Physical Fitness Level and the Selected Testing in Individuals with Intellectual Disability (ID): A Scoping Review

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ABSTRACT:

Individuals with Intellectual disabilities (ID) demonstrate a lower level of cardiovascular fitness than their normal counterparts, which starts at an early age and deteriorates with age. A poor level of physical fitness among individuals with ID, suggesting the need to improve their cardiovascular endurance, body composition, muscular endurance, strength, and motor coordination. This review aimed to elucidate findings on selected fitness testing used among individuals with ID and their physical fitness status. Literature was searched systematically based on PRISMA guidelines, using Science Direct, Scopus, Web of Science, and ProQuest databases. Twelve studies were included in the final analysis. There were randomised-controlled studies that investigated the measurement for fitness battery used among children, youth and athletes with ID. There are six main fitness batteries were reported to be used among ID people. Five studies reported to use Eurofit special battery, 3 studies using SAMU Dis fit, 1 study using Brockport, 1 study using Fullerton battery, while another 1 study using combination of Eurofit with Canadian Standard test and 1 study using others physical performance battery. Most of the batteries potentially to assess health and skill related fitness for special group population. The physical fitness tests also may be differ due to the differences in age factors, as a result from differ in capabilities and requirements in their daily functioning. Considering the health conditions of individual with ID, it is important to design and develop the fitness battery accordingly to provide appropriate recommendation to improve their overall wellbeing and health.

Keywords: Balance, Speed, Agility, Exercise

INTRODUCTION

People with intellectual disabilities (ID) have lower performances in physical fitness than people without ID, a situation that exists during all the life stages. Disabled adults are almost twice as likely as non-disabled people to be physically inactive (41% vs 20.9 %) (Lindsey & Bloyce, 2023). The poor performance in physical fitness of ID athletes could be due to a sedentary lifestyle (Bickum, 1995; Graham & Reid, 2000; Lotan et al., 2004; Pitetti & Boneh, 1995), a lack of motivation during test sessions, limitations and impediments in motor development (Frey & Chow, 2006; Hartman et al., 2010; Seidl et al., 1987; Vuijk et al., 2010; Westendorp et al., 2011), limited mental ability and a short attention span (Vuijk et al., 2010), physical characteristics such as short stature, infrequent opportunities to practice test items, and the tendency to withdraw from tests when feeling uncomfortable (Graham & Reid, 2000). Previous research has highlighted that the physical activity (PA) of individuals with ID is related to health-related parameters, such as the ability to maintain balance, muscle strength, and quality of life (Bartlo & Klein, 2011; Chanias et al., 1998; Heller et al., 2011). Researchers had found that the physical fitness level of elite athletes with ID is at best equal to or lower than that of their sporting peers without ID (Van De Vliet et al., 2006). Therefore, PA and regular exercise can improve the level of physical fitness, overall health, and well-being of individuals with ID. It is recommended that each individual aged between 18 and 64 years old should do exercise at least 150 min per week regardless of their health status. Nevertheless, adults with ID have a relatively low prevalence of PA in this population subgroup. Individuals with ID participate in approximately 17.5%–33% of the recommended physical activity levels (Jacob et al., 2023). However, the assessment of the physical fitness of individuals with ID often uses instruments that were designed for non-disabled people. The measuring physical fitness in individuals with ID comes with multiple challenges (Lahtinen et al., 2007). For example, the instruction and execution during measuring physical fitness are not always in accordance with the physical and cognitive abilities of the individuals with ID, resulting in dropouts and invalid test results (Hilgenkamp et al., 2013). Thus, due to their varying physical and cognitive abilities, it is important to take into account their limitations when measuring physical fitness.

PHYSICAL FITNESS STATUS AMONG INDIVIDUALS WITH INTELLECTUAL DISABILITY

Body Composition among Individuals with Intellectual Disability

Body composition is an important determinant that defines individual overall health and physical fitness (Chanias et al., 1998), as a person who carries excessive body fat can increase the risk of developing chronic health problems. Individuals with ID demonstrate a higher prevalence of being overweight or obese when compared to the general population (Cherif et al., 2022; Rimmer & Yamaki, 2006; Spinks et al., 2007). Lloyd et al. (2012) have investigated the body mass index (BMI) of individuals with ID (children and youth) based on geographical region, gender, and age. They reported a significantly higher BMI compared to their typically developing peers. Moreover, several scholars investigated the rate of obesity among individuals with ID and found a higher rate of obesity in individuals with ID that continues to increase during adulthood (Chanias et al., 1998; Fernhall, 1993; Graham & Reid, 2000). Previous researcher also found a higher BMI that was more prominent in females than males (Lahtinen et al., 2007). It is also stated that being overweight or obese is more common in females than males (Temple et al., 2014).

It is also crucial to understand the body composition of individuals with ID in an effort to identify and address the health risks in this population. Moreover, it is important to note that body composition is an essential component for daily functioning in adults with ID (Hilgenkamp et al., 2010). Fat mass can affect both physical and physiological performance (Maciejczyk et al., 2014); therefore, it could interfere with the daily functioning of individuals with ID. Multiple studies have addressed the poor fitness level related to the poor measure of body composition demonstrated in individuals with ID (Chanias et al., 1998; Franciosi, et al., 2010b; Graham & Reid, 2000; Van De Vliet et al., 2006). Individuals with ID have a high tendency to have higher body mass and body fat percentages (Graham & Reid, 2000) that are associated with obesity and increased risks of chronic health problems (e.g., cardiovascular disease (Rojas & Rodríguez, 2020), diabetes, hypertension, ischemic stroke, and cancers (Mozaffarian et al., 2015).

Therefore, it is important to consider that the body composition of individuals with ID may be different from that of their normal peers. They may have a typical

fat distribution or greater fat mass as a result of underlying syndromes or comorbid conditions (Humphries et al., 2009).

Muscular Strength among Individuals with Intellectual Disability

Muscle strength refers to the ability of a group of muscles to exert force against resistance or obstacles. Muscle strength is an important component of physical fitness as it is necessary for developing functional skills (Cowley et al., 2010; Rimmer, 2000) and allows individuals to perform daily activities such as brisk walking, circuit training, or jogging. In addition, muscular explosive strength is also an important component of health-related fitness. Muscle explosive strength is essential in generating an explosive force that is typically required in our daily functioning, such as jumping, sprinting, throwing, pushing, and rapid multi-directional movement changes. Previous research highlighted poor performance in muscular strength and explosive strength among individuals with ID (Burns, 2015; Guidetti et al., 2010; Mohammadi et al., 2021; Van De Vliet et al., 2006) compared to their normal peers. The results showed that their performance was good, although their muscular strength and explosive strength were poor (Onyewadume, 2006; Pitetti et al., 2000; Pitetti & Fernhall, 2004; Zhang et al., 2009). Karinharju (2005) suggested that good muscular fitness is important in generating effective movements in individuals with ID performing PA. The findings agreed with Orssatto et al. (2020), where the authors suggested that both muscular strength and explosive strength were important factors linked to functional capacity. Other studies found that poor physical fitness, especially in muscle strength and power, in individuals with ID is still significant when compared to their normal peers's performance (Onyewadume, 2006; Pitetti et al., 2000; Pitetti & Fernhall, 2004; Zhang et al., 2009). The above findings demonstrate the importance of developing and improving in terms of muscular performance in individuals with ID, as a strong muscle allows them to perform daily tasks and participate in or engage in various sports and recreational activities; therefore, it can promote the increase of PA and improve the quality of life among this population.

Balance among Individuals with Intellectual Disability

Balance refers to the ability to maintain one's stability and control the body's movements in both static and dynamic positions. Balance is one of the important components of physical fitness in providing stability and coordination, and it is essential for the development of functional skills (Cowley et al., 2010; Rimmer, 2000). Malina et al. (2004) proposed that the ability to coordinate movements is linked with the ability to maintain balance. Individuals with ID are often reported to experience difficulties that can affect their ability to maintain their balance and mobility (Cleaver et al., 2009; Gorla et al., 2003; McKinlay et al., 1987), which results in some problems related to their balance, especially in activities such as running, jumping, hopping, throwing, or any rapid changes of movements. This would possibly interrupt their daily functioning and quality of life (Diamond, 2000; Gorla et al., 2003; McKinlay et al., 1987). Oppewal et al. (2013) reported that difficulties in executing motor skills can be associated with underlying cognitive issues. The difficulty in processing information and the lack of motor coordination contribute to the poor balance performance of individuals with ID; thus, they are at a greater risk of falling and injuries than normal individuals (Carmeli et al., 2008; Cox et al., 2010). Therefore, it is important to increase the level of PA in individuals with ID to help them maintain balance, especially when they are older (Bartlo & Klein, 2011; Heller et al., 2011).

Agility Performance among Individuals with Intellectual Disability

Agility refers to the ability of an individual to move or change direction quickly and accurately. This skill requires a combination of physical and cognitive skills (e.g., perceptual and decision-making) (Chelladurai, 1976; Ellis et al., 2000; Chelladurai & Yuhasz, 1977; Sheppard et al., 2006; Young et al., 2001, 2002; Young & Farrow, 2006). Agility typically involves a set of coordinated and rapid movements when altering the directions of physical performance, such as running, jumping, balancing, throwing in PA, and other daily tasks (Gorla et al., 2003; McKinlay et al., 1987). It is documented that individuals with ID demonstrate poor agility due to difficulty executing coordinated movements (Bertini, 2005; Carmeli et al., 2008; Graham & Reid, 2000), a lack of perceptual ability, and delayed mental development (Gawlik & Zwierzchowska, 2004). Also, it has been demonstrated that the agility performance of individuals with ID is relatively lower than that of their non-disabled peers (Franciosi et al., 2010). Similarly, Jeoung (2018) reported that low performance was prominent in strength and agility in male students with ID (age 11 - 20 years).

It is important to consider that individuals with ID have limitations with their intellectual quotient (IQ) level, which depends on their level of intellectual disability.

IQ level was associated with the physical performance of individuals with ID, demonstrating that individuals with higher IQ levels have better capabilities to perform better in fitness tests compared to individuals with lower IQ levels (Bartík & Bolach, 2015; Mohammadi et al., 2021). In specific, a lack of cognitive processing in individuals with ID affects their ability to process information, especially related to sports skills. For example, the ability to make quick decisions when they are in complex and dynamic circumstances causes poor physical performance in this population (Burns, 2015). Previous research had suggested that 10 weeks of aerobic exercise significantly improved agility timing in children with ID (Angba, 2019). Therefore, it is important to improve the agility of individuals with ID to help them perform PA, at least at a moderate level of intensity. In return, increasing the level of PA can positively impact the agility performance of individuals with ID (Bartlo & Klein, 2011; Jeng et al., 2017).

Speed Performance among Individuals with Intellectual Disability

Speed performance refers to the ability of an individual to perform and complete a certain task in a short period of time, such as sprinting. Sprinting requires explosive force and a high-intensity burst of physical effort, which primarily depends on power. Andrews et al. (2009) reported that athletes with ID have significantly lower velocity and acceleration compared to normal athletes. They also highlighted that reduced performance in velocity and acceleration is associated with the anthropometric factors that result in a shorter stride length and slower acceleration, which is plausible due to the shorter mean (4 cm) in athletes with ID than their normal peers.

As previously mentioned by Bertini (2005), Carmeli et al. (2008), and Graham & Reid (2000), there is a lack of coordinated movements in individuals with ID, possibly due to the delay in mental development (Gawlik & Zwierzchowska, 2004). Interestingly, another study suggested that poor IQ levels in individuals with ID significantly affect the physical performance of hand movement speed and 25-m speed (Mohammadi et al., 2021). Sprinting performance (60-m sprint) in athletes with ID is also associated with their ability to coordinate movements, and the degree of ID was highlighted as an important factor that influences their motor coor-

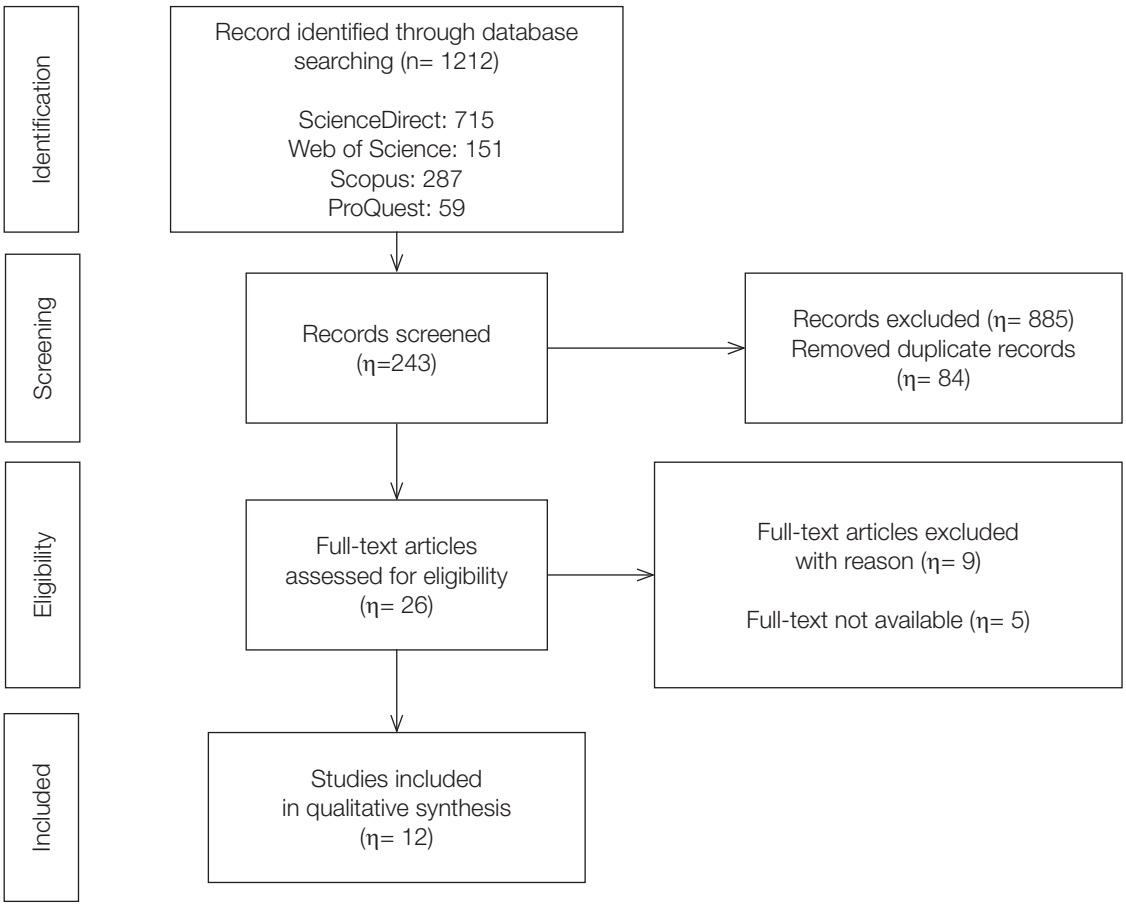

Figure 1. PRISMA flow for study selection

dination (Franciosi et al., 2010b). In addition, Kunz & Kaufmann (1981) denoted that anthropometric factors (height) and speed of limb play a major role in optimizing sprinting performance. The positive impact on improving speed is crucial for individuals with ID (Bartlo & Klein, 2011; Jeng et al., 2017). Hence, it is possible to encourage the participation of individuals with ID in sports and recreational activities (Castagno, 2001; Özer et al., 2012).

METHODS AND MATERIAL

Data sources

Related studies were searched electronically using the following databases: Science Direct, Scopus, Web of Science, and ProQuest. Briefly, the selected studies were hand searched using the same selection criteria as described below. In addition, cross- referencing on related previously published study was performed to obtain additional information. Peer-reviewed articles in English language until December 2023 were used. No attempts were made to contact authors for additional information. Comparable searches were made for the other databases.

Study selection

The search was conducted according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines (Liberati et al., 2009). The following keywords were used during the search: #test battery and #intellectual disability. Studies were screened for employing varieties of test battery as intervention, and intellectual disability as group population. Controlled trials and field studies on human were included in this review. The interventions comprised of physical performance battery while intellectual disability described as: (i) children with ID, (ii) young adult with ID, (iii) adult with ID and (iv) athletes with ID.

Participants criteria

The inclusion criteria for this study are: (i) physically active; (ii) mild category ID individuals (i.e., slow learner, dyslexia and autism); (iii) age below 18 years old (children) and above 18 years old (adult); (iv) identified as disabled by general practices before aged 18 years old. The exclusion criteria are: (i) participants who are on medication or taking any supplement prior to the study period; (ii) having any health problems (such as asthma, cardiac problem, diabetes, spinal cord injury); (iii) and having history of physical injuries in the past 6 months.

Data extraction

The titles and abstracts of retrieved articles were reviewed using the criteria specified to determine whether full texts were required for further analysis. Each full text manuscript was evaluated systematically according to the study: (i) objective/s, (ii) characteristics of the study (study design, participants, age and sample size), (iii) contents of intervention (intervention types, length of intervention or mode of exercise tested), (iv) targeted outcome/s and (5) main findings. The outcomes extracted from those studies were not combined, reanalysed or changed due to the nature of this systematic review.

RESULTS

Search results

The initial search from the databases identified 1212 potential articles from selected search engine. After removing duplicates, 1128 article were assessed based on titles and abstracts against the selection criteria. A total of 885 articles were excluded because they did not investigate on test battery among ID people. After detailed analysis only 12 full-text articles were included in this review. Figure 1 describes the PRISMA flow diagram for the study selection.

From the 12 studies reviewed, five studies were conducted by using Eurofit special, three studies were using SAMU Dis fit, one study was using Brockport, Eurofit combined with Canadian Standard test and Fullerton battery and finally one study focused on other physical performance battery. Those studies investigated among specific population such as children with ID (1 study), young adults with ID (2 studies), adults with ID (5 studies), and athletes with ID (4 studies). The studies investigated the fitness performance of ID people on health and skill related fitness related with body composition, muscle strength, balance, agility and speed. The present study will produce a comprehensive fitness status among ID individuals, in which it can be used by educators, sports scientist and coaches for selecting ID individuals to participate in sports. Also, the results of this study will provide recommendations to educators working with disabled poeple focusing on physical performance. This present study also could enhance the ability and open more opportunities for disabled people to be involved in physical activities. Implementation of a systematic approach during mass measuring programme will encourage sports practitioners to strengthen their coaching abilities and skills in helping to systematically measure physical fitness in ID population.

Table 1. **The adapted tests and measurements to assess the level of physical fitness in individuals with ID**

No	Authors	Name of fitness battery	Population	Assessment	Fitness Test	Main finding
1	Mohammadi et al. (2021)	Eurofit Special	Adults with ID (24.6 ± 3.0 years)	Standing long jump Medicine ball throw	Explosive strength	Poor performance in muscular strength and explosive strength among individuals with ID compared to the normal peers.
				Sit up	Muscle endurance	
				Walking test on balance board	Balance	
				Movement hand speed 25 meter sprint	Speed	
				Sit and reach	Flexibility	
				20 meter shuttle run	Cardiovascular	
2	Rintala et al. (2016)	Eurofit Special	Special Olympic athletes (16-45 years)	Standing long jump	Explosive strength	Most of the fitness parameters which could be compared, Special Olympic athletes fell below the INAS athletes (International Association of Sport for Para athletes with ID)
				Sit ups	Muscle endurance	
				Handgrip	Muscle strength	
				Stork stand	Balance	
				10 x 5 meter shuttle run	Speed	
				Sit and reach	Flexibility	
				2 km walk test	Cardiovascular	
3	Cabeza-Ruiz (2020)	SAMU DIS-FIT	Adults with ID (18-65 years old)	Handgrip	Muscle strength	High percentage of people with mild or moderate ID of both sexes present medium and low physical fitness values
				Sit-ups Time stand test	Muscle endurance	
				Modified of time and go	Balance	
				Deep trunk flexibility	Flexibility	
				6-minute walk test	Cardiovascular	
4	Frey & Chow (2006)	SAMU dis on youth	Youth with ID (6-18 years old)	1 min sit-ups Isometric push ups	Muscle endurance	Participants had limitations and impediments in motor development
				Sit and reach	Flexibility	
				6-minute walk/run test (6-8 years old)	Cardiovascular	
				9-minute walk/run test (9-18 years old)	Cardiovascular	

5	Rojas & Rodríguez (2020)	Brockport	Children and Youth with ID (15-22 years old)	Curl up and extended arm hand test	Muscle endurance	Obese children with ID have higher risk of cardiovascular disease
				Sit and reach	Flexibility	
				Course Navette and PACER	Cardiovascular	
6	Franciosi, Baldari, et al. (2010a)	Eurofit & Canadian standard test of fitness	Athletes with MR (20-45 years old)	Hand grip strength	Muscle strength	Poor measures of body composition correlated with poor physical fitness and athletic performance
				Sit-ups	Muscle endurance	
				Time and go test	Coordination and dynamic balance	
				Flamingo test	Static balance	
				Step test	Cardiovascular	
7	Van De Vliet et al. (2006)	Eurofit	Athletes with ID (17-19 years old)	Standing long jump and vertical jump	Explosive strength	Physical fitness level of elite athletes with ID is at best equal to or lower than that of their sporting peers without ID. Mostly athletes with ID have poor performance in muscular strength and explosive strength.
				Handgrip strength	Muscle strength	
				Sit- ups and bent hang test	Muscle endurance	
				Flamingo balance	Balance	
				Speed of limb movement (plate tapping) and 10 x 5 meter shuttle run	Speed	
				Sit and reach	Flexibility	
				20 meter shuttle run	Cardiovascular	
8	Cherif et al. (2022)	Test used were adapted from different studies	Athletes with different disabilities n = 22 ID (24.58 ± 3.33 years old)	Vertical jump Drop jump with right or left leg, countermovement, and squat jump	Explosive strength	Individuals with ID demonstrate a higher prevalence of being overweight or obese when compared to the general population
				Repeated sprint	Speed	
				Yo-yo intermittent recovery level 1 test	Cardiovascular	
9	Cabeza-Ruiz et al. (2021)	SAMU-DIS Fit	Adult with ID (20-60 years old)	Handgrip strength	Muscular strength	A significant association was observed between IQ and muscle strength, both in the lower and in the upper body. However, no such relationship was found with physical endurance, dynamic balance or BMI.
				Leg strength	Muscular strength	
				Dynamic balance	Balance	
				Physical endurance	Muscular strength	

10	Bibro & Żarów (2023)	Eurofit Special	Young adult with ID (18-25 years old)	Balance walk- walk on a bench	Balance	The balance measured and strength of upper limbs were significantly improved in the experimental group (climbing activities). The index of the relative strength of both limbs, depending on body weight, also increased
				Long jump	Muscular explosive strength	
				25 meter run	Speed	
				Sit and reach	Flexibility	
				Upper body strength- arm hang test and push 2 kg medicine ball Handgrip strength and relative strength	Muscular strength	
				Stabilometric test	Balance	
				Walking test	Gait	
				Chair stand test	Muscular strength	
				Timed Up & Go	Muscular strength	
11	Jacinto et al. (2023)	Fullerton battery (Functional capacity assessment)	Adults with ID (23- 58 years old)	30 second chair test	Muscular strength and endurance	Men presented the best performance for all selected functional tests.
				Timed up and go test	Muscular strength and endurance	
				6 minute walk test	Aerobic capacity	
				Isokinetic dynanometer (lower limb)	Muscular strength	
				Manual dynanometer (Handgrip)	Muscular strength	
12	Andrés Ramírez-Granizo et al. (2020)	Eurofit battery	Adults with ID (18-55 years old)	Plate tapping	Coordination	Flexibility, coordination and balance were better amongst females. The opposite trend was observed for BMI, with this being higher amongst the male.
				Flamingo balance	Balance	
				Handgrip test	Muscular strength	
				Sit and reach	Flexibility	
				Deep trunk flexion test	Flexibility	
				Handgrip strength	Muscular strength	
				Timed stand test	Muscular strength and endurance	
				30 second sit up test	Muscular strength and endurance	
				6 minute walk	Aerobic capacity	

DISCUSSION

Measuring physical fitness performance in intellectual disabled (ID) individuals

Physical fitness refers to the set of attributes that requires in each individuals to achieve in which linked to their ability in physical functioning. Physical fitness components are divided into health-related and skill-related components (ACSM, 2013). In regards to health-related components, this components were highly related to overall health and general wellbeing, indicating that the poor level in health-related components was a risk factor for all-cause of mortality and increase the risks in developing chronic diseases (e.g., metabolic syndrome, cardiovascular diseases and musculoskeletal conditions) (ACSM, 2013; Bouchard et al., 1994; WHO, 2010). Whereas, skill-related components refers to the ability which associate with in enhancing the performance in sports and motor skills (ACSM, 2013). It is important to be physically fit in both health and skill- related physical fitness as it was prerequisite in performing activities in daily living (den Ouden et al., 2011; Vermeulen et al., 2011).

It is important to consider that people with ID are particularly low in physical fitness compared to their typically developing peers, due to their sedentary lifestyle, sensory and mobility impairments, prevalence being overweight and chronic health conditions (Temple et al., 2006; Hilgenkamp, 2012; Evenhuis et al., 2001; Evenhuis et al., 2012; de Winter et al., 2012). Also, it is important to emphasize the differ extent in their physical and cognitive abilities which could limit their performance during assessing their physical fitness. An appropriate and suitable physical fitness tests are require to be established when measuring the physical fitness in this special population. Interestingly, it was reported that there were numerous studies have been conducted on ID population regarding the level of their physical fitness by adapting a different fitness batteries in various continent of the world. There are different test batteries were adapted and used to assess the level of physical fitness in ID population. For instance, in Mohammadi et al. (2021) study, the level of physical fitness in young adults with ID were assessed using Eurofit special battery, where the participants explosive strength was assessed using standing long jump and medicine ball throw test, muscle endurance; sit-ups test, balance; walking test on the balance board, speed; movement handspeed and 25m sprint, flexibility; sit and reach and cardiovascular; 20-meter shuttle run. Also, similar in other study by Rintala et al. (2016), the physical fitness of adults with ID were assessed using Eurofit Special battery, where the explosive strength was assessed using standing long jump, muscular endurance; sit-ups, muscle strength; handgrip strength, balance; stork stand, speed; 10x5m shuttle run, flexibility; sit and reach and cardiovascular; 2-km walk test. Besides Eurofit fitness battery, in the past scholars by Cabeza-Ruiz (2020) assessed the physical fitness of adults with ID using SAMU dis battery, which their muscle strength was assessed using handgrip strength, muscle endurance; sit-ups and time stand test, balance; modified of time and go, flexibility; deep trunk flexibility, and cardiovascular; 6-minute walk test.

However, it is important to consider the age of individual with ID when measuring their physical fitness. For instance, in Frey & Chow (2006) study, the study was conducted on youth with ID where the muscle endurance was assessed using 1 min sit-ups and isometric push-ups, flexibility; sit and reach, and cardiovascular tests were measured using walk/run test which the tests duration have been modified into 6-min (6-8years old) and 9-min (9-18 years old). A similar study conducted on children with ID under 18 years old and over 18 years old, where their physical fitness was assessed using the Brockport physical fitness test battery (muscle endurance; curl-up test and extended arm hand test, flexibility; sit and reach, and cardiovascular; course navette test and PACER), taking the age factor into consideration, a similar tests but with age scales were used in individuals over 18 years old (Rojas & Rodriguez, 2020). Furthermore, a study conducted in older adult with ID demonstrated a different fitness tests, which muscle strength; handgrip strength test, balance; Berg balance scale, speed; gait speed while walking at comfortable and fast speed, flexibility; extended version of modified back saver sit and reach, and cardiovascular; 10-m incremental shuttle walking test (Oppewal & Hilgenkamp, 2019).

In relation to measuring physical fitness in athlete population with ID, there have been several scholars used a different tests to measure their fitness components, explosive strength; standing long jump, muscle strength; hand-grip strength test, muscle endurance; sit-ups test; coordination and dynamic balance; the time and go test, static balance; the flamingo test, and cardiovascular; the step test (Franciosi et al., 2010a). Moreover, a similar study conducted in athlete with ID using Special Eurofit test battery, where the athlete's explosive strength was assessed using standing long jump and vertical jump, muscle strength; handgrip strength, muscle endurance; sit-ups and bent arm hang test, balance; flamingo balance test, speed; speed of limb movement (plate tapping) and 10x5m shuttle run, flexibility; sit and reach, and car-

diovascular; 20m shuttle run (Van de Vliet et al., 2006). Apart from this, another study conducted in athlete with ID used a different tests to measured their physical test, their explosive strength was assessed using vertical jump, drop jump with the right or left leg, countermovement and squat jump tests, speed; repeated sprint test, and cardiovascular; Yo-Yo intermittent recovery level 1 test (Cherif et al., 2022).

Particularly, it should be note that there are vary type of tests to assess the fitness components in ID population, especially when considering the age factor during measuring their fitness level. Also, a different test battery was adapted according to the different region, for example in Graham and Reid (2000) study, the authors used Canadian standardize test to measure the physical fitness level in adult with ID, whereas in Augustyn (2005) study, the authors administered a test battery which prescribed by Disability Sport South Africa (DISSA) to measure the physical fitness of the participants in the author study.

CONCLUSION

This low physical fitness impairs the quality of life and lowers the life expectancy of people with ID more than being obese and leads to high costs of families and health systems. Individuals with ID are at risk of developing metabolic and cardiovascular diseases, highlighting the significance of an intervention with physical exercise, as a way of mitigating and delaying some of these associated comorbidities. To conclude, physical fitness for individuals with ID varies should according to age factors, level of capabilities, and requirements in their daily functioning. Considering the unique characteristics of individuals with ID, it is important to design and develop individualized fitness tests and measurements. This initial assessment is important, for the development of an adapted, effective and safe prescription of physical exercise programs, according to the participants' characteristics.

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CONFLICT OF INTEREST

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