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REVIEW ARTICLE

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An overview of the effects of physical exercise programs on individuals with Intellectual and Developmental Disabilities

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ABSTRACT

Being aware of the relevance of physical exercise in individuals with Intellectual and Developmental Disabilities (IDD), we intend to conduct a brief review on the importance of regular physical exercise for this population. An approach will be taken in order to acknowledge the barriers to the high rates of sedentary lifestyles in this population, the potential benefits of physical exercise, and the essential aspects for a correct assessment, prescription, and implementation of these programs in the population with IDD, through a reflection supported by scientific evidence. The current overview aims to provide relevant information regarding the health benefits of physical exercise in individuals with IDD, as the basis for QoL promoting more active and healthier lifestyles, namely through structured physical exercise. In addition, it is also a useful tool for consultation by exercise professionals since adjusted indoor and outdoor exercise programs are listed.

KEYWORDS: intellectual and developmental disabilities; physical exercise; strength training; cardiorespiratory training; quality of life.

BRIEF REVIEW

Intellectual and Developmental Disabilities (IDD) are characterised by a deficit in intellectual and adaptive functioning in the conceptual, social, and practical domains, being identified in profound, severe, moderate, and mild degrees, developing before the of 22 years old (Schalock et al., 2021). Although the average life expectancy of these individuals has been increasing in recent years (Dieckmann et al., 2015), they still experience shorter longevity when compared to individuals without IDD (Glover et al., 2017; Heslop & Glover, 2015; McCallion & McCarron, 2014). In addition, they age prematurely, much due to the complications of the disability itself (Coppus, 2013), as well as health problems such as mental health or multimorbidity (Cooper et al., 2015; Hermans & Evenhuis, 2014; Timmeren et al., 2017). The continuous need for medical care and the acquisition of medication, among others, also results in high financial costs for their health (Anderson et al., 2013; Krahn & Fox, 2014; Lunsky et al., 2018).

On the other hand, sedentary lifestyles are prevalent in this population, and low engagement in physical activity practices (Dairo et al., 2016) fails to meet the guidelines suggested by Bull et al. (2020). This sedentary lifestyle and low engagement in active practices do not promote desirable physical fitness. Several studies indicate that individuals with IDD have low levels of physical fitness (Borji et al., 2014; Chow et al., 2018; Gawlik et al., 2016), which increases the risk of developing other comorbidities, including metabolic and cardiovascular diseases (de Winter et al., 2012). However, one of the reasons reported in the literature for this lifestyle is the presence of barriers to the practice of physical activity. In order to identify these barriers, Jacinto et al. (2021b) conducted a systematic

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review, updating a previously published one (Bossink et al., 2017), aiming to carry out a specific survey of the barriers, analysing whether it was decreasing or increasing compared to the last study. More specifically, the main barriers to physical activity perceived by individuals with IDD, their families, caregivers/technicians, or even from the perspective of project leaders can be systematised into personal (6 barriers were found), family (4 barriers were found), social (13 barriers were found), financial (1 barrier was found), and environmental (1 barrier was found) factors. All these barriers (25) have already been mentioned in a previously published systematic review (Bossink et al., 2017). However, the total number of barriers to physical activity perceived by individuals with IDD decreased compared to those perceived in the previous published review. This fact may presume that baseline work was carried out with strategies and recommendations in order to promote the practice of physical activity.

Although there are barriers for an individual with IDD to practice physical activity, it is agreed that any increase in physical activity or structured exercise for a sedentary and inactive lifestyle increases the chances of positive physiological improvements and consequent quality of life (QoL). In individuals with IDD, adopting active lifestyles and regular exercise seem to positively affect physical capacities (strength, aerobic, balance and flexibility), overall health, and QoL (Bartlo & Klein, 2011; Calders et al., 2011). On the other hand, knowing that one of the barriers to physical activity in this population is the lack of adapted exercise programs (Jacinto et al., 2021b), there is a need for studies that clearly identify recommendations for the assessment and prescription of physical exercise adjusted for individuals with IDD and which training method best meets their needs and the purpose of the exercises simultaneously. This information is a useful tool for promoting physical exercise among individuals with IDD, reducing this identified barrier.

Since this population has relatively high body mass index and waist circumference values (de Winter et al., 2012; Vancampfort et al., 2020) and aiming to identify the most effective type of training to promote this variable mentioned previously (related to metabolic and cardiovascular diseases), a systematic review with meta-analysis was conducted (Jacinto et al., 2023c). Performing an exercise program for the body mass index seems to have positive effects (p= 0.049), with strength training being the most effective (Z= 1.197 and p= 0,231). On the other hand, for the waist circumference variable, an exercise program also seems to have positive effects on the promotion of the variable (p= 0.001), with cardiorespiratory training being the most effective (Z= 3.092 and p= 0.002). However, the small number of studies included in the meta-analysis does not allow for more robust and concrete conclusions. In the same way, studies on the population without disabilities are also unclear. Skrypnik et al. (2015) found no significant differences between the different training methods. In turn, Garrow and Summerbell (1995) state that cardiorespiratory training reduces fat mass but has little effect on preserving muscle mass. In that sense, Willis et al. (2012) conclude that it is the most effective training method for reducing body mass (cardiorespiratory training). On the other hand, strength training, in addition to increasing muscle mass, can improve energy expenditure and lipid oxidation rates (Hunter et al., 2000). In turn, combining strength training with cardiorespiratory training in the same session has shown to be a good method to increase muscle mass and reduce fat mass (Ho et al., 2012).

Considering the literature review performed, none of the training methods were discarded, in the sense that both have their potential. A combined exercise program (cardiovascular fitness and strength in the same training session) may be the method with the most wide-ranging benefits for the population in question. In this sense, a literature review of strength and cardiorespiratory training intervention studies was carried out to prescribe exercise programs adapted to individuals with IDD.

Considering strength exercise programs, besides showing increases in upper and lower limb strength, balance and fat-free mass, salivary immunoglobulin concentration, testosterone levels, plasma leptin levels, tumour necrosis factor alpha and interleukins, there is an improvement in the response to systemic inflammation and antioxidant defence system, as well as a decrease in fat mass and waist circumference and oxidative damage. Most studies implemented an exercise program lasting 12 weeks, three times a week, with 45 to 60 minutes sessions. The prescription included two to three sets, six to 12 repetitions (per exercise or maximums), six to seven exercises, focusing on the main muscle groups (such as chest press, low row or lat pull-down, elevation, abduction or shoulder press, and abdominals due to their different variants, flexion of the forearm, the extension of the forearm, and leg extension/leg curl/leg press). This exercise prescription is performed using weight-training equipment to avoid the use of free weights for safety reasons (Jacinto et al., 2021a).

In the same way, cardiorespiratory exercise programs seem to promote an improvement in physical capacity, lipid, hemodynamic and metabolic profile, body composition, neuromuscular and cognitive capacity. Most of the studies included in the systematic review were of 8 to 12 weeks duration, with a weekly frequency of 3 sessions, with a session length of 20 to 60 minutes. The intensity of the sessions is mostly

prescribed according to the maximal heart rate (50% to 80%) or peak oxygen consumption (70% to 80%). The most often prescribed cardiorespiratory exercises are walking/running (a cycle ergometer can also be used as a resource) or cycling (Jacinto et al., 2023d).

Along with the American College of Sports Medicine guidelines (2021), the above results represent a useful tool, including aspects and recommendations that professionals should consider when structuring, prescribing and implementing a strength, cardiorespiratory or combined training program. For a population with a sedentary and inactive lifestyle, early ageing, and prevalence of several associated comorbidities, the recommendations presented are essential to promote QoL by decreasing the risk of the onset of chronic diseases, increasing physical fitness levels and reducing perceived barriers to practice. Therefore, it is essential to implement this type of exercise program into the routine of this population, which, when associated with an appropriate lifestyle, promotes a decrease in clinical expenses, an increase in healthy ageing, and better general health and QoL.

It is recommended that exercise professionals understand how to prescribe programs in an adapted and effective way in terms of methods, structure, and duration of the sessions. At the same time, professionals also need a thorough knowledge of each individual, their comorbidities, limitations and abilities, and preferences before prescribing any type of exercise program.

Since there is a research gap regarding the most appropriate exercise programs for the IDD population based on the previous results, as well as on the American College of Sports Medicine guidelines (2021) and on the CERT recommendations (Slade et al., 2016), two exercise programs were structured and developed. These intervention training programs aim to ensure that the high financial cost of the practice would not be another barrier to exercise (Jacinto et al., 2021b). Monetary barriers may be an obstacle to promoting physical exercise. With the outdoor program (low cost), no financial or costly investment is needed since it can be performed in an outdoor space, using only body weight, recycled materials (plastic bottles with sand) or low-cost materials (TheraBand's and ankle shin guards).

The indoor physical exercise program was carried out in a gym with weight machines. The program was divided into four parts: Part I - playful games or shuttle run (5 to 7 minutes); Part II - aerobic training (treadmill; 10 minutes; 40% to 80% of Heart Rate Reserve; between 12 to 17 according to the Borg RPE Scale (Borg, 1982); between 5 to 8 according to the Borg CR-10 Scale (Borg, 1998); Part III - strength training (around 25 minutes; Leg Press + Chest Press + Leg Extension + Lat Pull Down + Leg Curl + Shoulder Press; 40-80% of 3RM; 10-15 reps; 2-3 sets); Part IV - 4 static stretching exercises (30 to 60 seconds each).

The outdoor physical exercise program was carried out in a natural environment near the institution. For this experimental study, natural environments are defined as "any outdoor spaces with elements of nature, from pure or semi-natural areas to urban green or blue spaces, including green infrastructure" (Silva et al., 2018, p. 4). The program was divided into four parts: Part I - playful or shuttle run (5 to 7 minutes); Part II - aerobic training (walking; 10 minutes; 40% to 80% of Heart Rate Reserve; between 12 to 17 according to the Borg RPE Scale (Borg, 1982); between 5 to 8 according to the Borg CR-10 Scale (Borg, 1998); Part III - strength training (more or less 25 minutes; Sit to stand from the chair + TheraBand's; Low row + TheraBand's; Low row + TheraBand's; Sitting unilateral knee extension + shin guards; Chest press + TheraBand's; Standing unilateral knee flexion + shin guards; High row or seated shoulder press + TheraBand's; ≥ 15 reps depending on the OMNI-RES scale (Robertson et al., 2003); 3 sets); Part IV - 4 static stretching exercises (30 to 60 seconds each). Progression of exercises with changing the resistance of the TheraBand's and shin guards. The previously published study protocol describes all the program assessment and implementation procedures (Ferreira et al., 2022; Jacinto et al., 2022b). Although there is a clear need to carry out more research on healthy lifestyle interventions for people with more severe levels of IDD (profound IDD), our current intervention is limited to participants with mild to severe IDD, so future studies should take different levels of IDD into account. In addition to being adapted to individuals with mild to severe IDD, these programs are accessible to any context and financial availability, for both individual and institutional contexts. In addition, the performance of individuals with IDD in these physical exercise programs can reduce the risk of metabolic and cardiovascular diseases, decrease healthcare costs, and promote physical fitness, functionality, and QoL.

After the development of these two programs, an experimental study was conducted in order to understand if they are effective tools for reducing the barriers that hinder/attenuate the practice. On the other hand, we intend to contribute with recommendations for practice with innovative interventions with physical exercise, prescription and effective strategies, which we believe can positively impact the QoL of individuals with IDD. For that purpose, 21 adults with IDD were recruited. Subsequently, an initial assessment was performed to screen for any chronic disease or other important parameters to be monitored and to identify their initial

physical fitness level. According to the results, in addition to low levels of physical fitness, these individuals are at risk of developing metabolic and cardiovascular diseases (according to the existing literature), highlighting the importance of an intervention with physical exercise. This initial anamnesis is important not only for a "check-up" but also for developing a tailored, effective and safe physical exercise program according to the physiological characteristics of each participant. By performing an adapted and complete anamnesis, besides promoting trust between professionals and participants and mutual knowledge, it also allows us to collect indispensable data for the intervention and identify signs and symptoms that we need to be aware of (Jacinto et al., 2023a). We also highlight that this anamnesis must include a sufficiently robust and valid scientific method according to the literature (American College of Sports Medicine, 2021; Jacinto et al., 2021b). This process should be carried out before implementing any strategy in order to promote QoL in individuals with IDD. The results of the QoL assessment showed incongruence of response, with individuals with IDD perceiving higher values compared to the responses of the proxies. These results highlight the importance of measuring the QoL perceptions of individuals with IDD not only through the perceptions of their family members but also through self-reports, as both are complementary. On the other hand, if self-reports are not considered when planning intervention strategies, it may have a negative impact on the QoL of individuals with IDD (Jacinto et al., 2023e).

After this "initial photograph", the 21 participants were divided by convenience into an indoor training group (*N*= 7) performing exercise in a gym with weight-training equipment, an outdoor training group (*N*= 7) using low-cost materials, and a control group (*N*= 14) which continued with their regular activities. Both intervention programs had more than 75% participation, and the individuals were able to complete all the proposed exercises at the defined intensity, series, and repetitions. All the exercises proved to be adequate, adjusted, easy to perform, and perfectly adapted to the population under study. An outdoor, low-cost intervention in contact with nature seems to be effective in improving Physical Well-Being and fat mass. Finally, an indoor intervention using weight-training machines seems to be a good method to promote functional capacity, namely on *30 seconds Sit to Stand*, *Timed Up and Go* and *6-minute Walk Test* and physical fitness. None of the interventions showed significant differences for dementia/cognitive decline or blood sample variables. To our knowledge, this is the first experimental study with exercise that relates the variables studied to the IDD population in different practice environments. Both exercise programs seem to be effective in several variables and may hinder/attenuate the barriers to practice that this population experiences. These two programs can be implemented by any institution/organisation, considering the economic and environmental possibilities. Finally, the results of the experimental study justify the relevance of regular physical exercise tailored to their individual needs (Jacinto et al., 2023b, 2024).

The use of elastic bands in strength training in the outdoor exercise program has proven to be equipment in which the intensity is difficult to control since the individual can hold the band in different ways (with hands closer or further apart, holding the band in different places between sets) creating different tensions, which can influence the results. Some individuals with DID may not have the capacity to associate a scale to the perceived effort and give a response. The exercise professionals may be able to perceive this intensity through the difficulty of the exercise execution or the *Talk test* (American College of Sports Medicine, 2021; Reed & Pipe, 2014). On the other hand, it was evident that implementing aerobic and strength exercises of a more analytical nature in a gym environment and using equipment facilitates this control of intensity. The strength exercises performed with the use of machines may avoid some injuries because they present a lower degree of amplitude and planes. In order to perform the exercises at the intended speed of execution, the exercise professionals must constantly monitor them because this population sometimes cannot control the movement in the eccentric phase, performing it immediately.

Considering the results of our study, future research that implements these two exercise programs could conduct one session per week of the indoor exercise program and one session per week of the outdoor exercise program. Similarly, the prescription of exercise with cognitive stimulation tasks or multidisciplinary interventions (exercise plus cranial electrotherapy stimulation, socialisation, health education, educational advice) should be the object of study in future investigations in order to reach more robust conclusions in the domains of QoL and/or dementia. Future studies should ensure that evaluators have no knowledge of which group the participant belongs to, minimising the risk of bias. Further studies should recruit larger samples and samples from other age groups, not to limit the findings, and conduct a follow-up to analyse the long-term effects. Similarly, we suggest investigating the effects of sports practice and modalities on all the variables assessed in this study, as well as controlling diet and physical activity outside intervention programs.

For this population to change their sedentary and inactive behaviours, there is a need to raise awareness among people with IDD themselves, parents/families/guardians,

professionals and institutions/organisations that support this population, educating and empowering them with knowledge and healthy and active practices that will contribute to a healthy life and full social participation, namely through regular physical exercise. Both exercise programs can be replicated by all institutions/organisations working with individuals with IDD, being easy to understand and implement. They were structured based on scientific evidence and seemed an effective strategy, as they provoked a set of adaptations and benefits, promoting QoL. In addition, it is necessary that the formation of exercise professionals should include contents such as the dimensions of physical exercise for people with IDD, as well as the characterisation of physical, physiological, psychological, social and emotional aspects (Jacinto et al., 2022a).

The current overview provides relevant information regarding the health benefits of physical exercise in individuals with IDD, proving that structured and adapted exercise programs can be key to promoting more active and healthier lifestyles, increasing physical fitness and functional capacity and consequently improving QoL.

This document refers to several aspects and benefits that support physical exercise as a basis for QoL in an individual with IDD. It includes recommendations for assessing and prescribing physical exercise for individuals with IDD, as well as two intervention proposals. With this document, the lack of exercise programs adapted to individuals with IDD and the financial cost of the practice may no longer be a barrier. On the other hand, the intervention strategies used in this population need to be revised. Integrating physical exercise into their daily lives is a key aspect of maintaining and increasing physical fitness and functional capacity and consequent improvement in QoL.

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