Inclusive Physical Activity to Promote the Participation of People with Disabilities: A Preliminary Study

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Abstract: *Background*: Physical activity brings improvements in the quality of life in all individuals, disabled and non-disabled. There is little evidence in the literature of inclusive physical activity in which disabled and non-disabled people participate at the same level.

Objectives: The study aimed to demonstrate the effectiveness of an inclusive training program, structured in such a way as to encourage physical activity for all participants with and without disabilities, in improving body composition, explosive strength, and endurance.

Methods: A sample of twenty-four subjects (mean age: 24.09±3.92 years), 12 disabled and 12 non-disabled, was selected. Quantitative input and output data were recruited at 16-week intervals using a battery of tests: anthropometric measurements, Vertec Squat Jump test, and Yoyo Endurance Test. During the 16 weeks, all participants followed an appropriately structured training program in four mesocycle without any differences. Input and output data were compared employing the t-test for dependent samples.

Results and conclusions: The results showed statistically meaningful improvements at an alpha level set at 0.05 for the three parameters tested. These results confirmed the effectiveness of the proposed inclusive training protocol on the improvement of the tested parameters in all participants. These strategies didn't jeopardise the achievement of the overall objectives set; on the contrary, improvements in BMI, explosive strength, and endurance strength of 4.8%, 4.3%, and 56.2% respectively were observed.

Keywords: Inclusive well-being, High-Intensity Interval Training, physical activity for disability, Body composition, Social inclusion, and sport.

INTRODUCTION

The benefits that regular physical activity can bring to individuals of all ages and genders are well known [1, 2], such as reducing the risk of morbidity and mortality and the risk of contracting many chronic diseases, such as coronary artery disease, diabetes mellitus and cancer [3], also reducing the risk of falls in the elderly [4] and improving the level of independence of people with disabilities. The practice of sport makes it possible to productively satisfy human needs linked to the experience of play, movement, competitiveness, and group life.

The last thirty years have been characterized by a progressive evolution in physical and sporting activity in the context of disability. Despite many difficulties, the practice of physical and sporting activities for people with disabilities is now an established reality [5]. Many studies have demonstrated the positive effects of physical activity for people with disabilities [6-9]. For individuals with Down syndrome [10], physical and sporting activity promotes social interaction, self-esteem, mental and physical health [11] and prevents the risk of chronic diseases [12]. Regular physical activity improves mood and mental health, which is particularly important for young adults with Asperger's syndrome who struggle with mental health problems [13].

Physical activity, sport, and playful expression, based on what a person can do, stimulate consideration of oneself and one's existence [14]. It is a fundamental tool for the improvement of residual potential [15, 16] in all degrees of disability. In a lot of situations, it improves autonomy in movement and recognition/awareness of the sense-perceptual data inherent in the motor behaviors performed. In situations of medium severity, it eases the acquisition of elementary motor skills and their correct use in school life, in relationships, and preparation for sport. Finally, in less severe situations, they allow the acquisition of more complex motor skills that can enable the practice of sporting activities.

Subjects who engage in regular physical activity (group or individual sports, outdoor games, physical-motor activities) show greater confidence in their possibilities, are led to greater self-esteem, ease in

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social relationships, greater tolerance of stress and are, in a sense, more 'sheltered' from any propensity to disorders such as anxiety and depression [17].

However, despite these benefits, people with disabilities engage in less physical activity than non-disabled people [18, 19]. Evidence shows that the offers developed by fitness centers and gyms don't always meet an adequate level of participation by people with disabilities. This could be due to several variables, including unsuitable and non-inclusive environments or rigidly structured contexts for the disability category. Such contexts may generate feelings of discomfort and thus lead individuals to withdraw from physical activity.

Considering the possibility of developing inclusive training sessions, in which all individuals can participate without barriers and experience their potential in a social context, can be an effective solution.

The concept of inclusivity, in motor and sports practice, focuses on the possibility of allowing everyone to reach a basic level of technical skills, to feel pleasure in the commitment and effort produced, and not to be excluded from the context [20]. In this sense, the approach of individuals with physical, intellectual, and/or mental disabilities into the motor and/or sports practice, in public and private environments, should promote social inclusion and self-esteem, prevent the risk of obesity, and improve the quality of life. This requires an effort on the part of instructors and coaches to search for new teaching strategies and to create favorable environments for all individuals (disabled and non-disabled learners) so that they can develop, through self-organization [21], their abilities, skills, and competencies to the highest level.

Over the years, few studies have focused on this. In the world of fitness, there is no evidence of proposals in which disabled and non-disabled people practice the same training because of ideologies anchored to the concept of diversity and exclusion.

In this study, the effect of administering the same training protocol to disabled and non-disabled participants without differences, categories, or exclusions was evaluated. The study aimed to demonstrate that an inclusive training program, structured in such a way as to encourage physical activity for all disabled and non-disabled participants, can be effective in improving body composition, explosive strength, and endurance in all participants. An additional goal is to highlight whether there are differences in the improvement of the three parameters using the same training protocol.

METHODS

Subjects

Twenty-four subjects took part in this study, of whom eight were female and sixteen males (average age: 24.09±3.92 years, average height: 169.9±0.7 cm; average weight: 70.26±8.77 kg, average BMI 24.75±4.2). The sample was made up of twelve disabled subjects (four with Down's syndrome, two with congenital malformation of one hand, two with Asperger's syndrome, and four with mild mental disability and difficulty in concentrating) and twelve non-disabled subjects. Four of the twelve disabled subjects did not regularly engage in physical activity, and only two of the twelve non-disabled subjects regularly engaged in physical activity.

All participants were informed about the research procedures, requirements, benefits, and risks, and written informed consent was obtained before the study.

Experimental Design

The sample was subjected to a battery of input tests before the start of the training protocol and output tests at the end of the training period. The tests aimed to recruit quantitative data on body mass index (BMI), explosive strength, and endurance. The tests were administered during the same session after an adequate warm-up. The sequence and choice of tests were determined before administration in such a way as to ensure the collection of data useful for the objectives of the study. The tests performed were as follows:

- Weight measurement with Wunder professional scales and calculation of body mass index (BMI).
- Squat Jump test with a Vertec device through which the jump differential was measured.
- Yo-yo Endurance Test was performed in a field adjacent to the gym where the training period took place.

The training protocol was developed over 16 weeks, divided into 4 sub-phases:

Table 1: Experimental Protocol

Mesocycle	Duration	Work out phase	Description	Methodology	Tools
Anatomical adaptation	3 weeks	Warm-up	Joint mobility (5 mins) Cardio fitness at an intensity of 45 and 60 % of the HRmax (10 mins)		Tapis roulant Bike Rower
		Central phase	General adaptation strength exercises: Free body circuits or with small overloads Load: 45-60 %	Timed circuits to be repeated 3 times 25 repetitions per exercise 10 exercises in total Recovery between circuits 1 min	Lightweight medical balls Small dumbbells Boxes
		Final Phase	Active recovery and muscle-stretching exercises	Aerobic exercises Stretching	Tapis roulant Bike Rower
Strength and hypertrophy	6 weeks	Warm-up	Joint mobility (5 mins) Cardio fitness at an intensity of 45 and 60 % of the HRmax (10 mins)		Tapis roulant Bike Rower Jump rope
		Central phase	Exercises for developing strength and muscle hypertrophy load: 70-90 %.	Total body Split routine	Isotonic machines Barbells Dumbbells
		Final Phase	Active recovery and muscle-stretching exercises	Aerobic exercises Stretching	
Explosive strength	4 weeks	Warm-up	Joint mobility (5 mins) Cardio fitness at an intensity of 45 and 60 % of the HRmax (10 mins)		Tapis roulant Bike Rower Jump rope
		Central phase	Explosive exercises on the floor or with overloads Load: 40-70 %	Isotonic exercises Plyometric exercises	Plyoboxes Isotonic machines Medical balls Kettlebells Barbells
		Final Phase	Active recovery and muscle-stretching exercises	Aerobic exercises Stretching	Tapis roulant Bike Rower
Power resistance	3 weeks	Warm-up	Joint mobility (5 mins) Balance Cardio fitness at an intensity of 45 and 60 % of the HRmax (10 mins)		Tapis roulant Bike Rower Jump rope Proprioceptive cushions
		Central phase	Circuit exercises with overloads or free bodywork Load: 70% of HRmax	HIIT Duration: 20-30 mins	Plyoboxes Medical balls Kettlebells Barbells Battle rope
		Final Phase	Active recovery and muscle-stretching exercises	Aerobic exercises Stretching	Tapis roulant Bike Rower

- Anatomical adaptation (3 weeks);
- Development of strength and hypertrophy (6 weeks);
- Development of explosive strength (4 weeks) and development of power endurance (3 weeks).

For each week, three training sessions of approximately 60 minutes were carried out, using different tools and methods depending on the mesocycle. Various tools were used: cardio equipment, isotonic machines, barbells, dumbbells, kettlebells, plyoboxes and medicine balls, proprioceptive cushions, battle rope.

Statistical Analysis

Through descriptive statistics, the means and standard deviations of the percentages of improvement obtained at posttest (after the 16-week experimental protocol period) were calculated. Through one-way ANOVA, the means of the percentages of improvement in and between groups were compared. Effect size analysis was conducted to determine the power of the effect of the protocol on the tested parameters. In addition, a posthoc Bonferroni test was performed to test which averages differed from the others. The significance level was set at $P \leq 0.05$. All statistical tests were conducted using IBM SPSS.

Table 2: Test Results

	PRE & POST TRAINING EVALUATIONS					
	Anthropometric Data BMI		*Vertec jump Test (cm)*		*Yo-Yo endurance Test (mt)*	
	Pre	Post	Pre	Post	Pre	Post
1	24,51	24,33	40,8	42,3	1680	2450
2	29,06	25,95	30	31,95	160	400
3	18,91	19,61	35,25	36,75	520	800
4	28,35	27,12	37,5	39,3	2000	2550
5	22,87	22,69	40,05	41,1	1200	1700
6	23,34	21,89	37,5	38,85	400	840
7	29,04	27,93	33,45	34,5	400	730
8	23,78	22,72	34,95	35,7	400	750
9	25,92	23,83	35,7	37,95	1560	2150
10	27,81	24,77	37,05	37,5	320	600
11	22,72	22,39	40,6	44,6	1300	1350
12	24,65	23,41	38,4	41,2	1250	1450
13	26,2	24,33	40,8	42,3	1680	1700
14	29,06	25,95	32,2	31,95	160	400
15	18,91	19,8	35,25	36,75	520	700
16	28,2	27,12	37,5	39,5	2000	2550
17	22,87	22,69	40,05	42,1	1200	1750
18	23,34	21,89	37,5	38,85	400	840
19	29,04	27,93	33,45	34,5	460	730
20	23,78	22,72	34,95	35,87	400	700
21	25,92	23,83	37,5	37,95	1560	2150
22	27,81	25,21	37,05	37,5	320	500
23	22,8	22,12	40,6	43,23	1300	1350
24	24,65	22,34	38,4	42,34	1250	1300
Mean	25,1475	23,86	36,94	38,52	935	1268,33
St.Dev	3,01	2,3	2,89	3,45	615,88	707,53

RESULTS

All the exit tests after the 16-week training period showed improvements in the assessed parameters. All participants completed the training period without any particular difficulties. Table **1** shows the extent of the improvements. Specifically, the training protocol resulted in a decrease in BMI of 4.8%, an improvement in explosive jump differential of 4.3% in the SJ vertex test and an increase in distance travelled in the endurance Yoyo Test of 56,2%.

These results, processed with ANOVA one-way, were statistically meaningful. The improvements found were significant at an alpha level of 0.05, as Table **2** below clearly shows.

DISCUSSION

The results of the study showed that the participants improved the tested parameters (BMI, explosive strength, and endurance strength) through the administered protocol. The sample, consisting of 12 disabled and 12 non-disabled subjects, all completed the 16-week training protocol with positive results in terms of improved body composition, improved explosive strength, and improved endurance strength. They worked together and without differences in an appropriately structured inclusive environment before testing. Exercises were chosen so that could be performed by all participants without difficulty. The highest levels of improvement were noted in the ability to endure running long distances at increasing speeds. Table **3** shows the results of the one-way ANOVA test. There was a mean improvement of 333.33 ± 202 meters ($p<0.05$). The reduction in BMI was also positive: there was a mean reduction of 1.3 ± 1.1 ($p<0.05$). There was also an improvement in jump differential in the Squat Jump: the mean improvement found was 1.6 1.03 cm (<0.05). These results confirmed that the choice of inclusive settings doesn't compromise the overall results of the training process, as long as the programming includes a careful choice of methodologies and tools and a layout of the training environment that allows each participant to train safely without limitations. Through the one-way ANOVA test, it was demonstrated that the results obtained were not due to chance and that this protocol produced different results for each of the three parameters tested ($p<0.01$) and an effect size slightly higher than the mean value

Table 3: ANOVA One-Way and Effect Size Results

ANOVA						
point	**Sum of squares**	**df**	**Mean Square**	**F**	**Sig**	**Eta squared**
Between Groups	51953,587	2	25976,793	41,785	<,001	,548
Within Groups	42896,014	69	621,681			
Total	94849,601	71				

Table 4: Bonferroni Post-Hoc Test Results

Multiple Comparisons Dependent Variable: scoring Bonferroni						
(I) test	**(J) test**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
BMI	**Vertec test**	-9,09397	7,19769	,632	-26,7553	8,5673
	Yoyo Endurance	-60,98344*	7,19769	<,001	-78,6447	-43,3221
Vertec test	**BMI**	9,09397	7,19769	,632	-8,5673	26,7553
	Yoyo Endurance	-51,88947*	7,19769	<,001	-69,5508	-34,2282
Yoyo Endurance	**BMI**	60,98344*	7,19769	<,001	43,3221	78,6447
	Vertec test	51,88947*	7,19769	<,001	34,2282	69,5508

*The mean difference is significant at the 0.05 level.

(0.548). The Bonferroni posthoc test (Table **4**) showed which pairs of averages were significantly different from each other: there were significant differences ($p<0.01$) between the values of the BMI test and the Yoyo endurance test and between the values of the Vertec Jump and Yoyo endurance tests; there were no significant differences between the BMI and Vertec Jump tests ($p>0.05$). The results of the study showed that people with disabilities, as well as those without disabilities, can improve their skills and competencies [22] and learn to be autonomous and more aware of their choices in many life contexts through appropriately structured physical activity programs. However, there is evidence of differences in parameter improvement that underscores the greater appropriateness of the protocol toward some parameters than others.

A limitation of the present study is the low sample size. Therefore, our results may not generalize to the whole population. Therefore, more studies could expand the knowledge on this topic by selecting larger samples and choosing additional study parameters. Further research could also be conducted with the use of questionnaires to be administered to participants to assess the degree of satisfaction with participation in the training programs and to their families to assess their degree of perception and satisfaction with this inclusive mode of participation in motor activity for their relatives with disabilities.

CONCLUSION

The objective assumed at the beginning of the project was largely achieved, as shown by the results. Thus, in conclusion, it can be stated that this study contributed to an increased awareness of the effectiveness of the barrier-free physical activity. Increasing participation and thereby improving the levels of well-being and independence of people with disabilities is one of the tasks of teachers, trainers, and all those involved in learning contexts. Therefore, there is a need for strong competencies that have to be developed through educational pathways that are increasingly oriented towards inclusion and well-being for all individuals.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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