

Effectiveness of Aerobic Training Program on Cardiorespiratory Endurance among Individuals with Down Syndrome

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Abstract— Aim: The aim of the study was to evaluate the effectiveness of aerobic training program on cardiorespiratory endurance on individuals with Down Syndrome. Procedure: All participants who fulfilled inclusion criteria were selected from Association for Children with Emotional and Learning Problems (ACELP), Karachi. Participants received aerobic training program consisted of exercises. Cardiorespiratory endurance of each participant was measured before and after training by using 6 minute walk test. Results: Data was stored and analyzed using SPSS version 16.0, mean and standard deviation of the samples were estimated at pre and post stage of study. The results showed significance difference in weight reduction and distance covered before and after training program ($P < 0.05$). Conclusion: The results concluded that 8 weeks of aerobic training program is effective to improve cardiorespiratory endurance of Down Syndrome Individuals.

Keywords— Down Syndrome, aerobic exercises, cardiorespiratory endurance, six minute walk test, aerobic endurance, disability, physical activity.

INTRODUCTION

Physical activity and participation in sports not only promotes physical health but also reduces the risk for cardiovascular diseases if encountered on regular basis[1]. Individuals with disabilities like Down syndrome have low levels of Physical activity[2]. Down syndrome is a condition in which a person has an extra chromosome, chromosome 21, (Trisomy 21), due to non disjunction of the chromosomes and contributes as the single most common cause of severe mental retardation[3], characterized by low muscle tone, small stature, an upward slant to the almond shaped eyes, tongue that remains out of the mouth mostly and a single deep crease across the center of the palm[4]. Later child bearing is a probable cause for DS. In comparison with younger woman, woman over 35 years of age is 5 times more prone to have children with DS[2].

Globally, as of 2010, Down Syndrome occurs in about 1 per 1000 births[5]. In Karachi, Pakistan the prevalence rate among women was evaluated and it showed that 80 out of 1000 women fall in this category[3].

Cardiorespiratory endurance is a component of physical fitness that relates to health[5] and defined as the ability of respiratory and circulatory systems that during a sustained physical activity supplies fuel and eliminates fatigue products[6]. A number of health problems like obesity, hypertension, dyslipidemia, insulin resistance and metabolic syndrome are associated with low levels of cardiorespiratory fitness in children with impaired development[7].

A number of researches revealed that individuals with DS has low levels of VO_2 peak values that affects their daily life and in turn has an impact on their health[8]. Marwa M. Ibrahim et al

reported in their study that Down Syndrome individuals has low energy levels this is due to the fact that these individuals has decreased lung volumes and deficient removal of carbon dioxide from the lungs because of having small upper airway, reduced surface area, decreased number of alveoli and generalized weakness particularly of the abdominal muscles. For sufficient amount of oxygen consumption by the organ, the cardiovascular and respiratory systems depends on each other[8].

The American College of Sports Medicine (ACSM) defines aerobic exercise a "any activity that uses large muscle groups, can be maintained continuously, and is rhythmic in nature (American College of Sports Medicine, 1998)[9] and recommends aerobic training 3-5 times per week at an intensity between 60-90% of maximal heart rate (HR max) or 50-85% of VO_2 max to develop and maintain cardiorespiratory fitness in healthy adults[10].

Multiple studies has been done to evaluate the effects of aerobic exercise programs on the cardiorespiratory endurance of physically and mentally challenged individuals. Astrid C.J. Bulemans et al emphasized the involvement of disable children in suitable physical activity program to gain health benefits[11]. Studies conducted to determine the effects of combined aerobic and resistance training on individuals with DS and without disabilities concluded that combined training could improve submaximal and peak exercise capacity in individuals with DS as well as in individuals without disability[12].

Six minute walk test (6MWT) is a practical simple test done in a 100-ft Hall way but it doesn't require any exercise equipment or advanced training. It measure the distance covered during

Parameters	Pre (n=10)		Post (n=10)		P-value
	Mean	SD	Mean	SD	
Time at Baseline	9.79	0.69	9.85	0.68	<0.01*
Time at end of test	9.80	0.70	9.86	0.71	<0.01*
Heart Rate at Baseline	72.0	9.69	85.80	9.63	<0.01*
Heart Rate at end of test	71.49	11.64	84.80	9.65	<0.01*
Blood Pressure at Baseline	105.36	10.52	119.73	9.81	<0.01*
Blood Pressure at end of test	107.78	9.51	115.83	5.28	<0.01*
Number of laps	6.10	1.10	7.40	1.07	<0.01*
Final Partial Lap	67.50	32.59	85.50	35.46	0.02*
Total distance walked	386.80	64.48	470.30	54.49	<0.01*
Weight (Kg)	64.10	19.05	60.60	19.54	<0.01*

*P<0.05 considered significant using Sample t-test

a period of 6 minutes that is labelled as 6 Minute Walk Distance (6MWD). The patient walks quickly on a hard, flat surface. It estimates the responses of the systems that are involved during exercise like pulmonary and cardiovascular systems, muscle, metabolism, systemic circulation, blood, neuromuscular units and peripheral circulation. During test they are allowed to stop and rest and they choose their intensity of exercise[13]. Casey AF et al. reported in their study that for Down Syndrome individuals 6WMT showed good test-retest reliability[14].

METHODOLOGY

It was an experimental study and Sample size was calculated from Institute of Child Development, Association for Children with Emotional and Learning Problems (ACELP), Karachi in which total population of Down Syndrome individual was 28 and Cerebral Palsy was 22. Two strata were made according to the inclusion criteria and were randomly sampled. Thus the calculated sample size for each strata was 10. All participants who fulfilled Inclusion Criteria were selected from Institute of Child Development, Association for Children with Emotional and Learning Problems (ACELP), Karachi. Informed consent was taken from parents of each participant. The training program consisted of aerobic exercise, slow walking, cycling (on a stationary cycle) and slow aerobic dance with a frequency of 3 alternate days in a week at light intensity or 20-39% of HRR for 45-60 minutes/day for 8 weeks. Each day the training started with warm up and ended with cool down. Cardiorespiratory endurance of each participant was measured before the start of training program and after the completion of 8 weeks of training program by using 6 minute walk test. Data was analyzed on SPSS Quantitative data t test was used.

RESULTS

Six Minute Walk Test was used to evaluate the pre and post effects using t-test. P-value less than 0.05 was considered sig-

nificant. Table and Bar Chart were used to display the significant difference of parameters of 6MWT.

TABLE 1
Parameter of six minute walk test for Down Syndrome

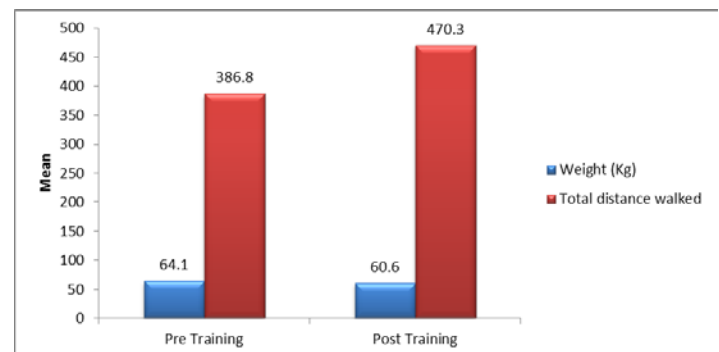


Fig. 1. Pre and post comparison for weight and distance for down syndrome group

DISCUSSION

According to a French geneticist, Dr. Jerome Lejeune, Down Syndrome is an aneuploidy condition that is caused by an extra 21st chromosome (Trisomy 21)[2]. Diana Hernandez & Elizabeth M.C. Fisher revealed in their study that anatomically nervous system of Down Syndrome individual is characterized by small cerebral and cerebellar hemispheres and brain stem[15]. Glenn E. Palomi et al stated in their study that maternal age in combination with sonographic measurement of Nuchal Translucency in the first trimester & measurements obtained by markers of maternal serum screening in first and second trimester identifies upto 90% of all cases of DS with 2% of a false positive rate[16]. Mette. M. Skjoth et al reported in their study that when there is a consideration of a fetus to be at high risk for DS, the amniocentesis or chronic villous sampling are suggested for the pregnant woman[17]. U.S, Israel and many European countries recommends maternal serum analysis markers screening for the risk of DS to every pregnant woman[18]. A number of researches revealed that individuals with DS has low levels of VO₂ peak values that affects their daily life and in turn has an impact on their health[8]. Marwa M. Ibrahim et al reported in their study that Down Syndrome individuals has low energy levels due to decreased lung volumes and deficient removal of carbon dioxide from the lungs[8]. Cardiorespiratory endurance serves to be the fundamental element of physical fitness that is associated with health and mortality[19]. The type of aerobic exercise that helps to build the cardiorespiratory endurance are walking, running, jogging, cycling, slow and fast dancing, skipping rope, elliptical exercise, stepping exercise, aqua aerobics, basket ball, volley ball etc[20]. Multiple studies has been done to evaluate the effects of aerobic exercise programs on the cardiorespiratory endurance of physically and mentally challenged individuals and it was proven that a well planned

aerobic exercise training program can improve the cardiorespiratory fitness of Down Syndrome children[8]. A phase II randomized control trial done by Nora Shields and Nicholas F. Taylor reported evidence that a walking program contributes as an advantageous and secured program for youth of DS having mild to moderate intellectual disability[21]. Karen J. Dodd and Nora Shields provided evidence in support of cardiovascular exercise programs in their systematic review that the cardiovascular type of exercises increases the peak oxygen consumption, peak minute ventilation, maximum work load and time to exhaustion in individuals with DS[22]. Astrid C.J. Bulemans et al emphasized the involvement of disable children in suitable physical activity program to gain health benefits[11]. Studies concluded that combined training (aerobic and resistance) could improve submaximal and peak exercise capacity in individuals with DS as well as in individuals without disability[12]. Six minute walk test (6MWT) a predictor of cardiorespiratory fitness not only in healthy individuals but also in individuals with severe disability[23].

CONCLUSION

The study indicated that individuals with Down Syndrome showed significant results in improving the cardiorespiratory endurance. Requires further researches on ground with other techniques on large sample size.

ACKNOWLEDGMENT

First and foremost I would like to thank Almighty Allah, on whom we ultimately depend for sustenance and guidance. My Heartiest tribute to the Holy Man in the hole galaxies, Hazrat Muhammad (Peace Be Upon Him) too, who is reformer of humankind. I am extremely grateful to my parents Mr. Kafeel Khan and Mrs. Razia Kafeel Khan, and my siblings whose valuable support gave me courage and confidence throughout the study. I would also like to thank Mr. Noman Ahmed Issani for his constant motivation and guidance during the study.

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