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Disability and inclusion: Swimming to overcome social barriers

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ABSTRACT

Nowadays all people can and must practice physical activity and engage themselves in various sports specialties. Among the various sports, swimming is ideal in all situations where the weight of the body is a problem, such as in cases of lower limbs disability (amputations, paralysis, etc.). The objective of this study is to investigate if disabled and not-disabled athletes can derive performance benefits and if it is possible to reduce the gap between the competition times between athletes, through a single, performance and training activity. The sample is made up of 12 athletes, including 6 disabled, belonging to the S2 category, and 6 not-disabled athletes skilled in the back. After an anamnesis and a careful initial valuation, it was proposed to all the athletes to do the HIIT method (for 4 weeks), Tabata method (for 4 weeks), and Pilates one (for 8 weeks). Moreover, to the disabled athletes were given physiotherapy sessions to increase joint ROM for 8 weeks. The aim is to promote social inclusion for disabled athletes, often marginalized by the group, to break down those who are the pillars of difference.

Keywords: Swimming; Unique performance; Training activity; Inclusion; Disability; Well-being.

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INTRODUCTION

Swimming is a cyclical sport with high quantitative base such as energetic cost and power (Altavilla, 2020, 2019, Raiola & Altavilla, 2020, Raiola et al., 2020) than qualitative base (Raiola, 2017, 20215ab, 2013) and it is characterized by continuous repetitions of stereotyped cycles of movements carried out in a stable environment, such as the stroke. Generally, and from point of the view, the swimming has not socio-educative value such as team sport (Altavilla et al, 2020, D'Elia, et al, 2020, Di Domenico et al.,2020, Raiola et al, 2020abc) but the epistemology of exercise and sport sciences include (Gaetano, 2012ab, Raiola, 2020ab, 2019ab, Raiola et al, 2018) especially about the adapted physical activity (D'Isanto 2020abc, 2019abc, 2016). These fundamentals of exercise and sport sciences are the significant elements for degrees academic course to develop the inclusion sport (D'Elia, 2020, 2019, D'Elia, D'Isanto, 2019). These starts point needs to deep the assessing aspects (D'Isanto et al., 2019, Sgro et al., 2019, 2018, 2017, 2015ab) inclusion aspects of sport between disabled and not disabled people. In this way, not only is the general pattern of movement relatively constant, but also the average power of the load or the speed of an athlete moving at a distance; the exception is in the short distances during which the speed of movement (Esposito & Raiola, 2020) changes significantly. Quickly the athlete must become aware of the muscular commitments it entails, especially the timing and the intensity with which the most important muscle groups are put into action. This image is essential to build the rhythmic base of the movement (Izzo et al., 2020) which perhaps represents the most important element of the structure itself. On Earth, to counteract gravity force involves a constant waste of energy (D'Elia, 2020), which in water is largely abolished, on the other hand, propulsion in water involves much higher caloric cost due to the greater resistance (Altavilla et al., 2019) of water than air. Minor alterations in the swimming technique are responsible for significant differences in propulsive efficiency and the evolution of various techniques has led to the combination of different positions of the forearm and arm tend to favour the movements of the upper limb in the antero- rear, useful for propulsion (Mazzeo et al., 2018). The techniques to minimize the action-reaction) forces (D'Elia et al., 2020) acting on the vertical plane used by not-disable swimmers are not equally applicable to disable swimmer due to structural modifications and joint and dynamic body differences (Di Domenico et al., 2019). For this reason, each different handicap requires an individualized technical project, which considers the anatomical and functional characteristics (Sannicandro et al., 2020) of each individual athlete. In the specific gesture of disable athlete, we can find:

a. Reduced ROM: incomplete stroke with semi-flexed elbow with lateral dispersion of thrust energy;
b. Unwanted lateral movements: difficulty to maintain swimming direction, especially in asymmetrical injuries;
c. Stroke of the lower limbs: the stroke of the lower limbs may be too wide and / or occur with excessive knee flexion.

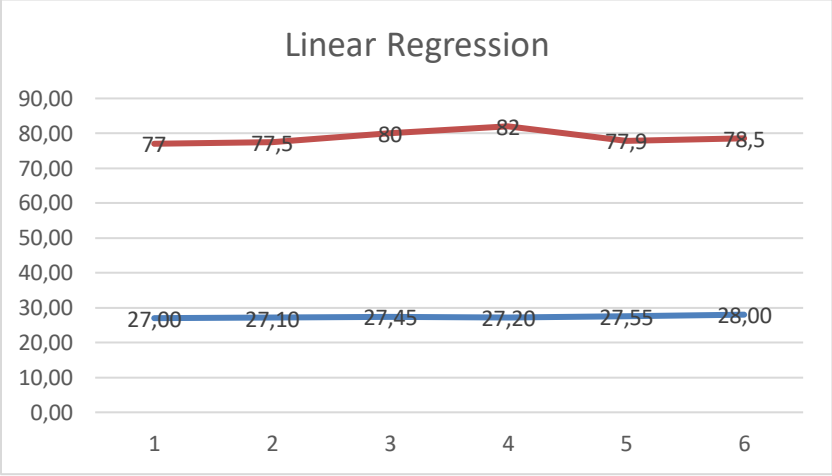
After completing a pool, to start the next one, the athlete performs a particular type of inversion of the direction of travel, called a turn or overturn, pushing against the edge of the pool with a relaxation of the lower limbs. A disabled swimmer can be more or less affected to lower limbs according to his pathology and consequently they perform a flip that is less efficient from the propulsive point of view. These are the elements that characterize the performance gap (Raiola, 2020) between the times in the pool of the two types of athletes. In reference to world records, disabled swimmer times are 3 times greater than those of a not-disabled swimmer. The goal of this study is to analyse the qualitative and quantitative differences (D'Isanto et al., 2019; Esposito et al., 2019) of two types of athletes regarding the specific gesture in the pool; after which we will work to minimize these differences.

METHOD AND MATERIALS

The sample consisted of 12 athletes, 6 athletes with disabilities and 6 non-disabled athletes with an average age of 23 years, who were given an 8-week training program. The program consists of 4 weeks of HIIT training and the other 4 weeks of Tabata training. During the 8 weeks, an attempt was made to increase joint ROM by having physiotherapy sessions for the 6 disabled athletes, and to have a Pilates workout for all the athletes examined. Height (cm), Weight (Kg), Years, VO_{2Max} and joint ROM were analysed as parameters and then the times in the pool of the 12 athletes were taken. To analyse data, Microsoft Excel software was used: linear regressions in order to observe the differences found between the pool times of the two types of athletes, multiple regression to extrapolate which of the variables depended more on the times and finally the two-tailed T-Test with equal variance both on times and on the number of strokes pre and post-training to highlight the possible differences induced by training.

RESULTS

The results show that although times have improved in all athletes, especially those with disabilities, the difference is still evident. The stroke variable is the one that has the greatest influence in pool times compared to the other variables (weight, VO_{2Max}, years).



Note: The orange line indicates the times of the athletes belonging to the S2 category, the blue line to the not-disabled athletes.

Figure 1. Graph relating to the times (pre-training) of the two types of athletes.

Table 1. Pre-training table of multiple regression.

	Coefficients
Intercept	-32.80432251
Years Variable	0.131724281
Weight Variable	-0.003647286
Strokes Variable	0.72070067
VO_{2Max} Variable	0.470751504

Note: The most influential variable is that relating to strokes.

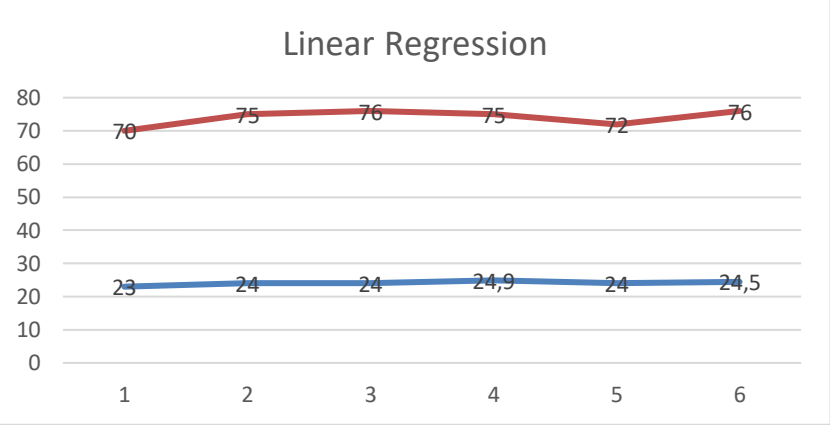
8 weeks training

Table 2. HIIT Training, 30:30.

Week 1-4 HIIT	
30" swim to 90%VO_{2Max}	30" swim to 70% VO_{2Max}
Repeat 10 times	

Table 3. Tabata Training, 20:10.

Week 5-8 Tabata	
20" al 120%VO_{2Max}	10" stop
Repeat until the times remain constant	



Note: There is still a substantial gap. Blue line highlights the times of not-disabled athletes, the orange line indicates the times of athletes belonging to S2 category.

Figure 2. Time chart post workout.

Table 4. Post-workout table of multiple regression.

	Coefficients
Intercept	17.44101719
Years Variable	-0.248337433
Weight Variable	-0.226547456
Strokes Variable	0.691640495
VO_{2Max} Variable	0.140896887

Note: It appears that the stroke variable is still the determining variable.

Table 5. Two Tails Test-T with same variance to times.

	Variable 1	**Variable 2**
Mean	53.1	50.17083333
Variance	723.1222727	590.5202083
Remarks	12	12
Total variance	656.8212405	
Hypothesized difference for means	0	
Gdl	22	
Stat t	0.279960083	
p (T<=t) one tail	.391061793	

Critic t one tail	1.717144374
p (T<=t) two tails	.782123587
Critic t two tails	2.073873068

Note: The difference does not influence in positive way.

Table 6. Two Tails Test-T with same variance to strokes.

	Variable 1	**Variable 2**
Mean	65.08333333	60.91666667
Variance	1424.083333	1213.537879
Remarks	12	12
Total Variance	1318.810606	
Hypothesized difference for means	0	
Gdl	22	
Stat t	0.281043256	
p (T<=t) one tail	.390651737	
Critic t one tail	1.717144374	
p (T<=t) two tails	.781303473	
Critic t two tails	2.073873068	

Note: Difference does not influence in positive way.

DISCUSSION

Based on a first observation, linear regression allows us to the difference between the time of the pool of disabled and not-disabled swimmers (Figure 1). By analysing the coefficients of the variables in multiple regression, it is possible to note that the stroke variable has a greater influence on the increase in the gap between the times in the pool of the two types of athletes (Table 1) than the others (weight, VO_{2Max}, years). To the subjects examined were offered an 8-week training which included 2 different training methods. In the first 4 weeks athletes did HIIT workout in which alternated 30" of strokes at 90% of VO_{2Max} and 30" of strokes at 70% of VO_{2Max} repeated 10 times (Table 2). By training with a HIIT method, athletes can gain a better physical condition and a higher athletic capacity (Altavilla et al., 2020), moreover, HIIT workouts are advantageous for an improvement in the aerobic (Pastore et al., 2019; Calandro et al., 2020) and anaerobic threshold thanks to the frequent change of pace. The second training cycle, consisting of the other 4 weeks, included a "*Tabata*" style training in which the athletes swim at 120% of VO_{2Max} for 20" followed by 10" of complete inactivity (recovery) to be repeated until the distance covered in the 20 " remained unchanged (Table 3). Tabata is a training method that requires constant transitions from anaerobic to aerobic metabolism based on the variation in intensity (Invernizzi et al., 2020), to allow for regular recovery in order to maintain anaerobic performance (Gaetano & Rago, 2014; D'Elia et al., 2020) over time. These two types of training work on the aerobic and anaerobic thresholds of athletes. During the 8 weeks, an attempt was made to increase joint ROM by having physiotherapy sessions for the 6 disabled athletes, and to have a Pilates workout for all the athletes examined. Pilates Method, also called Pilates, is a training system developed at the beginning of the twentieth century by Joseph Pilates, which involves an exercise program that focuses on postural muscles (Aliberti et al., 2020), that help keep the body balanced, essential to support the spine. Pilates exercises raise awareness of breathing (Raiola et al., 2020a) and spinal alignment by strengthening the muscles of the deep plane of the trunk. It turns out to be an excellent complementary training for high-level athletes (Rago et al., 2017). At the end of the 8 weeks, the pool times of the 12 athletes were examined again and the same tests were performed again with the addition of the t-test. The linear regression shows how the gap between the times of the two types of athletes is still substantial (Figure 2). Once again, multiple

regression (Table 4) shows the stroke variable has the greatest impact on times. Tables 5 and 6 relating to the t-tests of times and strokes show that the differences between times in pool are still considerable despite a reduction in times and gaps.

CONCLUSION

The study show that it was not possible to eliminate the performance gap between the two types of athletes in 8 weeks of training, although the performance was improved in all the subjects involved. Disabled athletes reported that they were more motivated to train and compare with their not-disabled colleagues, so much so that the improvements they achieved were better than the results of not-disabled colleagues. Therefore, a common performance and training activity for disabled and not-disabled people can bring improvements not only from the performance point of view, but also from the psychosocial point of view (Cascone et al., 2020). Although in recent years the competitions in which disabled and not-disabled athletes compete together are increasing, the difference in times is still too evident an element. For greater gratification and a greater inclusive perspective (D'Elia et al., 2020) we could go and look for "*strategies*" such as, for example, the use of small "*counterweights*" for not-disabled athletes in order to equalize the times in the pool. In this way disabled athletes can feel more gratified thanks to greater inclusion.

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