EXERCISE PERFORMANCE OF YOUNG PEOPLE WITH INTELLECTUAL DISABILITY

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Introduction

Information about young people's exercise performance is relatively secure in comparison to what is known about the exercise capability of young people with intellectual disability (ID). Past work in our laboratory in Singapore suggested that the aerobic performance of boys with ID were inferior to those of similar-aged-peers without ID (Teo-Koh and McCubbin, 1999). The reasons for this are not readily apparent but one possible reason may be that individuals with ID may be 'socialised' to patterns of inactivity because of their disability.

Conversely, the capability of boys with ID to perform all-out intensity exercise of a brief duration remains unexamined and there are apparently no available data in the extant literature. Performance data in this area are insightful as the natural habitual physical activity patterns of young people, albeit there are no related information on boys with ID, tend not to be sustained, but instead, take the form of sporadic bouts of high-intensity exercise, interspersed with longer periods of no exercise. Indeed young people's physical activity patterns have been described as "like particles in Brownian Motion" (Rowland, 1996), that is, the activity is of varying intensity and duration and, is seemingly without order.

Recent consensus among health experts state that short-duration intermittent bouts of physical activity of a moderate-to-high intensity may accrue health benefits to its participants (National Institute of Health Consensus Panel, 1996; Pate, Pratt and Blair, 1995). Since young people with ID have difficulty sustaining moderate intensity exercise of longer duration, the use of short-duration high intensity exercise may be a viable alternative in 'harvesting' health benefits. Importantly, such 'manageable' bouts of short-duration exercise (between five and 30 seconds) may create a foundation of regular exercise habits that may be carried through into adulthood.

The WAnT is an all-out intensity effort test that involves the task of pedalling against a pre-determined applied force that is set at a percentage of the subject's body mass, for a duration of usually 30 seconds. The WAnT, though originally conceived for use with able-bodied healthy people, has been used to assess young people with chronic diseases such as muscle dystrophy, muscle atrophy, cerebral palsy, spina bifida, cystic fibrosis and anorexia nervosa (Inbar, Bar-Or and Skinner, 1996). The compliance rate for these special populations is high (Tirosh, Rosesenbaum and Bar-Or, 1990; Parker, Carriere, Hebestriet and Bar-Or, 1992). The test has also been successfully used to assess the performance of elderly patients aged between 54 and 84 years with chronic obstructive lung diseases, albeit a test duration of 15 seconds was used (Bar-Or, Berman and Salsberg, 1992).
Despite its popularity as an exercise test among special populations, the WAnT has apparently not been used to assess young people with ID. Therefore the purpose of the study was to describe the WAnT performance of young boys with ID.

Methodology

Subject recruitment and familiarisation to the test procedures

Nineteen male students from two MINDS (Movement For The Intellectually Disabled

Of Singapore) schools in Singapore, with the appropriate informed consent participated in the study. The criteria for inclusion in the study included the following: subjects are male aged between 15 & 17 years, were free from any known physical disabilities and long-term ailments, and had informed consent. The informed consent included approval from the school, the parents or guardians and the subjects concerned. Ethical clearance for the study was also obtained from the institutional review board.

The boys were familiarised to the WAnT procedures including a performance on an abbreviated WAnT and a 'dry' post-exercise blood lactate sampling using the finger- stick method. Power outputs were derived on all four attempts and analysed to determine if more sessions were necessary (i.e. if peak power variation was more than 10%), to minimise any significant 'learning effects'. The performance data of 16 boys with ID, over the last two tests, were also used to determine the reliability and stability of the test results.

Anthropometric measurements and determination of sexual maturity status

Anthropometric measurements for stature and body mass were determined using standard established procedures. Body fat, lean body tissue as well as lower limb muscle mass were determined using a dual x-ray absorptiometry procedure (DEXA). A male medical doctor appraised the sexual maturity status of the subjects in accordance to the criteria that were outlined by Tanner (1962). Essentially, the procedure involved the doctor's appraisal of the pubic hair and genitalia development of the boys by visual inspection. An adult teacher was always present throughout the procedure.

Wingate Anaerobic Test (WAnT)

The WAnT is an "all-out" intensity 30s test for evaluating lower limb muscular endurance. The test was conducted on a Monark cycle ergometer (model 824 *E)* that was calibrated in accordance to the manufacturer's instructions immediately prior to the test series.

Standardised warm-up

The standardised warm-up procedure consisted of a constant pedal rate of 60 revolutions per minute over a period of four minutes. During the four minutes, three separate "all out" intensity sprints of 2-3 seconds, against the test applied force was initiated, at the start of each minute. This was followed by two minutes of stretching for the quadriceps, hamstrings and groin muscles.

Test commencement

The WAnT commenced from a "rolling start" at a pedal revolution of between 60 revolutions per minute. A count-down "3,2,1,Go! was initiated, after which the subject pedalled as fast as he could, against an applied force that was set equivalent to 0.74N (75g) per kilogramme of body mass, whilst remaining seated throughout the duration of the test. All the subjects were verbally encouraged to give their best effort throughout the duration of the test.

WAnT variables of interest

Peak power (highest power output averaged over 1s), mean power (average pow over the duration of the test) and a measure of fatigue (% power decline) were the variables of inte est. Other variables like total work accomplished, average work accomplished as well as time to pe power were also obtained from the test. The inertial factors of the flywheel and the cycle ergomet r were taken into account in the power computations in accordance to the recommendations propo d by Chia, Armstrong and Childs (1997).

Standardised cool down

Immediately following the test, the subject was encouraged to pedal at a self-selected cadence that was set against a minimal applied force for a period of at least 3 minutes or until the subject recovered from the exercise exertion.

Post-exercise blood sampling

A capillary blood sample, equivalent to 25 micro-litres (about three drops of blood) was obtained at two-minute post exercise, using the finger stick method (Softclix@II) during an active recovery period with subject seated on the ergometer. The blood sample was analysed for whole blood lactate concentration using an automated self-calibrating lactate analyser (YSI 2300 Stat Plus).

Statistical treatment of the data

Statistical analyses of the data collected were performed using a SPSS software programmes (version 10.0). Intra-class reliability coefficient, a repeated measures analysis of variance and the 95% limits of agreement over two test sessions were computed to determine the reliability and stability of the test results in the WAnT. Descriptive statistics of the subjects (means and standard deviations) were generated. Statistical significance was established at $p < 0.05$.

Results

Subject characteristics

The characteristics of the boys are summarized in Table 1.

Table 1: Characteristics of the subjects

Variable	Boys (N=19)
Age (y)	15.5 + 0.9
Body mass (kg)	47.6 + 12.3
Stature (m)	1.59 + 0.07
% body fat	19.9 + 8.9
Degree of ID (Weschler Intelligience Scale)	Mild to Moderate (35-40 to 50-55)

100% (N=14) of the boys were adjudged by the doctor to be Tanner Stage 2 or 3 in their genitalia development whilst 86% were Tanner Stage 2 or 3 in their pubic hair development. The other 14% were adjudged as Tanner Stage 4 in pubic hair development.

Reliability and stability of the subjects with ID on the Wingate Anaerobic Test

Sixteen boys with ID from the same cohort successfully completed the two WAn tests that were used to compute the reliability and agreement tests. Mean power output, which i the average power of the 30s test, over two tests, was used to compute the reliability and stability of he boy's performance in the WAnT. This is illustrated in Figure 1.

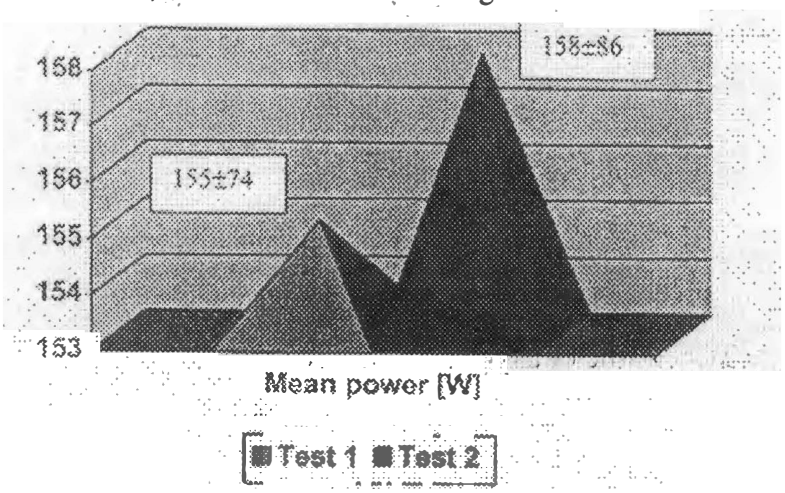

Figure 1: Mean power over Test 1 & Test 2 (N=16 boys). 155 ±74W vs. 158 ±86W, p>0.05

The intra-class correlation coefficient for mean power between Test 1 & Test 2 wa 0.95 ($p < 0.05$) and the 95% limits of agreement (Bland and Altman, 1995) was between –22.5 W d 15.7 W. The difference in mean power between Test 1 and Test 2 was not significantly differen ($p > 0.05$).

Wingate Anaerobic Test performance

The Wingate Anaerobic Test performances of the boys with ID are summarized in Table 2.

Table 2: WAnT performances of the subjects

Variable	Boys (N=19)
Peak power (W)	247 ± 103
Relative peak power (W/kg BM)	5.2 ± 1.9
Mean power	158 ± 86
Relative mean power (W/kg BM)	3.5 ± 1.8
Fatigue index (%)	61.7 ± 25.9
Post-WAnT blood lactate (m/ML)	6.9 ± 2.2

Wingate Anaerobic Test Profile

A typical subject's WAnT profile is depicted in Figure 2.

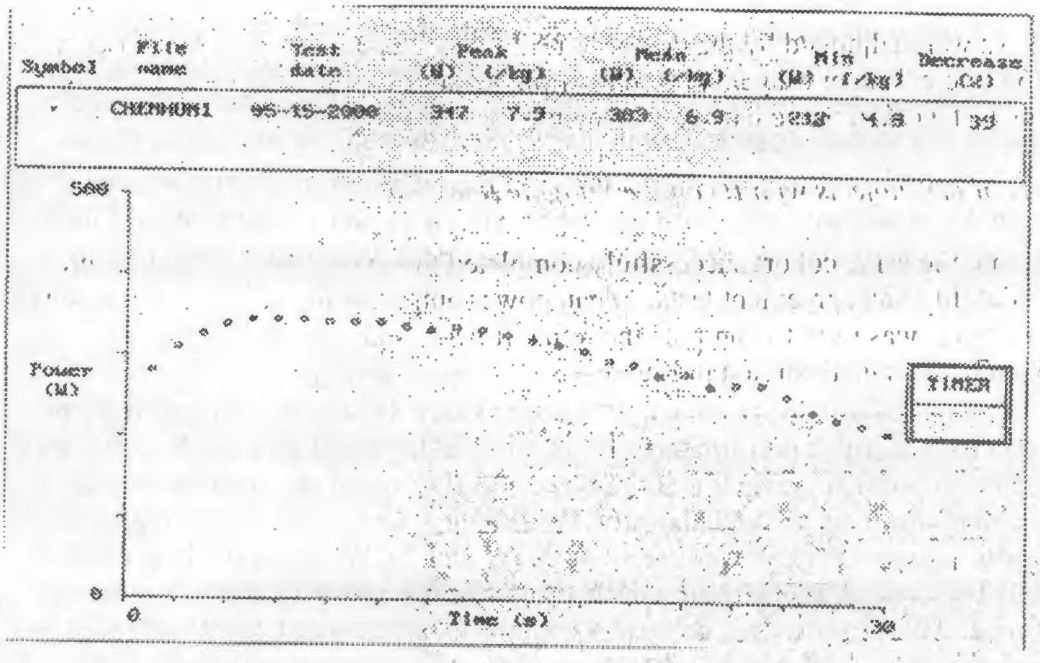

Figure 2: Wingate Anaerobic Test Profile of a typical subject with ID.

Discussion

Research into the exercise capability of young people with ID is very much in its infancy, especially in Singapore. All over the world, it appears that exercise and performance data of young people with ID, male and female, lag behind those of young people without ID. This discrepancy in research attention may be due in part to the assertion that young people with ID may not fully comprehend what is required of them in exercise tests, and they may therefore not complete the tests. The present study dispelled this assertion. Indeed over the entire test series that consisted of four separate laboratory sessions, the compliance of the 19 subjects was 84%, a figure that is comparable to, if not better than similar studies on young people without ID. Our results showed good reliability and limits of agreement for the WAnT for this cohort of boys with ID. The intra-class reliability coefficient for mean power of 0.95 and 95% limits of agreement of between -22.5W and 15.7W, are comparable to other studies on people with special

needs (Tirosh *et al,* 1990; Parker *et al,* 1992) and also in studies on young people without ID (Chia, 1998). However, the boys with ID needed a lot of encouragement and personalised attention and also many opportunities to familiarise themselves to the test environment, in order to achieve reliable results. This view is similarly echoed by researchers who used a treadmill test to assess the aerobic performance for adolescents with multiple disabilities (Pitetti, Jongmans and Fernhall, 1999).

Young people's natural habitual physical activity has been described as like "like particles in Brownian Motion" (Rowland, 1996). Rowland contends that the habitual physical activity is sporadic in nature, with bouts of high intensity activity that are interspersed with periods of low intensity activity, and that the activity sequence proceeds seemingly with any discernible order. Although, there are apparently no data on the nature of the natural physical activity of young people with ID in Singapore, it is thought that young people with ID may be less physically active than their peers without ID, as is the case in adults (Messent, Cooke and Long, 1998). The reasons for that are not apparent, but it is possible that they may be 'socialised' to physical inactivity because of their mental disabilities, due, in part to the reduced opportunity to participate in physical activity (Messent *et al,* 1998).

Whilst there are exercise data on the aerobic performance of young people with ID, there are apparently none on the anaerobic performance of young people with ID. This is surprising as both aerobic and anaerobic metabolism help provide a more complete picture of the exercising young person with ID. For instance, Teo-Koh and McCubbin (1999), in their study of adolescent males with mental retardation, reported on their peak $V0^2$ results and the relationship with the one-mile walk test. Their study on 45 adolescent males with ID, aged between 12 and 17 years (IQ:WISR-R: 50.3:±10.6) demonstrated that their average body mass-accounted peak $V0_2$ values were 14% to 27% lower than their non-ID peers of equivalent age range.

The absence of equivalent data on the anaerobic performances of boys with ID precludes any direct comparisons with the results of the present study. However, previous work by the same investigator, on the anaerobic performances of prepubertal boys and girls, without ID, aged 9.7 years, using the same test protocol, reveals that the boys with ID, lagged significantly behind in their anaerobic development, for their age and maturity. For instance, Chia *et al* (1997), reported that prepubertal boys and girls achieved peak power values of 205W and 202W, respectively versus 245W for boys with ID. The corresponding mean power values for the nearly 10 year old children were 165W for boys and 163W for girls. This compares with the mean power of 158W achieved by the boys with ID. This is despite of the boys with ID being older, more mature and significantly heavier (more than 10kg), than the younger children without ID. A point of interest is that in the cited study of Chia *et al,* younger subjects achieved only 64% of the 6.9 mM/L mean blood lactate value obtained in the present study, using a similar methodology. The high post-exercise blood lactate concentration achieved by the boys with ID provided indirect evidence that the boys with ID were capable of giving a supra-maximal effort in the test.

Our findings mirror those reported in the extant literature. A body of evidence in the literature suggests that people with ID are not on par in their cardiovascular fitness (Fernhall, Petit ti, Stubbs and Stadler, 1996; Teo-Koh and McCubbin, 1999), and muscular strength (Stadler and Pitetti, 1996), when they are compared to their peers without ID. It has been suggested that young people with ID may lack the motivation to perform exercise (Cormack, Brown and Hastings, 2000), or that they may not fully comprehend the tasks required of them. However, it is equally arguable that because young people with ID pose a challenge to teach and to train, less attention is paid to them in harnessing their true physical and physiological potentialities.

Young people with ID can benefit from a structured physical activity and exercise programme (Pitetti and Tan, 1991; Pitetti, Millar and Fernhall, 2000). Indeed, there are compelling reasons for organising such programmes, as if the situation is left to deteriorate, the lower fitness of young

people with ID may become entrenched in adulthood, exacerbating their quality of life even further. Recent data show that trained adult runners with mild ID were just as good as runners without ID on measures of peak $V0_2$, percent body fat and lower back/hamstring flexibility (Frey, Kasser, Hannigan-Downs and Skaggs, 1999).

Recent consensus among health experts states that short-duration intermittent bouts of physical activity of a moderate-to-high intensity can accrue health benefits to its participants (National Institute of Health Consensus Panel, 1996; Pate, Pratt and Blair, 1995). Since young people with ID have greater difficulty sustaining moderate intensity exercise of longer duration, the use of short-duration high intensity exercise may be a viable alternative in 'harvesting' health benefits. Importantly, such 'manageable' bouts of short-duration exercise (between five and 30 seconds) may create a foundation of regular exercise habits that may be carried through into adulthood.

Physical activity sessions that focus on intermittent sprint-type activities, that are interspersed with short active rest periods and are organised in a 'circuit-like' manner or in a game setting may be a way forward for young people with ID to enjoy and develop their full physical potential. Such sessions can also cultivate positive attitudes toward leading a physically active and healthier lifestyle by equally focusing on developing aspects of health-related fitness (e.g. muscular strength, endurance, body composition, and flexibility) in a balanced manner. As young people with ID start to view themselves as capable of performing a battery of short-duration and moderate- to-high intensity exercise tasks, it is conceivable that their self esteem and confidence will be enhanced.

Summary and conclusions

Young people with ID are capable of all-out intensity exercise of a short-duration such as in the Wingate Anaerobic Test. The results show appropriate reliability and compliance to the test for this cohort of subjects. It appears however that boys with ID lag behind their peers in WAnT power by a number of years. Their inferior anaerobic performance may be due to their lack of exposure and opportunities to participate in exercises of such a nature. Recent consensus states that high intensity exercise of a brief nature that is repeated many times over on a daily basis, can be beneficial to health. Since young people with ID may not have the concentration, patience or motivation to engage in sustained aerobic-type exercises of moderate intensity, WAnT -type exercises may be the way forward to get more young people with ID to stay physically active for as long as possible.

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