Cardiovascular Fitness of Young Canadian Children with and without Mental Retardation

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Abstract: Individuals with mental retardation (MR) typically exhibit lower levels of cardiovascular fitness than their non-disabled peers. However, there seems to be a gap in the literature with respect to comparative studies between younger children with and without MR. The present investigation compared cardiovascular fitness levels of youth with and without MR. Sixty youth (30 with MR, 30 non-disabled) performed a 20-m shuttle run designed to assess cardiovascular fitness. Results indicated that non-disabled children exhibited significantly greater levels of aerobic fitness than did those with MR. Findings illustrate the need for critical examination of physical activity programs for children with MR, as lags in fitness evidenced versus non-disabled peers approximately 50 years ago still exist.

The study of health-related physical fitness (HRPF) among persons with mental retardation (MR) is an area that has undergone critical examination over the past half-century. Francis and Rarick (1959) conducted the seminal investigation into the HRPF characteristics of individuals with MR. They explored fitness and motor performance of children and adolescents with MR concerning the variables of age, gender, and comparison with non-disabled children. The finding concerning comparison with non-disabled individuals provided a foundation for future understanding of how individuals with MR differentiate in terms of their fitness levels versus non-disabled persons. Their overall conclusion in this area has been widely quoted in subsequent works:

In general, it can be stated that with the mentally retarded children studied, the means of both boys and girls on most measures were two to four years behind the published age norms of normal children. Furthermore, the discrepancy between the normal and mentally retarded tended to increase with each advancing age level (p. 810).

In the almost 50 years since Francis and Rarick (1959) established that individuals with MR are delayed when compared to their non-disabled counterparts, much scholarly inquiry has been devoted to examining exercise among this segment of the population (Chanias, Reid, & Hoover, 1998). The vast majority of those studies conducted have confirmed the findings of Francis and Rarick. Recent published literature notes that individuals with MR exhibit lower levels of cardiovascular endurance (Fernhall et al., 1998; Fernhall, Tymeson, & Webster, 1988; Pitetti, Rimmer, & Fernhall, 1993; Reid, Montgomery, & Seidl, 1985), body composition (Kelly, Rimmer, & Ness, 1986; Rimmer, Braddock, & Fujiura, 1993; Seidl, 1998), muscular strength and endurance (Horvat, Croce, Stadler, & Pitetti, 1996; MacDonncha, Watson, McSweeney, & O’Donovan, 1999), and flexibility (Montgomery, Reid, & Seidl, 1988; Reid et al., 1985) relative to non-disabled individuals.

Therefore, despite increased opportunities for participation in physical activity, the realization that healthy lifestyles are as important for individuals with MR as non-disabled persons (Lavay, Reid, & Cressler-Chaviz, 1990), and the shifting emphasis toward health promotion for persons with disabilities (Rimmer, 2000), HRPF levels among individuals with MR lag behind the non-disabled. Numerous reasons have been cited to explain low levels

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of fitness among persons with MR (e.g., lack of motivation, absence of accessible programs, inappropriate measurement methodology, lack of homogeneity among participants; Fernhall et al., 1998; Frey, McCubbin, Haggan-Downs, Kasser, & Skaggs, 1999; Pitetti, Jackson, Stubbs, Campbell, & Battar, 1989).

In spite of substantial evidence indicating that persons with MR demonstrate lower levels of HRPF than non-disabled individuals, there appear to be some gaps in the literature that warrant further investigation. For example, while the majority of studies indicate significant differences in HRPF between the above mentioned groups, Pitetti, Millar, and Fernhall (2000) did not find cardiovascular fitness levels of children and adolescents with MR to be lower than their non-disabled peers. Chanias et al. (1998) cite the need for research utilizing smaller age ranges among participants. There also seems to be a gap in the literature with respect to comparative studies among youth with and without MR in terms of their cardiovascular endurance (Pitetti, Yarmer, & Fernhall, 2001). Continued examination into the above-mentioned areas would help to further build the knowledge base with respect to cardiovascular endurance among youth with MR as compared to their non-disabled counterparts. Recent examination (Pitetti et al., 2001) has begun to address some of current omissions previously outlined. Further investigation, however, is necessary in order to build a knowledge base concerning the aerobic fitness levels of children with MR versus their non-disabled peers. Therefore, the purpose of the present investigation was to examine cardiovascular fitness levels of young Canadian children with and without MR. The development of knowledge concerning aerobic fitness for younger with children with MR is imperative, given that promoting cardiovascular fitness among children is critical because it appears that poor health habits may occur early in an individual’s life (Blair et al., 1989; Fernhall et al., 2000). As previously noted in the literature (Booth, Gordon, Carison, & Hamilton, 2000; Pitetti et al., 2001), low levels of cardiovascular endurance create a significant risk for the development of both cardiovascular and metabolic disorders. Espousing benefits of cardiovascular fitness for children with MR as early as possible has the potential to minimize the developmental versus chronological age gap commonly evidenced.

**Method**

**Participants**

Sixty students (30 male, 30 female) enrolled in an urban public school system in Canada were recruited as participants for the study. Thirty participants (15 male, 15 female) were non-disabled, while the remaining thirty individuals (15 male, 15 female) were identified as having a mild level of MR according to school board classification procedures. Specific information concerning educational test scores were not made available; however, school board policy identifies students with mild levels of MR as having an IQ range of 55-70 and deficits in adaptive skill behaviours. Written informed consent was acquired from the respective parents/guardians. Mean age of participants with MR was 96.0 months (SD = 7.47), and 94.9 months (SD = 6.50) for those individuals who were non-disabled. Participants came from four separate school buildings within the district, with classroom placement for all individuals with MR being a separate alternative classroom. Students who were non-disabled participated fully in the regular classroom setting. Convenience sampling was used to recruit participants for the study. A consent form signed by the parent/guardian provided informed consent for all participants.

**Testing Protocol**

The 20-m shuttle run (Leger & Lambert, 1982) was selected as the cardiovascular fitness protocol for the current study. While the one-mile walk-run test appears to be the most commonly used field test among children (Cuerton, 1994; Fernhall et al., 2000), the 20-m shuttle run was selected because of the relatively simple administration procedures and the ease of performance for children with MR (Fernhall et al., 1998; Fernhall et al., 2000). The 20-m shuttle run also provides a field test that can be administered by individuals providing physical activity programs to children with MR (e.g., adapted physical edu-
cation teachers, Special Olympics coaches) in a relatively small area, which is critical given spatial restraints commonly seen in schools and community facilities. The 20-m shuttle run is established as a valid indicator of cardiovascular endurance for children with and without MR (Pitetti et al., 2001).

**Procedure**

All participants were tested individually. Testing took place in the gymnasium of the four school buildings. The 20-m course was marked by two strips of tape at opposite ends of the course, with a pylon being placed at each end of the pieces of tape. Participants were told that the goal of the activity was to run between the two pieces of tape on the floor before the “beep” went off. Pace music was played from a compact disc recording. The protocol required participants to run the 20-m at a speed of 8.5 kilometres/hour during the first minute of the test, with a subsequent increase in running speed of 0.5 kilometre/hour each minute. An inability to keep up with the required pace for two consecutive laps resulted in the test being finished. The test was also terminated if the participant was unable to continue.

**Participants with MR.** Participants with MR were provided with practice sessions before data collection sessions took place. These meetings were designed to orient the participants to the task. Use of practice sessions has been found to neutralize a lack of experience in performing field tests of cardiovascular fitness for participants with MR (Cressler, Lavay, & Giese, 1988; Pitetti et al., 2001). During the orientation sessions, participants were shown the testing environment, allowed to listen to the pace music, and to practice the 20-m shuttle run protocol that would be administered during data collection sessions. A pacer ran alongside the participant during the practice lengths for motivational purposes.

Upon completion of orientation sessions, participants were tested on the 20-m shuttle run during two separate sessions that were separated by 72 hours. During the two testing sessions, participants entered the testing area and were briefly re-oriented to the shuttle run. This re-orientation consisted of a verbal explanation of the test and a two-length demonstration by the researcher. The participant then completed the 20-m shuttle test. As in the orientation sessions, a pacer ran along with the participant for motivational purposes. The score for both shuttle runs was number of laps (i.e., one lap consisted of running from one length of tape to the other) completed by the participant.

**Participants without MR.** Individuals without MR performed the 20-m shuttle run under the identical protocol to participants with MR. The only difference in testing procedures between groups was that children without MR performed the shuttle run without use of a pacer running alongside. Additionally, participants who were non-disabled were not provided with orientation sessions that were afforded children with MR.

**Statistical Analysis**

Data were analyzed using an independent samples t test to determine whether significant differences existed between the groups on the 20-m shuttle run. Statistical significance was pre-established at .05. The highest score (measured by number of laps completed) on the two shuttle run trials for each participant was used for analysis purposes. Effect size calculations will be performed using $\omega^2$ to determine the percentage of the total variance accounted for by differences between groups. Descriptive statistics (i.e., means and standard deviation) were calculated for each of the two testing sessions.

**Results**

Means and standard deviations for the number of shuttle run laps completed for both groups are located in Table 1. Results of the independent sample t test indicate a signifi-

<table>
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<tr>
<th>Group</th>
<th>Mean Number of Laps</th>
<th>Standard Deviation</th>
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<tbody>
<tr>
<td>1 (MR)</td>
<td>9.50</td>
<td>3.86</td>
</tr>
<tr>
<td>2 (Non-disabled)</td>
<td>16.97</td>
<td>8.01</td>
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</table>
cant difference between groups, $t = -4.60$, $df = 58$, $p < .05$. Participants in the non-disabled group completed significantly more laps of the 20-m shuttle run (mean = 16.97, $SD = 8.01$) than did those children with MR (mean = 9.50, $SD = 3.86$). The effect size calculation for group ($\omega^2 = .251$) indicates a large effect.

**Discussion**

Results of this study indicate that young children with MR have significantly lower levels of cardiovascular fitness as compared to their non-disabled peers. This finding mirrors much of the previous literature evidenced for adolescents (Pitetti et al., 2001) and adults (Pitetti et al., 1989) with MR. Analysis of data in this investigation indicate that the trend of poor cardiovascular fitness among older individuals with MR is also evidenced early in childhood.

As noted by Cluphf, O’Connor, and Vanin (2001), MR alone is not a cause for low levels of health-related physical fitness. In fact, it has been shown that persons with mental retardation can improve their fitness levels through training (Chaniais et al., 1998), and are able to achieve very high levels of cardiovascular endurance similar to non-disabled individuals (Frey et al., 1999). In addition, opportunities for persons with MR to become involved in physical activity programs have greatly increased since the early findings of Francis and Rarick (1959). In spite of the increased programs available to children with MR (e.g., adapted physical education programs, Special Olympics) that were not in existence at the time of the Francis and Rarick investigation, and the capacity for fitness development, low levels of aerobic fitness continue to be extant among this group.

Expanded physical activity opportunities, therefore, do not appear to have had a significant positive impact on the cardiovascular fitness of young children with MR. This finding lends support to the notion that a critical examination of current programmatic offerings is warranted. As noted by Horvat and Franklin (2001), the existing viewpoint regarding children with MR is that their levels of fitness and overall functioning is lower because they are less active during school time and they have fewer opportunities for physical activity participation as compared to their non-disabled peers. It therefore seems that movement opportunities such as adapted physical education programs and Special Olympics are not resulting in significant improvements in health-related physical fitness among children with MR. Pitetti et al. (2001) indicated that issues of low exercise capacity and cardiovascular endurance of children with MR need to be attended to by both school districts and agencies dealing with individuals with MR. These authors further state that dietary and exercise interventions need to be initiated for those children with MR who have body mass index levels that approach the benchmark associated with being overweight. It appears that these physical activity opportunities in current form are not having a positive impact on the health of young individuals with MR as compared to their non-disabled counterparts.

Low levels of cardiovascular endurance evidenced in the current study present cause for great concern with respect to the long-term health of children with MR. Seidl (1998) noted that individuals with MR typically lead sedentary lifestyles without external support and encouragement from individuals such as family members, group home workers, and educators. Levinsen and Reid (1991) corroborated the importance of external supports, and further indicated that sedentary lifestyles become more common with increasing age. Given this, it stands to reason that if young children with MR exhibit poor levels of cardiovascular fitness in comparison to their non-disabled peers, the gap between groups is likely to increase with age. There is a wealth of evidence indicating that adults with MR display poorer levels of aerobic fitness than do non-disabled persons (Baumgartner & Horvat, 1991; McCubbin, Rintala, & Frey, 1997; Pitetti et al., 1993). The trend toward progressively decreased levels of activity as individuals get older has led to high incidence of obesity and cardiovascular disease among adults with MR, as well as early onset of old age for these individuals (Chaniais et al., 1998).

In conclusion, low levels of physical fitness evidenced among children with MR versus a non-disabled cohort by Francis and Rarick (1959) almost a half-century ago are still ex-
tant. Analysis of current program opportunities for children with MR appears necessary in order to ameliorate the gap between the above-mentioned groups. Future investigations regarding the effect of various physical activity opportunities on cardiovascular fitness for children with MR appear warranted.

References


Pitetti, K. H., Rimmer, J. H., & Fernhall, B. (1993). Physical fitness and adults with mental retarda-


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