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Effectiveness of a cross-circuit exercise training program in improving the fitness of overweight or obese adolescents with intellectual disability enrolled in special education schools

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ABSTRACT

This study assessed the effects of a cross-circuit training intervention program on the body composition, cardiorespiratory fitness, balance, and muscular strength endurance of overweight or obese students with intellectual disability. A total of 43 students with intellectual disability (aged 13–19 years) were enrolled in this program; 28 overweight/obese students were assigned to either an obesity-control group (n = 14) or obesity-exercise group (n = 14), and those with normal weight were assigned to a normal weight group (n = 15). The experiment was divided into three periods: pretest (involving the three groups), exercise intervention (involving only the obesity-exercise group), and post-test (involving the obesity-exercise and obesity-control groups). The test involved measuring the body composition, 1-min sit-ups, dynamic and static balance, vertical jumps, and modified Bruce treadmill protocols for measuring cardiorespiratory fitness. The exercise program involving the cross-circuit training concept was conducted nonstop with different types of exercise activities. The training program lasted 12 weeks, and it was executed 5 days a week, with each daily session lasting 50 min. The results revealed that the obesity-exercise group demonstrated reduced weight, BMI, and fat mass after the intervention program. Moreover, the exercise tolerance test (including total exercise time and maximal heart rate), dynamic balance, sit-up, and vertical jump performance of the participants improved significantly. In conclusion, the cross-circuit training program effectively improved cardiorespiratory fitness, dynamic balance, muscular strength and endurance, and weight control in overweight or obese students with intellectual disability enrolled in a special education school.

What this paper adds

A simple and practical exercise prescription and readily available aids were employed to design a 12-week cross-circuit training program (5 days per week and 50 min per session). The nonstop cross-circuit training program was integrated with

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aerobic, muscular strength and endurance, and coordination exercise activities. This type of training could help students with intellectual disability in special education schools lose weight and improve their cardiopulmonary fitness, dynamic balance, and muscular strength and endurance.

1. Introduction

It has been reported that children with intellectual disabilities (ID) exhibit unsatisfactory cardiorespiratory fitness and muscle strength, and that a high proportion of such children are obese (Pitetti, Yarmer, & Fernhall, 2001). In special education schools, students typically receive two or three sessions of physical education per week. However, this is insufficient. It is recommended that school children obtain 60 min of moderate to vigorous physical activity for at least 6060 min per day (Morrow et al., 2013). Furthermore, such children are often incapable of achieving moderate to vigorous physical activity levels during the adapted physical programs. As a consequence, most students (particularly those with mild to moderate intellectual disability) become overweight or obese. In special education, physical therapists train students with ID to participate in individualized exercise and to improve their motor skill, muscular endurance, balance skills, and cardiorespiratory fitness, thereby helping such students to overcome their difficulties in daily life, learning, and employment. Studies have shown that exercise can considerably improve cardiorespiratory fitness (Boer et al., 2014; Elmahgoub et al., 2009; Guidetti, Franciosi, Gallotta, Emerenziani, & Baldari, 2010; Mendonca, Pereira, & Fernhall, 2011; Oviedo, Guerra-Balic, Baynard, & Javierre, 2014; Ozmen, Ryildirim, Yuktasir, & Beets, 2007; Pastula, Stopka, Delisle, & Hass, 2012), muscular strength and endurance (Boer et al., 2014; Cowley et al., 2011; Elmahgoub et al., 2009; Guidetti et al., 2010; Oviedo et al., 2014; Shields, Taylor, & Dodd, 2008), balance skills (Jankowicz-Szymanska, Mikolajczyk, & Wojtanowski, 2012; Oviedo et al., 2014), metabolic functions (Boer et al., 2014; Elmahgoub et al., 2009), cognitive ability (Pastula et al., 2012), and body composition (Boer et al., 2014; Elmahgoub et al., 2009; Guidetti et al., 2010; Oviedo et al., 2014; Seron, Silva, & Greguol, 2014) of people with ID (Table 1). However, specific studies on how to train obese people with ID to lose weight or to maintain healthy body are limited. Therefore, the purpose of the present study was to develop an individualized training program for overweight/obese children with ID. We attempted to use readily available aids to design a simple exercise program to be executed 50 min per day. In addition, we propose a cross-circuit training concept integrating aerobic workout, muscular strength and endurance, as well as coordination in one conditioning session. The entire exercise set must be executed without interruption. Given existing resources and appropriate use of the environment, our objective was to use simple exercise routines and few human resources to effectively enhance the exercise participation, motivation, and physical fitness of overweight/obese youth with ID.

2. Methods

2.1. Participants

In total, 43 students (19 boys and 24 girls; average age, 16.98 ± 1.35 years) with ID who were aged 13–19 years and enrolled in a special education school were recruited in this study. Table 2 shows the demographic information of the participants. These participants were classified based on the BMI cutoff values for Taiwanese adolescents as underweight, normal weight, overweight, or obese (Sports Administration Fitness Norm – BMI, 2013). The BMI norm cutoff points are based on percentiles for various age groups and gender in Taiwan; a BMI exceeding the 85th percentile indicates overweight, and that exceeding the 95th percentile indicates obesity. Among the participants, 28 overweight/obese participants were divided into two groups: the obesity-exercise group (14 participants) and the obesity-control group (14 participants). The remaining 15 normal weight participants constituted the normal weight group. In the obesity-control group 57% of the subjects (N = 8) were obese and 43% (N = 6) were overweight. However, in order to allocate our teaching resources most effectively, for the intervention group we prioritized the recruitment of obese students over overweight ones, with the result that more subjects in the obesity-exercise group were obese (93%, N = 13) and fewer were overweight (7%, N = 1). In addition, because the participants were vulnerable adolescents with intellectual disability, their intentions and those of their guardians were considered during group assignment, and they were not randomly assigned to a group. The exclusion criteria were as follows: students with abnormal auditory or visual perception, physical disability, encephalopathy, epilepsy, congenital cardiopulmonary diseases, or other types of severe functional disability; those who had regularly engaged in exercise during the past 3 months before the study; and those who could not understand simple instructions for exercise testing or training. In Taiwan, the International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY) framework was used to determine the presence and severity of disability for children and youth. The information is used to determine eligibility for issuance of a Mental/Physical Disability card. Participants in this study were classified according to the severity label on the card, whereby 2 participants had mild disability, 33 participants had moderate, 5 participants had severe, and 3 participants had extremely severe disability (Table 2). In addition, the code b117 of ICF-CY was used in the diagnosis of their intellectual function deficits. After assessment, 2 participants were classified as having mild intellectual disability and 41 participants as having moderate intellectual disability. Besides ID, some participants had a secondary diagnosis: 7 participants had Down syndrome, 4 had vocal dysfunction, 3 had autism, and 1 had mental disorder. The study was approved by the Institutional Review Board of XXX Hospital, and the guardians on behalf of the children gave informed consent in writing before children participated in the study.