra short and light exercises on various psychological measures. The current results should provide an incentive for undertaking further inquires in this area with the prospect of reducing sedentary behaviour and improving the overall quality of the day in the modern society.

Conclusion

Very light exercise of ultra short-duration (3 minutes) has notable effects on subjective feeling states. Changes in arousal and expectations – regarding the benefits of exercise – may both contribute to improved feeling states after a very short exercise session. The type of exercise used in this study could be adopted in almost any public settings or environments in the daily life and could be performed even by those with restricted movement. Repeated performance of such exercises – during the day – may result in additive benefits in combating sedentary lifestyle.

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