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ORIGINAL ARTICLE

Can a Lifestyle Intervention Improve Physical Fitness in Adolescents and Young Adults With Spastic Cerebral Palsy? A Randomized Controlled Trial

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Abstract

Objective: To evaluate both the short- and long-term effectiveness of a lifestyle intervention on physical fitness in adolescents and young adults with cerebral palsy (CP).

Design: Single-blind, randomized controlled trial.

Setting: University hospitals and rehabilitation clinics.

Participants: Adolescents and young adults (N=57) with spastic CP classified in Gross Motor Function Classification System levels I through IV; of these, 42 completed the study.

Intervention: A 6-month lifestyle intervention consisting of physical fitness training combined with counseling sessions focused on physical behavior and sports participation.

Main Outcome Measures: Physical fitness, including measures of cardiopulmonary fitness, muscle strength, and body composition.

Results: Favorable short- and medium-term effects were found for peak oxygen consumption, oxygen consumption, and load on the anaerobic threshold and waist circumference. Favorable long-term effects were found for sum of skinfolds, systolic blood pressure, and total cholesterol.

Conclusions: This exploratory study showed that the lifestyle intervention was effective in improving cardiopulmonary fitness and body composition. Effects of body composition were maintained in the long term. However, the intervention needs to be optimized to increase muscle strength and for long-term retention of effects on aerobic capacity.

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Sufficient physical fitness and physical activity (PA) are major contributors to a healthy lifestyle for the general population,[1] particularly because of their inverse relation to total and cardiovascular mortality.[2] For persons with cerebral palsy (CP), defined as "a group of permanent disorders of the development of movement and posture, causing activity limitation that are attributed to non-progressive disturbances that occurred in the developing foetal or infant brain,"[3(p9)] sufficient physical fitness and PA is likely to be even more important. In addition to health benefits, sufficient physical fitness and PA are believed to maintain and optimize daily life performance[4] and prevent the development of secondary health problems in adulthood.[5] Nevertheless, research consistently shows that people with CP have low levels of physical fitness[6-9] and PA.[10-13]

During adolescence, there are many changes occurring with substantial impact on the development of the adult lifestyle.[14,15] Therefore, improving physical fitness and incorporating sufficient PA at this age seem to be an appropriate goal to benefit the

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person through their lifespan. Important health-related components of physical fitness are cardiopulmonary fitness, body composition, and muscle strength.[16] Children, adolescents, and young adults with CP benefit from all these measures of physical fitness directly after the interventions as described in 2 systematic reviews.[17,18] However, both reviews indicate that cardiopulmonary fitness tends to return to baseline at follow-up.[17,18] Also, benefits to muscle strength were no longer present at follow-up in 2 out of 5 studies in the review by Verschuren et al.[17] Apparently, offering a temporary intervention focused on improving physical fitness is insufficient to maintain improvements in physical fitness over the long term in persons with CP. Behavioral change toward a more active lifestyle may be more effective in the long term. Counseling sessions appear promising to achieve behavioral changes among persons with physical disabilities.[19,20] Therefore, the active lifestyle and sports participation intervention was developed in The Netherlands to increase physical fitness and PA through behavioral change in adolescents and young adults with childhood-onset physical disabilities.[21] The present study is part of the LEARN 2 MOVE 16-24 study,[22] and its aim is to evaluate the effectiveness of this active lifestyle and sports participation intervention on physical fitness in adolescents and young adults with spastic CP. Effects of the intervention on other outcome measures (eg, PA, fatigue, participation, quality of life) will be presented in forthcoming publications. By offering an exercise program combined with PA counseling to achieve behavioral changes toward more PA, effects on physical fitness are expected in both the short and long terms.

Methods

Study design

The present study is a multicenter trial with a randomized controlled design. To obtain equally distributed gross motor functioning between experimental and control groups, stratification of participants was performed using the Gross Motor Functioning Classification System (GMFCS).[23] Random allocation of participants to these groups (1:1) was performed for each participating center and within each stratum. The active lifestyle and sports participation intervention was received by the experimental group, whereas no intervention to improve physical behavior and fitness was received by the control group. Individuals allocated to the control group continued their regular treatments. These regular treatments consisted of physiotherapy for slightly >80% of control group participants and had an average duration of 2 hours per week. However, in contrast with the active lifestyle and sports participation intervention, these regular treatments were not aimed at increasing fitness or PA levels. Assessors performing the study measurements were blinded to group allocation.

List of abbreviations:

AT	**anaerobic threshold**
CP	**cerebral palsy**
CPET	**cardiopulmonary exercise testing**
GEE	**generalized estimating equation**
GMFCS	**Gross Motor Function Classification System**
PA	**physical activity**
Vo_2peak	**peak oxygen consumption**

Setting and participants

Review of health records at 4 rehabilitation centers and 2 rehabilitation departments at university hospitals throughout the western-central part of The Netherlands identified eligible participants. Persons were eligible if they met the following inclusion criteria: diagnosed with spastic unilateral or bilateral CP; age 16 to 24 years old; and GMFCS levels I to IV. Persons were excluded if they had any of the following: disabilities other than CP affecting cardiopulmonary fitness or PA; contraindication to (maximal) exercise[24]; exceeding the mean PA level + 2 SD of a CP population[10] as measured with an accelerometry-based activity monitor[25] corresponding to 263 minutes of PA per day; or insufficient understanding of the project caused by severe cognitive impairment or insufficient comprehension of the Dutch language. An informational letter, including an invitation to participate, was sent to eligible persons. Three weeks later, nonresponders received a reminder letter. Written informed consent was provided by all participants. The study was approved by the medical ethics committee of the Erasmus Medical Center. All participating centers granted local approval.

We identified a target population of 456 adolescents and young adults with CP in the patient registers of participating centers. Many patients had not received care at a rehabilitation center for many years. Therefore, the accuracy of their contact information was uncertain. A total of 183 potential participants responded to our invitation; of these, 57 (31%) consented to participate, and 42 completed the study (fig 1).

Intervention

The active lifestyle and sports participation intervention aims to permanently increase physical fitness and PA levels and reduce sedentary behavior. The intervention is targeted at adolescents and young adults with physical disabilities and promotes a more active lifestyle. The active lifestyle and sports participation intervention consisted of 3 parts. The first included weekly supervised center and weekly home-based physical fitness training with a focus on increasing levels of cardiopulmonary fitness and muscle strength offered by a physical therapist for a period of 3 months. The second included counseling on daily PA, which was based on motivational interviewing.[26] Barriers and facilitators of PA in daily life were discussed, and increasing PA and minimizing sedentary behavior were encouraged during these sessions. In total, 6 monthly sessions with a duration of 30 minutes were offered and guided by a personal coach (physical therapist/movement therapist). The third part included counseling on sports participation, which was carried out to find accessible, suitable, and appropriate sports and sports facilities conveniently located in each participant's environment. In total, 2 to 4 sports counseling sessions were offered by a movement therapist over a period of 6 months depending on the participant's desires. Furthermore, optional sport-specific training was offered, which included practice opportunities to match sports to participants' interests and abilities.[21] A time schedule of the active lifestyle and sports participation intervention is presented in table 1. Details of the active lifestyle and sports participation intervention have been described elsewhere.[22]

The training frequency of the active lifestyle and sports participation intervention did not meet guidelines for cardiopulmonary exercise training.[27] However, the content of the counseling and sport-specific training was considered because it also