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Original article

Mental training can improve physical activity behavior in adolescent girls

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Abstract

Purpose: Lately, physical activity (PA) has been frequently discussed in young girls, thus we were interested to examine whether a mental training intervention can increase the level of PA in young girls.

Methods: A sample of 56 girls aged 15.4 ± 0.3 years (mean \pm SD) was assigned to either the intervention or control group. We then conducted a 6-week mental imagery training program on young female participants. PA was evaluated with objective accelerometer monitors. Physical self-concept was also assessed in all participants.

Results: Young females' PA increased after a course of mental training compared to female participants in control group. Furthermore physical self-concept improved related to mental training program.

Conclusion: Exercise imagery may be an effective method of PA increase besides psychological enhancement in young girls.

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Keywords: Accelerometer; Exercise imagery; Girls; Psychological competence; Youth

1. Introduction

Adolescents in high school years show a decline in level of physical activity (PA); whereas girls experience poorer state than boys. Several findings addressed a wide range of decrease in PA (64%–100%) across different populations, particularly in girls from developing societies.¹ Although several public health guidelines for PA have been established, a majority of young girls do not meet PA guideline² and in turn, the prevalence of metabolic disorders related to sedentary lifestyle is growing in young population groups such as girls of developing countries.³

Several home and community based interventions have been introduced to help young girls become more active.^{4–6} Most of the interventions are focused on school activities such as physical education classes and environmental changes to fulfill the requirements of PA programs.⁷ Surprisingly there are little data on PA interventions in high school

girls; while previous studies dominantly examined elementary children.⁵ Thus providing a novel solution to youth inactivity remains a major universal challenge.⁸

On the other side, psychological demands of PA in girls have been mostly overlooked. Regular PA is indicated as a determinant of physiological and psychological well-being.⁹ Studies showed that mental readiness is very critical to adopt a PA program.¹⁰ Recently, researchers have addressed the mental training programs to gain psychological or physical benefits of PA.^{11,12} They indicated that psychological exercises may help individuals to image themselves in better shape, more physically active or healthier. Indeed mental images including representations of goals, actions or behaviors may be rehearsed either as hypothetical events or reconstructions of real events. Similar to actual images, mental images can therefore be helpful to motivate individuals for the purpose of health behaviors.¹³

In that vein and for several years, mental imagery techniques have been used by athletes to enhance the skills and motivation reaching their ultimate goals.¹⁴ Thus reasonable grounds exist to suggest that non-athlete exercisers can also benefit from mental imagery to imagine their success and enjoyment of

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the exercise process.¹⁵ Furthermore mental images related to goal or process of exercise may be particularly effective in enhancing motivation for physical exercise. Examining sedentary individuals, researchers discussed that increase in action planning or physical self-concept may underlie the influence of mental exercise imagery on level of PA.¹⁶ Based on study of Bandura,¹⁷ including vicarious modeling in the intervention would result in a higher exercise self-efficacy/concept. Vicarious modeling may involve either observation of an explicit exercise behavior or mentally imaging oneself exercising. Mental imagery can further recruit positive physiological and emotional outcomes related to the exercise, thus may strengthen the exercise self-concept attitude.¹⁸

Mental imagery has been demonstrated to have neurological basis that involves the activation of internal models of action. Mirror neurons in premotor and parietal cortex may be responsible for both perception and action of movement behavior.¹⁹ Furthermore, using brain imaging techniques, neuroscientists found a neural network involved in mental imagery including primary motor cortex, supplementary motor area, anterior cingulate cortex, inferior and superior parietal lobules, and the cerebellum.²⁰ Indeed recruiting a large area of brain regions during imagery related to sensory, intention reading, conflict resolution, and emotional regulation as well as planning skills highlights the possible contribution of mental imagery to enhance the health behaviors (i.e., PA) and related psychological skills.²¹

Although previous studies showed benefits of mental imagery to enhance exercise self-efficacy/concept in exercisers or even inactive people,²² so far there are very few imagery interventions with the specific aim to increase exercise self-concept in young females. The current study had two central aims: first, to investigate the effectiveness of exercise imagery in their ability to increase exercise behavior over a period of 6 weeks. The mental imagery intervention involves images related to exercise behavior and related psychological and physical outcomes. The second aim of the study refers to the evidence suggesting a link between imagery use and self-concept in exercisers in addition to association of exercise behavior and self-concept. We then hypothesized that girls attending imagery exercises about their PA, health status, appearance, and energy would improve their physical and/or psychological competence.

2. Materials and methods

2.1. Study design

The study measured pre/post differences in a 6-week exercise imagery program. High school girls in the intervention group completed demographic, physical self-concept questionnaires and assessed by accelerometer monitors at weeks 0 and 6. Anthropometrics were measured at weeks 0 (baseline) and 6 (post intervention). Also, demographics, physical self-concept, accelerometry, and anthropometrics were assessed at baseline and week 6 for control participants. All participants were asked not to change their routine physical education curriculum during the study period.

2.2. Participants

Fifty-six schoolgirls aged 15–16 years old were assigned to the study from two high schools in Tehran. While all participants received usual physical education programs, 28 girls have been assigned to exercise imagery intervention but the other 28 girls in control group received only recommendations on PA promotion. Participants in two sex- and age-matched groups have met inclusion criteria and been excluded if they reported any physical impairments that prevent them from physical activity. Girls and their caregivers have been asked to provide a written informed consent before data collection. This study was approved by Ethics Committee of Tehran University of Medical Sciences.

2.3. Measures

2.3.1. PA

We used a GT3X monitor (ActiGraph, Pensacola, FL, USA) to assess the PA. The GT3X is a small and light monitor device that provides activity counts as the outcome measure of PA. Larger counts stand for the higher level of activity. This is a reliable and valid instrument based on previous data from healthy populations.²³ The accelerometer monitor was placed on the right hip using an elastic belt for 1 week.²⁴ Caregivers and teachers were asked to record the times that children woke up, wore the Actigraph on/off and went to bed on a 7-day time sheet. The accelerometry data collected from waking hours were employed to analysis using the ACTILIFE™ software (ActiGraph). Based on previous studies, the accelerometers were programmed to collect data in 1-min intervals and the output was expressed based on vector magnitude (VM) score as counts per minute (c.p.m.) or overall PA.²⁵ Other variables were provided by dividing the overall PA into two categories based on day-time, in-school (08:00–14:00) and after-school (16:00 to bedtime), seeking to examine time–activity patterns. To control for school's finish time, a 2-h gap between 14:00 and 16:00 was considered.

2.3.2. Physical self-concept

Physical Self-Description Questionnaire (PSDQ) with 11 subscales of endurance, strength, coordination, appearance, flexibility, PA, body fat, sports competence, health, global physical self-concept, and global self-esteem was used to assess physical related psychological competence. There were six response options for participants; from “strongly agree” to “strongly disagree”. The questions addressed physical perception of participants. For example, how good they are at coordinated movements, how often they do exercise or activities that make them breathe hard, whether they are overweight, and whether they are attractive for their age. The questionnaire showed a good test–retest reliability ($r = 0.83$) and also an acceptable factor validity in previous studies.²⁶

2.3.3. Mental imagery

The exercise imagery intervention was presented to improve participants' perception of PA outcomes. In order to enhance the interest of girls in PA using exercise imagery interventions, several features were proposed by previous studies such as

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