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EVALUATION OF THE EFFECTIVENESS OF AN ADAPTED PHYSICAL ACTIVITY PROGRAM ON THE PHYSICAL FITNESS OF CHILDREN WITH INTELLECTUAL DISABILITIES IN NATIONAL CENTER FOR THE REHABILITATION OF HANDICAPS (NCRH) YAOUNDE, CAMEROON

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Abstract

The purpose of this study was to evaluate the effectiveness of an adapted physical education program on the physical fitness of children with intellectual disability. The study was designed as a pre-test-post-test experimental model. 58 intellectually disabled children, made up of 27 females and 31 males took part in a 24-week adapted program which included fitness activities like endurance, speed, strength and agility. Data was collected after each 6 weeks using some conventional tests. Applying descriptive (mean scores and standard deviation) and inferential (Independent T-test) statistics to analyzed data, the results revealed the following: The difference between the VO_{2max} of the 27 female subjects were significantly different since the probability of the F-test is less than 0.05 and equal to 20.49. Equally, the difference between the VO_{2max} of the 31 male subjects tested 4 times in intervals of 6 weeks from 6 weeks to 24 weeks were significantly different since the probability of the F-test is less than 0.05 and equal to 7.39. As concerns the broad jump, The difference between the broad jump of the 31 male subjects tested 4 times in intervals of 6 weeks from 6 weeks to 24 weeks were significantly different since the probability of the F-test is less than 0.05 and equal to 7.60. The performances of the 30 m dash for the male subjects were significantly different ($p \leq 0.05$) for each subject over the test period with 22.42 as F value. This was similar to that of the female participants. From the results above, it is concluded that the adapted physical education program applied on the intellectual disability children had an impact on the physical fitness of the children. The fundamental recommendation was the need for a carefully National Designed Physical Education Instructional Program for learners with a disability, based on a comprehensive assessment, to give the learner the skills necessary for a lifetime of rich leisure, recreation, and sport experiences with the aim of enhancing physical fitness and wellness.

Keywords: Physical education program, physical fitness, intellectual disability

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Introduction

An Adapted Physical Education (APE) generally refers to school-based program for students with disabilities. Intellectual disability (ID) is defined as a significantly reduced ability to understand new or complex information and to learn and apply new skills (Boddy *et al*. 2015). It affects a large number of individuals [10.37/1000 population (Maulik *et al*. 2011), reducing their ability to cope independently, with a lasting effect on development. ID is defined as a disability that occurs before 18 years of age, and where individuals experience significant limitation in intellectual functioning and adaptive behaviors (AAIDD, 2011).

Individuals with ID are able to lead satisfying, meaningful, and healthy lives with support to enhance physical, social, emotional, and cognitive functioning.

The World Health Organization (WHO, 2019) estimates that 650 million people live with disabilities of various types and 80% of these persons with disabilities live in low income. Following the first Special Olympics in 1968, the public and those working directly with individuals with Intellectual Disabilities (ID), including teachers and parents, have become more aware of the physical capabilities of people with intellectual disability, as well as the social and emotional benefits they derive from participating in sports and physical education programs. (Cratty 1989), page 169, (Pitetti et al.1989).

Many researchers have found that adults with ID show low performance on standardized assessments of physical fitness and specifically in cardiovascular endurance, body composition, muscle strength and endurance, and muscle coordination (Carmeli et al., 2008 ; Chanias, Reid, & Hoover, 1998 ; Frey, Stanish, & Temple, 2008; Graham & Reid, 2000 ; Van de Vliet et al., 2006 ; Zafeiridis et al., 2010). Yet, following a proper intervention program, people with ID have been shown to improve muscle strength and balance (Fotiadou et al., 2009).

Although programs of disabilities in general and intellectual disability in particular is widely discussed in Cameroon, it faces some problems, such as a lack of personnel- qualified teachers and teachers 'assistance who would be capable of introducing an adaptive physical education program in their lessons. Physical and sports education face many challenges when it comes to inclusion of pupils with disabilities as it does not receive as much attention as the other academic subjects.

It is worth noting that, no comprehensive research has been carried out using an adapted exercise program that shows effective and stable physical fitness improvement in Cameroon. . Equally, there is no evidence of an existing national harmonized structured program exclusively for individuals with disabilities. Existing handicap centers adapt their programs from the existing official mainstream physical education program and teach the pupils.

Equally, Past research has suggested that sufficiently long intervention program duration is crucial for beneficial results. In most studies programs varied from 6 to 12 weeks in length (e.g., Borremans, Rintala, & Kielinen, 2009 used a 12-week physical exercise program; Davis, Zhang, & Hodson, 2011 used an 8-week adapted physical activity program; Giagazoglou et al., 2012 used a 10-week hippotherapy program; Giagazoglou et al., 2013 used a 12-week trampoline exercise intervention program; Rahmat & Hasan, 2013 used a 6-week exercise program; Tsimaras & Fotiadou, 2004 used a 12-week training program; and Wang et al., 2007 used a 12-week aquatic program), but this duration may not be enough to show effective and stable physical fitness improvement. In the context of this past literature, the present study sought to: 1) identify the initial physical fitness level of a group of adolescents with ID; and 2) evaluate the effects of a 24-week adapted physical education program on the fitness of adolescents with ID using objective tests.

Focus of the study

The idea of physical activities is very important for intellectual disability children especially in relation to their physical fitness. Compared to the general population, intellectual disability children tend to perform poorly on physical fitness tests. Hence increasing physical activity (PA), because of its proven association with favorable health outcomes (e.g., reduced risk of heart diseases, hypertension, cancer, diabetes, and obesity), is supposed be a recommended cultural practice. This study is scientifically supportive to the fact that the various families, the centre in which these children spend most of their time and the inhabitants of various communities in which these children with intellectual disability live. .It is in this view that the purpose of this study is to research on the effectiveness of an adapted physical Education program on the physical fitness of children living with intellectual disability.

Methodology

Participants

The study took place in the 201-2022 school year and it comprised of 58 intellectual disability children in the National Center for the rehabilitation of handicaps Yaounde, Cameroon. Out of the 58 adolescents, 27 were females and 31 were males. The age range of participants was as follows: Females between 15-20 years, 20 participants while more than 20 years 7 participants. For the males between 15-

20 years 25 participants while ages more than 20 we registered 6 participants. Their levels of education were also registered. Here, 23 participants (39.66%) were of primary level while 4 participants (6.9%) had a secondary education. For the males, 27 participants (46.55%) had a primary education while 4 participants (6.9%) had a secondary education.

Procedures

The present study was carried out using a pretest-posttest, randomized, controlled design. The adapted physical education program found in the National Center for the Rehabilitation of Handicaps Yaounde was used in training the adolescents. This program which took place twice a week had all the fitness elements including strength, speed, agility and endurance. The experiment comprised of drilling the adolescents in this program for 24 weeks. After each 6 weeks, an evaluation was conducted using some conventional tests. Hence at the end of the 24 weeks a total of 4 test sessions had been done. Meanwhile a testing session was scheduled one week before the start of the training period, including the Six Minutes' Walk Test (6MWT) **(**Callens, et al., 2014**)** to assess cardio-respiratory fitness., Standing Long Jump Test/Broad Jump (Anaerobic Power-Explosive Leg Strength) (Gontarev et al., 2014). to assess strength and power of the lower limbs., and Thirty (30) metres dash (Anaerobic Power-Sprinting Ability) (Young et al., 2008). The preliminary session before the pre-test session was to familiarize themselves with all the testing procedures. It should be worth noting that permission to carry on the study was obtained from the Ministry of social welfare Yaounde. Permissions were also obtained from the school management, parents of the all the children involved in the study. Investigative methods included a questionnaire approach as well as subsequent measurements of the physical fitness the children.

Instruments

Age and gender of the children were recorded in a structured questionnaire. Interviews were done in French and English. Exceptionally it was done in the best understood language. The age of each child was calculated from date of birth and confirmed from the school registers as entered by parents based on the information in the birth certificate.

In relation to the cardiovascular fitness of the children, the six minutes' walk test (6 MWT) was used where the participants were instructed to walk to their pace as far as possible in six minutes without running and at the end of the six minutes, a whistle was blown for them to stop and the distance covered by each child was recorded.

The calculation of VO_2max is given by the Maximun Aerobic Speed formula (Cooper, 1998**)** below:

$$MAS = \frac{Distance\ covered}{100}$$

$$VO_2 \max = MAS \times 3.5$$

MAS: Maximum Aerobic Capacity $V0_{2:}$ Maximum Consumption of Oxygen

To determine the explosive leg strength of the children, The broad jump (BJ) test was used. Here, the child stood behind the starting line, with feet together, and pushed off vigorously and jumped forward as far as possible. The distance was measured from the take-off line to the point where the back of the heel nearest to the take-off line landed on the floor. The test was repeated twice, and the best score was recorded (in cm).

In relation to the speed of the children, a 30 m shuttle test was done on a 30-meter track with cones placed at the beginning and the end of the 30m track. The children were asked to run at maximum speed and time was recorded with a stop watch. Two trials were allowed, and the best time was recorded to the nearest 2 decimal places. The starting time was from the first movement (if using a stopwatch) or when the timing system was triggered and finishing was when the head crossed the finish line (Young *et al*., 2008).

Analysis of data

Inferentially, one-way analysis of variance was used. The mean of square variance due to treatment (MSTR) and that due to the error (MSE) were then compared as; MSTR/MSE = F which is defined by the degree of freedom for the MSTR and that of MSE.

Findings

The purpose of the study was to determine the effectiveness of an adapted physical education program on the physical fitness of intellectual disability children.

Table 1. Summary statistics table for cardiovascular fitness ($VO_{2max\ (mL/min/kg)}$) for female subjects

	Effective	Mean	Standard Deviation	Coefficient of variation	Min	Max	Stretch	Standard Asymmetry	Typical errors for Fisher LSD at 95.0%
Subject 1	4	17.55	1.08474	6.18087%	16.8	19.1	2.3	1.22822	0.454888
Subject 2	4	20.175	0.35	1.73482%	20.0	20.7	0.7	1.63299	0.454888
Subject 3	4	20.05	0.759386	3.78746%	19.3	21.0	1.7	0.447485	0.454888
Subject 4	4	17.525	1.29196	7.37211%	15.8	18.9	3.1	-0.626145	0.454888
Subject 5	4	14.675	0.713559	4.86241%	13.7	15.4	1.7	-0.800607	0.454888
Subject 6	4	16.1	0.244949	1.52142%	15.8	16.4	0.6	0	0.454888
Subject 7	4	19.5	1.46742	7.52525%	17.5	20.9	3.4	-0.846509	0.454888
Subject 8	4	17.525	1.12657	6.42838%	16.5	19.1	2.6	1.02233	0.454888
Subject 9	4	17.55	0.544671	3.10354%	16.8	18.0	1.2	-0.97018	0.454888
Subject 10	4	20.775	0.4272	2.05632%	20.3	21.3	1.0	0.238255	0.454888
Subject 11	4	19.75	0.310913	1.57424%	19.3	20.0	0.7	-1.30401	0.454888
Subject 12	4	15.575	1.05633	6.78222%	14.7	17.1	2.4	1.2765	0.454888
Subject 13	4	19.2	1.19164	6.20645%	17.5	20.2	2.7	-1.18895	0.454888
Subject 14	4	18.35	0.994987	5.42227%	17.5	19.4	1.9	0.11273	0.454888
Subject 15	4	15.825	1.11766	7.06263%	14.7	17.1	2.4	0.178517	0.454888
Subject 16	4	19.275	1.30224	6.75612%	17.5	20.6	3.1	-0.786129	0.454888
Subject 17	4	20.325	0.298608	1.46917%	20.0	20.7	0.7	0.344987	0.454888
Subject 18	4	17.4075	1.23297	7.083%	15.8	18.8	3.0	-0.420094	0.454888
Subject 19	4	16.325	0.512348	3.13842%	15.8	17.0	1.2	0.614689	0.454888
Subject 20	4	19.175	1.12361	5.85977%	17.5	19.9	2.4	-1.57206	0.454888
Subject 21	4	15.375	1.23929	8.06041%	14.0	17.0	3.0	0.477778	0.454888
Subject 22	4	18.55	0.914695	4.93097%	17.5	19.5	2.0	-0.160036	0.454888
Subject 23	4	20.925	0.736546	3.51993%	20.0	21.8	1.8	-0.165005	0.454888
Subject 24	4	20.675	0.287228	1.38925%	20.3	20.9	0.6	-0.697748	0.454888
Subject 25	4	21.375	0.298608	1.397%	21.0	21.7	0.7	-0.344987	0.454888
Subject 26	4	21.35	0.288675	1.35211%	21.0	21.7	0.7	0	0.454888
Subject 27	4	21.7	1.2083	5.56822%	20.0	22.7	2.7	-1.10154	0.454888

Table 2. ANOVA table for female VO2max (mL/min/kg)

Source of variance	Sum of squares	DF	Means square	F	Probability
Treatment	440.934	26	16.959	20.49	0.0000
Error	67.0432	81	0.827694		
Total	507.977	107			

The two tables about present the summary statistics and ANOVA table for the evolution of the $VO_{2max\ (mL/min/kg)}$ of the female subjects who participated in the study

The difference between the VO_{2max} of the 27 female subjects were significantly different since the probability of the F-test is less than 0.05 and equal to 20.49.

Table 3. Summary statistics table for cardiovascular fitness ($VO_{2max\ (mL/min/kg)}$) for male subjects

	Effective	Mean	Standard deviation	Coefficient of variation	Minimum	Maximum	Stretch	Standard Asymmetry
Col_1	4	18.025	2.32576	12.903%	15.0	20.3	5.3	-0.604807
Col_2	4	18.825	1.68003	8.92446%	17.5	21.0	3.5	0.659352
Col_3	4	17.775	1.06888	6.01338%	16.8	19.3	2.5	1.14917
Col_4	4	18.9	1.42829	7.55707%	17.0	20.0	3.0	-0.789118
Col_5	4	20.85	1.47535	7.07603%	19.3	22.8	3.5	0.598004
Col_6	4	18.65	2.5619	13.7367%	16.5	22.0	5.5	0.699246
Col_7	4	15.95	2.68887	16.8581%	12.2	18.6	6.4	-0.946171
Col_8	4	18.75	1.30767	6.97424%	16.8	19.6	2.8	-1.57449
Col_9	4	19.075	2.91362	15.2745%	15.8	22.0	6.2	-0.151297
Col_10	4	17.975	1.68003	9.34648%	15.8	19.3	3.5	-0.659352
Col_11	4	21.2	1.73013	8.16097%	19.3	23.5	4.2	0.556225
Col_12	4	16.9	0.804156	4.75832%	15.8	17.5	1.7	-0.942074
Col_13	4	10.65	1.27671	11.9879%	9.8	12.5	2.7	1.33399
Col_14	4	18.55	1.85203	9.98397%	16.8	21.0	4.2	0.705387
Col_15	4	12.7	2.85657	22.4927%	10.5	16.5	6.0	0.789118
Col_16	4	17.55	1.76163	10.0378%	15.8	20.0	4.2	0.922101
Col_17	4	19.5	3.36353	17.2489%	15.8	22.4	6.6	-0.176119
Col_18	4	15.125	2.46762	16.3149%	12.2	17.5	5.3	-0.302604
Col_19	4	18.125	0.75	4.13793%	17.5	19.0	1.5	0.302406
Col_20	4	16.5	2.6808	16.2472%	13.0	18.6	5.6	-0.697748
Col_21	4	13.675	2.51048	18.3582%	10.9	15.8	4.9	-0.185324
Col_22	4	13.5	1.81659	13.4562%	11.9	15.8	3.9	0.55298
Col_23	4	15.875	1.02429	6.45221%	14.7	17.2	2.5	0.356147
Col_24	4	17.7	2.67333	15.1035%	13.7	19.3	5.6	-1.60826
Col_25	4	14.0	1.46969	10.4978%	12.2	15.8	3.6	0
Col_26	4	18.4	1.88503	10.2447%	15.8	20.3	4.5	-0.86012
Col_27	4	19.7	1.14018	5.78769%	18.6	21.0	2.4	0.209326
Col_28	4	20.675	2.21115	10.6948%	18.2	23.5	5.3	0.358055
Col_29	4	21.825	1.60909	7.37269%	20.0	23.5	3.5	-0.132434
Col_30	4	22.275	2.19754	9.86548%	20.1	24.5	4.4	0.0187539
Col_31	4	20.325	2.27065	11.1717%	17.5	23.0	5.5	-0.154884
Total	**124**	**17.7266**	**3.24834**	**18.3247%**	**9.8**	**24.5**	**14.7**	**-1.95618**

Table 4. Anova table of the $VO_{2max\ (mL/min/kg)}$ of male subjects

Source of variance	Sum of variance	DF	Means squares	F	Probability
Treatment	914.475	30	30.4825	7.39	0.0000
Error	383.387	93	4.12245		
Total	**1297.86**	**123**			

The two tables above present the summary statistics and ANOVA table for the evolution of the VO2max (mL/min/kg) of the male subjects who participated in the study

The difference between the VO2max of the 31 male subjects tested 4 times in intervals of 6 weeks from 6 weeks to 24 weeks were significantly different since the probability of the F-test is less than 0.05 and equal to 7.39.

Table 5. Summary statistics table for broad jump (explosive force) for male subjects

Subject	Effective	Mean	Standard deviation	Coefficient of variative	Typical error	Minimum	Maximum	Stretch	Asymmetry	Flattening
1	4	2.35	0.331662	14.11%	0.165831	2	2.8	0.8	0.716169	0.789505
2	4	2.7625	0.179699	6.50%	0.0898494	2.5	2.9	0.4	-1.38509	1.23061
3	4	2.575	0.330404	12.83%	0.165202	2.2	3	0.8	0.356533	0.475881
4	4	2.7125	0.239357	8.82%	0.119678	2.5	3.05	0.55	1.08849	0.779626
5	4	2.8	0.147196	5.26%	0.073598	2.6	2.95	0.35	-0.76805	0.612372
6	4	2.5	0.454606	18.18%	0.227303	1.9	3	1.1	-0.52144	0.612372
7	4	1.85	0.369685	19.98%	0.184842	1.5	2.3	0.8	0.387857	-1.1089
8	4	1.675	0.639661	38.19%	0.319831	1	2.4	1.4	0.114647	-1.32681
9	4	2.7375	0.188746	6.89%	0.0943729	2.5	2.95	0.45	-0.29219	0.105046

10	4	2.97	0.062716	2.11%	0.0313581	2.9	3.05	0.15	0.357468	0.218315
11	4	2.7425	0.214223	7.81%	0.107112	2.5	3.02	0.52	0.389372	0.556933
12	4	1.825	0.298608	16.36%	0.149304	1.5	2.2	0.7	0.344987	-0.16988
13	4	2.0225	0.220662	10.91%	0.110331	1.8	2.3	0.5	0.447009	-0.55979
14	4	2.5475	0.380821	14.95%	0.190411	2.29	3.1	0.81	1.34349	1.04524
15	4	2.2375	0.377216	16.86%	0.188608	1.8	2.6	0.8	-0.24957	-1.48618
16	4	2.4625	0.430842	17.50%	0.215421	2	2.9	0.9	-0.06477	-1.80002
17	4	2.725	0.386221	14.17%	0.193111	2.3	3.1	0.8	-0.13818	-1.80006
18	4	2.3375	0.485412	20.77%	0.242706	1.9	2.95	1.05	0.532506	-0.82852
19	4	1.825	0.434933	23.83%	0.217466	1.2	2.2	1	-1.2281	1.08031
20	4	1.95	0.057735	2.96%	0.0288675	1.9	2	0.1	0	-2.44949
21	4	1.7625	0.377216	21.40%	0.188608	1.2	2	0.8	-1.57586	1.53834
22	4	1.75	0.420317	24.02%	0.210159	1.3	2.2	0.9	0	-1.59492
23	4	1.97	0.295973	15.02%	0.147986	1.6	2.3	0.7	-0.28821	-0.05453
24	4	2.3125	0.201556	8.72%	0.100778	2.15	2.6	0.45	1.19971	0.829058
25	4	1.715	0.373586	21.78%	0.186793	1.3	2.06	0.76	-0.17955	-1.83923
26	4	2.0775	0.063443	3.05%	0.0317214	2	2.15	0.15	-0.16707	-0.13098
27	4	2.725	0.434933	15.96%	0.217466	2.1	3.1	1	-1.2281	1.08031
28	4	3.2625	0.221265	6.78%	0.110633	3.05	3.5	0.45	0.105993	-1.9485
29	4	2.8075	0.122031	4.35%	0.0610157	2.7	2.98	0.28	1.10832	0.808665
30	4	2.86	0.106771	3.73%	0.0533854	2.75	2.99	0.24	0.319304	-0.8251
31	4	1.97	0.062716	3.18%	0.0313581	1.9	2.05	0.15	0.357468	0.218315

Table 5. ANOVA table for broad jump of male subjects

Source of variations	Sum of squares	DF	Mean squares	F	Probability
Treatment	23.6421	30	0.788071	7.60	0.0000
Errors	9.64675	93	0.103728		
Total	33.2889	123			

The tables above present the summary statistics and ANOVA for the male broad jump of the participants respectively. The difference between the broad jump of the 31 male subjects tested 4 times in intervals of 6 weeks from 6 weeks to 24 weeks were significantly different since the probability of the F-test is less than 0.05 and equal to 7.60.

Table 6. Summary statistics table for broad jump (explosive force) for female subjects

Subject	Effective	Mean	Standard deviation	Coefficient of variation	Minimum	Maximum	Stretch	Asymmetry	Flattening
1	4	2.55	0.404145	15.85%	200.00%	2.9	0.9	-0.89058	0.121403
2	4	2.675	0.206155	7.71%	250.00%	2.9	0.4	0.163083	-1.98332
3	4	2.3875	0.085391	3.58%	230.00%	2.5	0.2	0.614689	0.139971
4	4	2.3	0.216025	9.39%	210.00%	2.6	0.5	0.971909	0.612372
5	4	2.125	0.262996	12.38%	190.00%	2.5	0.6	1.17825	0.912381
6	4	2.275	0.132288	5.81%	215.00%	2.45	0.3	0.705387	-0.11664
7	4	2.275	0.262996	11.56%	200.00%	2.5	0.5	-0.10099	-2.1597
8	4	2	0.08165	4.08%	1.9	2.1	0.2	0	0.612372
9	4	2.075	0.15	7.23%	1.9	2.2	0.3	-0.30241	-1.59267
10	4	2.45	0.251661	10.27%	2.1	2.7	0.6	-0.9221	0.909229
11	4	2.15	0.129099	6.00%	2	2.3	0.3	0	-0.4899
12	4	2.55	0.351188	13.77%	2.2	2.9	0.7	0	-2.12742
13	4	2.575	0.170783	6.63%	2.4	2.8	0.4	0.614689	0.139971
14	4	2.685	0.240624	8.96%	2.4	2.95	0.55	-0.15144	-0.72736
15	4	2.675	0.287228	10.74%	2.5	3.1	0.6	1.50748	1.39307
16	4	2.375	0.411299	17.32%	2	2.9	0.9	0.57208	-0.67489
17	4	2.45	0.208167	8.50%	2.2	2.7	0.5	0	0.159434
18	4	1.925	0.45	23.38%	1.3	2.3	1	-1.01922	0.398479
19	4	2.125	0.170783	8.04%	1.9	2.3	0.4	-0.61469	0.139971
20	4	2.25	0.450925	20.04%	1.9	2.9	1	1.28234	0.986774
21	4	2.55	0.506623	19.87%	1.9	3	1.1	-0.6028	-0.65648
22	4	2.375	0.478714	20.16%	180.00%	2.9	1.1	-0.19537	-0.61962
23	4	2.15	0.238048	11.07%	190.00%	2.4	0.5	0	-1.77143
24	4	2.275	0.221736	9.75%	200.00%	2.5	0.5	-0.3932	-0.69382
25	4	2.3125	0.154785	6.69%	210.00%	2.45	0.35	-0.92887	0.309312
26	4	2.275	0.05	2.20%	220.00%	2.3	0.1	-1.63299	1.63299
27	4	2.275	0.05	2.20%	2.2	2.3	0.1	-1.63299	1.63299

Table 6. ANOVA table for the broad jump of female subjects

Source	Sum of squares	DF	Means squares	F	Probability
Treatment	4.45541	26	0.171362	2.22	0.0036
Error	6.25745	81	0.0772525		
Total	**10.7129**	**107**			

The tables above present the summary statistics and ANOVA for the female broad jump of the participants respectively.

The broad jumps performance of all the subjects were significant different ($p \leq 0.05$) and the males had an F-value of 7.6 (Table 6) which was further verified by the Kruskal-Wallis null hypothesis statistics test = 87.8662 and probability = 1.37796×10^{-7}.

Table 7. Summary of statistics for 30m dash (Sprints) in seconds of male participants

Subjects	Effective	Mean	Standard deviation	Coefficient of variation (%)	Minimum	Maximum	Stretch	Asymmetry	Flattening
1	4	4.825	0.142421	4.90	4.5	5	0.5	-0.97475	0.177887
2	4	4.7475	0.141421	3.63	4.5	4.9	0.4	-1.21212	1.13235
3	4	4.85	0.143421	9.60	4.2	5.3	1.1	-0.97151	0.866743
4	4	4.9	0.181421	5.59	4.5	5.1	0.6	-1.39133	1.19299
5	4	5.86	0.089067	8.38	5.45	6.5	1.05	0.68274	-0.53472
6	4	6.9125	0.373973	4.95	6.65	7.4	0.75	1.19479	0.746866
7	4	5.8125	0.075	2.26	5.7	6	0.3	1.17825	0.912381
8	4	5.83	0.089069	1.53	5.7	5.9	0.2	-1.37274	1.242
9	4	5.8375	0.075	1.28	5.8	5.95	0.15	1.63299	1.63299
10	4	5.9625	0.047871	0.80	5.9	6	0.1	-0.69775	-0.52634
11	4	6.13	0.173973	2.84	5.9	6.3	0.4	-0.67731	-0.01493
12	4	5.09	0.231084	4.54	4.8	5.3	0.5	-0.50922	-0.87564
13	4	4.8	0.141421	2.95	4.7	5	0.3	1.1547	0.612372
14	4	4.4225	0.397524	8.99	4.09	4.9	0.81	0.382681	-1.36872
15	4	6.225	0.607097	9.75	5.7	7.1	1.4	1.24754	1.14665
16	4	5.3525	0.69356	12.96	4.7	6.3	1.6	0.869227	0.375758
17	4	5.0775	0.249048	4.90	4.8	5.4	0.6	0.41851	0.420059
18	4	4.2375	0.179699	4.24	4.1	4.5	0.4	1.38509	1.23061
19	4	5.1475	0.252372	4.90	4.9	5.5	0.6	0.95978	0.93211
20	4	5.1325	0.104682	2.04	5.01	5.25	0.24	-0.08808	-0.70476
21	4	4.3250	0.170783	3.95	4.1	4.5	0.4	-0.61469	0.139971
22	4	4.135	0.050662	1.23	4.09	4.2	0.11	0.602797	-0.65648
23	4	5.5525	0.415963	7.49	5.01	6	0.99	-0.50659	0.270559
24	4	5.1375	0.256174	4.99	4.9	5.5	0.6	1.08519	0.969428
25	4	4.6625	0.125	2.68	4.5	4.8	0.3	-0.45724	0.378854
26	4	4.15	0.040825	0.98	4.1	4.2	0.1	0	0.612372
27	4	5.04	0.095219	1.89	4.9	5.1	0.2	-1.45269	1.27984
28	4	4.6275	0.333204	7.20	4.15	4.9	0.75	-1.22819	0.934504
29	4	5.0575	0.03304	0.65	5.02	5.1	0.08	0.356533	0.475881
30	4	5.7875	0.175	3.02	5.6	6	0.4	0.26185	-0.65225

Table 8. 30 m dash ANOVA table for male subjects

Source of variance	Sum of squares	DF	Mean squares	F	Probability
Treatment	53.9349	29	1.85982	22.42	0.0000
Error	7.46627	90	0.0829586		
Total	61.4012	119			

The two tables above present the summary statistics and ANOVA table for the evolution of the 30m dash of the male subjects who participated in the study. The performances of the 30 m dash for the male subjects were significantly different ($p \leq 0.05$) for each subject over the test period with 22.42 as F value (Table 7).

Table 9. Summary of statistics for 30m dash (Sprints) in seconds of female participants

	Effective	Mean	Standard deviation	Coefficient of variation	Minimum	Maximum	Stretch	asymmetry	Flattening
Subject 1	4	5.3725	0.765305	14.24%	4.89	6.5	1.61	1.46989	1.31598
2	4	5.215	0.235726	4.52%	4.96	5.5	0.54	0.235253	-0.64001
3	4	5.675	0.537742	9.48%	5	6.2	1.2	-0.46864	-0.69968
4	4	5.6375	0.590783	10.48%	4.99	6.25	1.26	-0.07508	-1.61553
5	4	5.0525	0.251313	4.97%	4.8	5.4	0.6	0.87744	0.855582
6	4	4.6075	0.370889	8.05%	4.2	5	0.8	-0.05463	-1.51187
7	4	5.825	1.09049	18.72%	4.8	7	2.2	0.122307	-1.96928
8	4	5.0125	0.597739	11.93%	4.3	5.75	1.45	0.098565	0.391813
9	4	6.325	0.330404	5.22%	5.9	6.7	0.8	-0.35653	0.475881
10	4	5.48	0.68274	12.46%	4.8	6.28	1.48	0.248268	-1.30649
11	4	6.6525	0.974863	14.65%	5.8	8	2.2	0.974545	0.392429
12	4	6.12	0.469326	7.67%	5.7	6.78	1.08	1.06759	0.749212
13	4	5.0625	0.205649	4.06%	4.8	5.3	0.5	-0.29044	0.523434
14	4	4.8625	0.604669	12.44%	4	5.4	1.4	-1.16277	1.00466
15	4	4.8475	0.741861	15.30%	4.2	5.9	1.7	1.13627	0.857085
16	4	4.6725	0.557696	11.94%	4.1	5.39	1.29	0.513306	-0.19069
17	4	5.2	0.316228	6.08%	4.8	5.5	0.7	-0.5164	-0.69402
18	4	5.205	0.206801	3.97%	4.92	5.4	0.48	-0.91563	0.533808
19	4	5.205	0.206801	3.97%	4.92	5.4	0.48	-0.91563	0.533808
20	4	6.75	0.5	7.41%	6.1	7.3	1.2	-0.45724	0.378854
21	4	4.575	0.262996	5.75%	4.2	4.8	0.6	-1.17825	0.912381
22	4	4.4375	0.958623	21.60%	3	4.95	1.95	-1.63001	1.62815
23	4	4.76	0.31209	6.56%	4.49	5.1	0.61	0.159445	-1.98967
24	4	5.45	0.550757	10.11%	4.8	6	1.2	-0.26392	-1.2382
25	4	4.94	0.112842	2.28%	4.8	5.05	0.25	-0.4296	-0.83526
26	4	4.905	0.042032	0.86%	4.85	4.95	0.1	-0.52779	0.288637
27	4	4.7725	0.219905	4.61%	4.5	5	0.5	-0.36952	-0.61689

Table 10: 30 m dash table for female subjects

Source of variance	Sum of squares	DF	Mean square	F	Probability
Treatment	39.4666	26	1.51794	5.17	0.0000
Errors	23.7873	81	0.29367		
Total	63.2539	107			

The two tables above present the summary statistics and ANOVA table for the evolution of the 30m dash of the female subjects who participated in the study

The performances of the 30 m dash for the female subjects were significantly different ($p \leq 0.05$) for each subject over the test period with 5.17 as F value.

A direct correlation also existed between the evolution of the training periods and the performances realized in both sexes over the study period. The performance from the first day improved significantly ($p \leq 0.05$) at F=3.03 and probability = 0.0321 for the males while it was F=1.67 with a probability of 0.00145 for the females.

Discussions

The purpose of this study was to investigate the effectiveness of an adapted physical activity program on the physical fitness of children with intellectual disabilities in NCRH Yaounde.

According to the impact of endurance exercises (Aerobic exercises) on the physical fitness of adolescents suffering from intellectual disabilities, it has been observed that the F value is less than 0.05

and equal to 20.49 for the females. In the same note, VO2max for the 31 males had an F value less than 0.05 and equal to 7.39 which implies that generally there is a positive difference between endurance exercises and the physical fitness of the participants. Accordingly, there is a significant difference between cardiovascular exercises in the adapted physical education program in the center and the physical health of the adolescents living with intellectual disabilities. The above findings are in line with research that has demonstrated that exercise has health benefits for people with learning disabilities including improved endurance, aerobic capacity and muscular strength (Collins and Staples, 2017). Similarly, the study of Pommering, Brose, Randolph et al. (1994) indicated that physical activity programs integrated into community recreation could enhance cardiovascular fitness. It also goes in line to the fact that the benefits of participating in structured exercise programmes may vary according to the type of exercise (Calders et al, 2011), but these programmes have generally been found to improve the health of individuals with learning disabilities. It is in this view that the researcher Kastanias et al (2015) found that a 12-week aerobic exercise programme resulted in significant improvements in a range of health indicators, including body mass index (BMI) and blood pressure. Hakim et al (2017) found that participation in an eight-week aquatic exercise program improved balance and endurance. All the aforementioned studies are in relation to the fact that the endurance exercises found in the adapted physical education programme of the center had an impact on the cardiovascular fitness of the children especially the male subjects as indicated in the findings of their maximum consumption of oxygen (Vo2max).

Meanwhile, the results show no correlation of the maximum consumption of oxygen (Vo2max) for some of the female subjects. This goes in line with some researchers who opine that participating in community-based physical activity programs has not been shown to improve cardiorespiratory fitness in some children with intellectual disability. That is caused by the fact, that the intensity level of physical activity programs for individuals with intellectual disability are quite often lower than what is needed to elicit increases in cardiorespiratory fitness. (Pitetti, Jackson, Stubbs, Cambell & Battar 1989; Romar, Lahtinen, Rintala, Rusi 1998.). This can be explained to the fact that the activities in which some of these female participants do in their daily chores apart from the regular school activities could be less demanding.) Equally some studies opine that individual with intellectual disability need systematic intervention strategies for building their physical fitness. People with disabilities face many challenges that impede their progress to become physically active like architectural barriers, being overprotected, fostering an inactive lifestyle, the potential for obesity and other health concerns. (Prasher and Janicki 2002). Discussions with some parents who usually accompany their children to the centre made us to understand that they overprotect their children at home such that they are not allowed to go out and play with other children for fear of certain circumstances like their children taking unknown directions from the house. Hence fostering them into an inactive lifestyle which might lead to overweight and eventually obesity. We could say that the endurance exercises in the adapted physical education program in the centre was lower than what is needed to elicit increases in cardiorespiratory fitness of the female participants.

In relation to the impact of explosive force exercises on the physical fitness of adolescents living with intellectual disabilities, it has been observed that F value is less than 0.05 and equal to 2.2 for the females. In the same note, explosive force for the 31 males had an F value less than 0.05 and equal to 7.60 which implies that generally there is a positive difference between explosive force exercises and the physical fitness of the participants. Accordingly, there is a significant difference between explosive force exercises in the adapted physical education program in the center and the physical fitness of the adolescents living with intellectual disabilities.

It is therefore evident that, the adapted physical education programme program had an impact by improving the explosive force of the individuals with intellectual disabilities though this was more significant in male subjects. This goes in line with the fact that so far, most studies have shown improvement in balance and strength from non-standardized physical exercise interventions. Past research has suggested that sufficiently long intervention program duration is crucial for beneficial results. In most studies programs varied from 6 to 12 weeks in length (e.g., Borremans, Rintala, &

Kielinen, 2009 as in Asonitou et al., 2018 used a 12-week physical exercise program; Davis, Zhang, & Hodson, 2011 as in Asonitou et al., 2018 used an 8-week adapted physical activity program; Giagazoglou et al., 2012 as in Asonitou et al., (2018) used a 10-week hippotherapy program; Giagazoglou et al., 2013 used a 12-week trampoline exercise intervention program; Rahmat & Hasan, 2013 used a 6-week exercise program; Tsimaras & Fotiadou, 2004 used a 12-week training program; and Wang et al., 2007 used a 12-week aquatic. In our study we used a 24-week adapted physical education program that englobed all the items of physical fitness (endurance, speed, explosive force, agility and balance).

In the same line, a recent systematic review of 18 studies and subsequent meta-analysis of 14 studies found that, in adolescents with learning disabilities, exercise resulted in improvements in agility, power, reaction time and speed (Jeng et al, 2017). In the aforementioned objective we are interested in the fact that in the review mentioned above exercise resulted in improvements in power which is in line with our objective that the presence of explosive force exercises in the program improved the physical fitness of the children within the 24-weeks of its implementation.

According to the impact of speed exercises on the physical fitness of adolescents suffering from intellectual disabilities, it has been observed that the F value is less than 0.05 and equal to 5.17 for the females. In the same note, explosive force for the 31 males had an F value less than 0.05 and equal to 22.42 which implies that generally there is a positive difference between speed exercises and the physical fitness of the participants. Accordingly, there is a significant difference between speed exercises in the adapted physical education program in the center and the physical fitness of the adolescents living with intellectual disabilities.

In another vein, there was a direct correlation between period of training and the feedback observed from the participating subjects in both the male and female subject presenting Pearson correlation coefficients of 2.98 and 0.997 for males and females respectively. This tendency was further confirmed by the Spearman intragroup comparison with a coefficient of correlation of 0.347 for males and 0.124 for females respectively.

The aforementioned findings are in consonance with recent systematic review of 18 studies and subsequent meta-analysis of 14 studies which found that, in adolescents with learning disabilities, exercise resulted in improvements in agility, power, reaction time and speed (Jeng et al, 2017). In this objective we are interested in the fact that in the review mentioned above, exercise resulted in improvements in reaction time and speed which is in line with our objective that the presence of speed exercises among others in the program improved the physical fitness of the children within the 24-weeks of its implementation.

Conclusion

As conclusion, the results of this study have indicated that the adapted physical education presently being implemented in the National Center for the rehabilitation of disable persons has an impact on the physical health, emotional and social stability levels in a positive way.

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