Affective Responses to Exercise

Exercise can influence how people feel. This observation has attracted considerable research attention in the last 50 years. There are several reasons for this. First, if exercise can improve how people feel, this could have significant implications for mental health. Disorders impacting mood (depression, dysthymia, bipolar disorder) and anxiety (generalized anxiety, phobia, posttraumatic stress) are prevalent and can have a devastating effect on quality of life for sufferers and their families. Moreover, standard therapies such as pharmacotherapy and psychotherapy are costly and not always effective. Psychoactive drugs in particular can have several undesirable side effects. Against this backdrop, exercise offers the promise of an intervention that can be effective (by some estimates, at least as effective as the standard forms of therapy), inexpensive, free of undesirable side effects, and associated with many additional benefits for the body (e.g., reduced cardiovascular risk) and mind (e.g., reduced risk for dementia).

Second, people engage in various unhealthy lifestyle behaviors to regulate how they feel. For example, they consume caffeine and sugary snacks to feel more energized and they smoke cigarettes or drink alcohol to calm the nerves and relax. In pursuit of a feel-better effect, some people even engage in illicit and dangerous activities, such as abusing psychotropic drugs. Over time, these behaviors may lead to serious problems, from obesity and diabetes to chronic cardiorespiratory conditions to life-endangering addictions. Therefore, it would be desirable to replace these behaviors with an alternative that has the same affect-enhancing properties without a negative impact on health. Exercise engages some of the same brain mechanisms targeted by widely abused chemical affect regulators, such as dopamine, endogenous opioids, and endocannabinoids; can increase perceived energy and calmness; and has positive, rather than negative, effects on overall health.

Third, the low adherence to exercise represents a major public health problem. Most people who become physically active either do not exercise regularly or quit. Although most contemporary theories assume that nonadherence and drop-out are the result of a rational decision-making process, these phenomena may also be driven by affective processes. Affect is a powerful motive in human behavior. People may adhere to exercise if their affective responses are positive and may drop out if their affective responses are consistently negative. This possibility, which has received empirical support, offers researchers new insight into the mechanisms underlying exercise behavior.

History

The first studies on affective responses to exercise appeared in the late 1960s. The typical methodological approach consisted of administering a questionnaire of mood (such as the Profile of Mood States) or anxiety (such as the State-Trait Anxiety Inventory) shortly before and after an exercise bout. At the time, very few questionnaires were designed to assess nonclinical forms of how people feel. Therefore, the limited availability of measures dictated the dependent variables being studied. Consequently, those variables might or might not have been the most relevant, raising the possibility that changes also occurred in variables other than those being measured. The samples of respondents typically consisted of conveniently accessible groups, such as young, healthy, physically active, and fit university students. The intensity of exercise was rarely monitored via objective means (electrocardiography or expired gases) and, when it was standardized across participants, the method was often based on estimated, rather than directly measured, maximal exercise capacity (typically, age-predicted maximal heart rate, known to result in considerable errors). Despite these methodological limitations, which were consistent with a nascent line of research, early studies provided voluminous evidence of an exercise-associated anxiolytic and mood-enhancing effect.

Mechanisms

In the 1980s and 1990s, along with numerous replications of the anxiolytic and mood-enhancing effects across different settings, samples, and types of exercise, research attention turned to mechanistic hypotheses. These included proposals that exercise makes people feel better because (a) they perceive that they are doing something challenging and, at the same time, beneficial (the mastery hypothesis); (b) it provides an opportunity to temporarily escape the stresses and hassles of daily life (the distraction or time-out hypothesis); (c) it provides an opportunity for enjoyable social

interaction (the social interaction hypothesis); (d) it corrects imbalances in monoaminergic neurotransmission that are associated with negative affectivity (the monoamine hypothesis); (e) it promotes the release of peripheral and central endogenous opioids (the endorphin hypothesis); and (f) it raises core temperature, which creates a sense of relaxation or exhilaration (the thermogenic hypothesis).

The conclusions from these investigations have been mixed. What seems clear is that no single explanation can provide an exclusive account of the reasons why exercise can make people feel better. Studies on the mastery hypothesis have demonstrated that participants whose physical confidence is strengthened report feeling better than those whose physical confidence is weakened. On the other hand, the thermogenic hypothesis has been largely discredited, with studies demonstrating that elevations in core temperature during exercise are associated with feeling worse, not better. The endorphin hypothesis continues to hold promise. However, interest in this idea has declined following a string of studies that produced conflicting results and, thus, confusion and frustration among researchers. However, upon closer analysis, the inconsistencies can be attributed to methodological weaknesses, which, in turn, could be due to the lack of interdisciplinary expertise on the physiology and pharmacology of the endogenous opioid system. The distraction and social-interaction hypotheses may provide partial explanations, but there are caveats for both. Specifically, while other distracting activities may also produce a feel-better effect, exercise often produces changes that are qualitatively different. For example, while a session of meditation or a period of quiet rest may primarily induce relaxation, a typical response to a bout of moderate-intensity exercise consists of an increase in perceived energy during and immediately following the bout and, only later, an increase in relaxation compared to baseline. Furthermore, while an enthusiastic and supportive social group can enhance the positive affective response to exercise, an indifferent group may experience no effect and a group or an exercise leader perceived as critical can have a negative effect. Moreover, studies have shown that people can feel better even when they exercise in an empty room while staring at a barren wall. The monoamine hypothesis remains viable, with findings showing that monoamines (serotonin, dopamine) may be implicated in the feel-better effect. However, at least for now, this research is limited to experimental animals, with all the interpretational challenges that this entails, that is, inability to directly extrapolate from observable animal behavior to subjective human feelings.

Mechanistic research has now moved in some notable new directions. First, studies have begun exploring associations between affective responses to exercise and neurotransmitter dynamics. Advances in positron emission tomography have made it possible to quantify exercise-associated changes in receptor occupancy in the human brain. Second, research is emerging on the role of endocannabinoids, a class of substances discovered relatively recently, that are extensively involved in reward. Both experimental studies with animals and preliminary correlational studies of peripherally circulating endocannabinoids in humans suggest that these substances may add one more piece to the mechanistic puzzle. Third, research is examining the role of exercise-upregulated neurotrophic factors in anatomical adaptations in the human brain that may be associated with how people feel. While chronic psychological stress is associated with reduced synthesis of neurotrophic factors and reduced volumes of brain structures involved in emotion and mood regulation, exercise is among the most potent known stimuli for the upregulation of these neurotrophic factors.

Beyond the Feel-Better Effect

Critics express skepticism about the ability of exercise to make people feel better based on a simple but intriguing argument: If exercise could, in fact, make people feel better, would most people be sedentary? Research based on a new methodological platform is beginning to show that the feel-better effect, while feasible, is neither automatic nor guaranteed for everyone. It should more accurately be described as conditional.

One of the methodological innovations was the introduction of measures that tap the main dimensions of affect, as opposed to a few discrete affective states. Theoretically, the advantage is no major variant of affective experience resulting from exercise (including negative variants) can go undetected. A second aspect of the revised methodology is the timing of affect assessments. It became clear that, by measuring only before and after the exercise bout, the shape of the affective response could be misrepresented. For example, depending on the

intensity of exercise, pleasure could be reduced during exercise but rebound postexercise. However, if affect is assessed only before and after the bout, one could conclude that the only change was a pre-to-post increase in pleasure. Thus, newer studies have employed repeated assessments of affect, both during and after the bout. Thirdly, newer studies use more accurate methods for standardizing exercise intensity, reducing error variance and increasing statistical power. The measurement of expired gases has become common practice. Furthermore, several laboratories base the standardization of intensity on the more laborious but more meaningful practice of identifying physiological markers, such as the ventilatory or lactate threshold and the respiratory compensation point. These markers differ among individuals, even of the same sex, age, health status, activity habits, and aerobic capacity. Research suggests that exercising at intensities slightly above and below these markers may be associated with considerable differences across several physiological systems as well as differences in affective responses. Finally, once it became clear that affective responses varied between individuals, even in response to the same, well-standardized, exercise stimulus, it also became apparent that analyses of change restricted to the level of entire groups could be misleading. This is because subgroups within the same sample may respond in different directions (e.g., increased versus decreased pleasure). Thus, it is possible for two subgroups to exhibit changes of equal magnitude but in opposite directions, resulting in a group mean that appears unchanged over time. In such cases, the sample mean fails to reflect the actual response of individuals, becoming merely a statistical abstraction. To address this problem, in newer studies, change is examined both at the level of the entire sample and at the level of individuals and subgroups.

The conclusion from studies based on this revised methodology is that the feel-better effect represents only one aspect of the multifaceted exercise–affect relationship. Interindividual differences are prevalent and reductions in pleasure are common. For example, obese and inactive middle-age women report declines in pleasure across the entire range of exercise intensity.

Affective Responses and Exercise Prescription

The optimization of affective responses to exercise is gradually being adopted as one of the pillars of exercise prescription guidelines, alongside the maximization of biological adaptations like gains in fitness and health and the minimization of risk. Exercise practitioners are advised to systematically monitor the affective responses of participants and to regulate exercise intensity to ensure that affective responses remain positive or at least nonnegative. This can be achieved by (a) allowing participants to self-select their intensity, in order to engender a sense of perceived autonomy and self-efficacy; and (b) ensuring that intensity does not greatly exceed the ventilatory threshold (which can be estimated without instruments as the level of intensity that brings about a perceptible increase in the frequency and depth of ventilation and a subjective characterization of perceived exertion as "somewhat hard" or "hard"). Maintaining proper hydration and comfortable ambient temperature and humidity levels is also important.

Furthermore, it is crucial to recognize that the relationship between exercise intensity and affective responses is influenced by individual differences. Because of a combination of genetic and epigenetic factors, people develop varied preferences for levels of exercise intensity and different degrees of tolerance to intense exercise. These differences influence the affective responses that individuals experience at different intensities. Although a standard method of tailoring exercise intensity to individual levels of preference and tolerance has yet to be developed, practitioners should keep in mind that what was pleasant for one participant may not be pleasant for another.

Finally, it is advisable to maintain a social environment in which participants can feel confident and secure. The presence of other exercisers who appear to be of superior fitness or an exercise leader who emphasizes skill, appearance, or interpersonal comparisons could induce social-evaluative and self-presentational concerns.

Panteleimon Ekkekakis

See also Addiction, Effects of Exercise on; Affect; Emotional Responses; Energy, Effects of Exercise on; Hedonic Theory; Runner's High

Further Readings

Chaouloff, F., Dubreucq, S., Matias, I., & Marsicano, G. (2013). Physical activity feel-good effect: The role of endocannabinoids. In P. Ekkekakis (Ed.), *Routledge*

handbook of physical activity and mental health (chap. 3). London: Routledge.
Ekkekakis, P., Parfitt, G., & Petruzzello, S. J. (2011). The pleasure and displeasure people feel when they exercise at different intensities: Decennial update and progress towards a tripartite rationale for exercise intensity prescription. *Sports Medicine, 41,* 641–671.
Henning, B., & Dishman, R. K. (2013). Physical activity and reward: The role of endogenous opioids. In P. Ekkekakis (Ed.), *Routledge handbook of physical activity and mental health* (chap. 2). London: Routledge.
Rhodes, J. S., & Majdak, P. (2013). Physical activity and reward: The role of dopamine. In P. Ekkekakis (Ed.), *Routledge handbook of physical activity and mental health* (chap. 4). London: Routledge.

Affirmations

Affirmation is the act of reflecting on core aspects of the self, such as important values, relationships, and personal characteristics like religion, music, or sports. Previous research shows that self-affirmation interventions can reduce psychological and physiological stress and defensiveness, while boosting personal responsibility and performance. Self-affirmation interventions and theory have promising applications in sports and exercise, including facilitating achievement and helping individuals respond adaptively to setbacks.

Self-Affirmation Theory

The social psychologist Claude Steele proposed self-affirmation theory in 1988. It holds that individuals are motivated to maintain self-integrity: a sense that one is a person of worth, morally adequate and effective at making changes in one's life. There are many routes to self-integrity, and affirmations of the self in one part of life (e.g., reflecting on being a good father) can buffer threats in other parts of life (e.g., poor performance). Affirmations in the context of threat can protect the self and allow people to respond with reduced stress and defensiveness because they are reassured that they possess integrity and worth.

When an event such as a sports loss or failure to complete a workout regimen threatens a valued self-image (e.g., being a good athlete or motivated exerciser), people are at risk of responding defensively by rejecting responsibility or giving up. If, however, the person affirms an important personal value before the threat, their sense of moral adequacy and efficacy can be reinforced and protected. Within social psychology, interventions involving values affirmations often take the form of having individuals reflect and write briefly about an important personal value such as relationships with friends and family. Writing about important personal values can fulfill the global need for self-integrity and enable people to constructively respond to threatening events.

Reduction of Defensive Strategies

Sport and exercise present psychological threats like the fear of low performance that can impact one's personal and public image. There is empirical evidence that people can respond to these threats by construing situations as less threatening to personal worth and well-being. For example, athletes may use defensive strategies such as attributing more internal causes for success than for failure (e.g. "I won because of my ability," but "I lost because of the weather": self-serving biases); denying their team's responsibility for a negative outcome or exaggerating their role in victory (group-serving biases); or claiming handicaps (e.g., claiming back pain before a competition to have an excuse for failure or to enhance credit for success: claimed self-handicapping). These defensive strategies help maintain self-integrity by reducing threats but can limit achievement when personal responsibility is denied and failure is attributed to external causes. Self-affirmation can reduce engagement in these maladaptive strategies.

For instance, a field study demonstrated how self-affirmation can lower athletes' engagement in self-handicapping strategies. Claimed self-handicapping was assessed before and after an affirmation intervention. First, coaches asked their athletes to report to what extent handicaps such as physical pain or stress could disrupt their training. Using a classic self-affirmation study design, athletes assigned to an affirmation condition ranked a list of values (e.g., relationships with friends) from the most important to the least important, and then wrote an essay about their most important value. Athletes in a no-affirmation control condition ranked the same values but wrote an essay on why their least important value might be important to someone else. Athletes in the affirmation

Robert C. Eklund | **Gershon Tenenbaum**
Editors

Encyclopedia of Sport and Exercise Psychology



ENCYCLOPEDIA OF
Sport and Exercise Psychology

Los Angeles | London | New Delhi
Singapore | Washington DC

FOR INFORMATION:

SAGE Publications, Inc.
2455 Teller Road
Thousand Oaks, California 91320
E-mail: order@sagepub.com

SAGE Publications Ltd.
1 Oliver's Yard
55 City Road
London, EC1Y 1SP
United Kingdom

SAGE Publications India Pvt. Ltd.
B 1/I 1 Mohan Cooperative Industrial Area
Mathura Road, New Delhi 110 044
India

SAGE Publications Asia-Pacific Pte. Ltd.
3 Church Street
#10–04 Samsung Hub
Singapore 049483

Printed in the United States of America.

Library of Congress Cataloging-in-Publication Data

Encyclopedia of sport and exercise psychology / edited by Robert C. Eklund, Gershon Tenenbaum.

pages cm
Includes bibliographical references and index.

ISBN 978-1-4522-0383-6 (hardcover)

1. Sports—Psychological aspects—Encyclopedias.
2. Exercise—Psychological aspects—Encyclopedias. I. Eklund, Robert C. (Robert Charles), 1958– II. Tenenbaum, Gershon.

GV706.4.E5 2014
796.03—dc23 2013021776

Acquisitions Editor: Jim Brace-Thompson
Developmental Editor: Sanford J. Robinson
Reference Systems Manager: Leticia M. Gutierrez
Reference Systems Coordinators: Anna Villasenor, Laura Notton
Production Editor: Tracy Buyan
Copy Editors: Diane DiMura, Megan Markanich
Typesetter: Hurix Systems (P) Ltd.
Proofreaders: Sally Jaskold, Kate Peterson
Indexer: Sheila Bodell
Cover Designer: Candice Harman
Marketing Manager: Carmel Schrire

14 15 16 17 18 10 9 8 7 6 5 4 3 2 1