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THE EFFECT OF 8 WEEKS AEROBIC TRAINING ON PERFORMANCE OF WECHSLER ACID PROFILE AMONG CHILDREN (ARITHMETIC, CODING, INFORMATION, DIGIT SPAN) IN STUDENTS WITH LEARNING DISABILITY

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ABSTRACT

The aim of this study is to investigate the effect of 8 weeks aerobic training on performance of subtests in Wechsler ACID profile for students with learning disability. In this study, an experimental pretest - posttest approach with control group and random assignment was used. For this purpose, the population from which the participants were chosen included all girl students of 8 years old with learning disability in Sarayan city in academic year of 1393-1392 among whom a sample of 30 patients were randomly selected. Wechsler test for Children was used to measure ACID profile in pretest. Aerobic exercises were applied as group training to experimental group. After training period, the posttest was conducted. The results of covariance analysis showed that 8 weeks of aerobic training significantly increased the performance of Wechsler ACID profile among children in information ($p<0.03$), arithmetic($p<0.02$) and digit span($p<0.04$) subtests and in coding subtest it is ineffective. Therefore, due to the effectiveness of rhythmic movements and according to the capacity and efficiency of the components of Wechsler ACID profile in students with learning disability, it is recommended that children's training and educational centers devoted a part of their programs to rhythmic movements. And instructors in centers of learning and behavior disabilities can use rhythmic movements as a new approach in treatment of specific learning disabilities in their cure schedule.

Key words: Aerobic Training, Learning Disability, Wechsler ACID Profile among Children.

INTRODUCTION

Until a few years ago, people who had learning disability were seen among people with mental retardation. But the researchers found that some children have average or even above average IQ, while in learning some of the training courses, despite their considerable attempts, are unable. Researchers named them children with learning disabilities. The word learning disability was first used by “Samuel Kirk” in 1963. "Samuel Kirk" proposed this term as an appropriate solution to destroy various labels which were used to describe children with ordinary intelligence but learning problems (Jahangiri, 2007). He used this term for children who had a little progress in reading, writing and mathematics and used learning disability in the field of special education (Jalili Abkenar, 2013). The increase of people with learning disabilities, due to the growth and development of definitions and tools to identify learning disabilities, has attracted the attention of several research areas. Currently, the prevalence of learning disability is estimated between 1 to 30 percent of the school population and is one of the most common known disabilities (Karand et al., 2011).

In many studies, the use of Wechsler ACID profile among children has been proposed to identify learning disability (Groth-Marnat, 1997). Many psychologists have believed that there is a particular interpretation of the patterns or Wechsler subtests profile. Despite the widespread popularity of subtests or Wechsler scores profile analyses, more supports of these activities are based on clinical or personal descriptions. They compared the percent of children with ACID profile, in Wechsler scale for children with learning disability and attention deficit hyperactivity samples with the percentage of normal samples. The results showed that the prevalence of ACID profile in clinical samples to approximately 5% of children with learning disabilities, 12% of children with attention deficit hyperactivity disorder showed this profile, although acid profile occurred only in one percent of the normal samples (Prifitera and Dersh, 1993). Researchers studied on the prevalence of children’s ACID Wechsler profile among 382 students with learning disability and reported the prevalence of 7.4 percent (Ward et al., 1995). The researchers suggested that when it is possible to obtain preliminary data on early identification of learning disability, the use of ACID profile in diagnosing children's learning disability is more practical. As a result, paying attention to the performance of students in children’s Wechsler subtests can have useful applications to diagnose, effective teaching and learning for children with specific learning disability and knowing this set of factors in various service systems for assessment, clinical education, training methods and finally treatment of children with specific learning disability, have had increasing effects (Delle & Naglle, 1996). Children with learning disability have problem in neuropsychological aspects, executive functions and attention, language, processing visual-spatial and memory and learning; and disability in neuropsychological skills can predict children's learning disabilities (Abedi et al., 2008). Since the special learning disabilities have neurological nature and all learning functions form in the brain and nervous system, we can say that a defect in the central nervous system function is one of the most common causes of learning disabilities (Ghanaei Chaman Abad, 2010). By keeping the brain active, cognitive performance improves. One of the most important methods that keep the brain active is exercise and sport activities (Erickson et al., 2009). Because the cerebellum is in connection with the base and root of brain, it has not only motor and transport functions, but also intellectual and emotional functions. When children do sport activities, its profit is transferred to the learning of other skills. This happens automatically and needs no consciousness (Behmard et al., 2012).

Over the years, various teaching methods have been emerged for children and students with learning disability. One of these methods is perceptual-motor method. Proponents of this method (Kephart, Getman & Barsch) believed that motor learning is the origin of learning and great mental learning processes occur after the proper development of motor system and cognitive system as well as communication links between motor and cognitive learning. Newell Kephart is one of the most famous pioneers in perceptual-motor method and believes that motor learning is effective in intelligence and education. Kephart in his book which is named 'The Slow Learners in the Classroom' writes: "It is logical to assume that all behavior is basically ambulatory and a prerequisite for any kind of movement is muscles and motor responses". In other words he believes that behavior origins from muscles' activities and more complex behavior depend to more simple behavior. He believes that children need many links between cognitive and motor information. He says many children in the early years of education do not complete this process effectively; therefore, they can not communicate as necessary with lesson plans and class. Kephart believes that perception should associate with motion, not motion with perception (Saif Naraghi & Naderi, 2003). In more than 30 years ago, the results of independent studies and also research conducted by the Institute of PsychologyBody Nerve in 1975 in Chester has shown that there is a direct relationship among the reflections of children without mental maturity and lack of academic improvement and increased anxiety in adult life and a treatment plan that directly aims to stimulate and integrate the initial and postural reflexes (standing, walking and sitting form) can cause a positive change in mentioned domains (Sally Goddard et al., 2009). Johnston (2009) believes based on the mental flexibility model, nervous flexible system provides an opportunity for central nervous system to learn skills and remember information and recognize the neural network in order to respond to environmental stimuli. Flexibility strengthens the brain changes and usually causes adaption. These changes are associated with the physical changes with dendritic and neuronal circuits' actions and physical activities especially rhythmic activities have a significant role in this process (Ghanaei and Kareshki, 2011). With the introduction of activities, games and sports as a key to life, a new horizon and a fresh perspective on education have been introduced (Bakhshipour et al., 2013). Use of slow and rhythmic sequence and sometimes fast and large is useful to improve the spatial image, self-control skills, body image and relaxation, perceptual-motor skills, balance, timing and impulsive behavior control inchildren (Houshvar, 2008).

Rhythm, especially in the form of music is important as a part of people and different cultures training. The combination of these sport movements with music and lyrics and rhythmic songs make them more effective in working with children. Music impacts significantly on the plasticity and cortical activity and because in children with learning disabilities there are various sensory ways that a part of it is due to the neurological limitations, use of music and rhythm in a game and rhythmic exercise at the same time increases nerve branches. In other words, long-term sensory stimulation increases brain synapses and finally lead to high levels of perception (Dehghani et al., 2012). Communal rhythmic movements via interaction with training fellowships and relationship with therapist cause the subject to make new discovery about his body (Corsini, 2001).Rhythmic exercise or movements are one of the favorite practices of children and especially teenagers. These movements and activities have a coordinated natureand their correct performance needs to do various movements with regular motion such as balance, coordination and understanding of the explicit relationships. In these forms of exercises, often spatial cognitive, time and direction perception ability of all or part of the body is actively involved. Since these movements are often accompanied with lively music and performed as group training, people are motivated to participate in it. Children and adolescents, too due to these characteristics are interested to do this type of body movements (Ghasemi Kahrisangi et al., 2012). Chyhu and Chun (2003) stated that systematic and regular rhythmic movements are effective on memory processing. Kulyr and Lugan (2000) also believe that short-term memory performance by the use of alternate auditory rhythmic stimuli is better than when visual stimuli are used. It is stated that music through mental imagery causes memory enhancement (Karimi & Zare, 2013).

According to the recent opinion and main problems of children with learning disability and according to the fact that some researchers have studied rhythmic exercises and activities in terms of their impact on various aspects of social life and some others have studied them in terms of their impact on emotional development, the impact of rhythmic motor activities on cognitive aspect (children’s cognitive profiles performance) particularly in children with learning disabilities is the other aspect of assessment which has been less in attention. So this study aimed to investigate the effect of 8 weeks aerobic training on performance of children's Wechsler ACID profile in students with learning disability in elementary school.

MATERIALS AND METHODS

In this study, according to the nature, purpose and extent of executive selected facilities the experimental pretest-posttest with control group and random sampling was used and its plan is in the table below.

Table 1: Pretest-posttest with control group

	n=15		n=15
Group	**Pretest**	**Independent Variable**	**Posttest**
Test	**T1**	**X**	**T2**
Control	**T1**	**_**	**T2**

2-1. Sample

The sample consisted of 30 eight years students of elementary school that were selected among children who in Wechsler Intelligence Scale of Children-Revised (Wisc-R) had significant weakness in ACID factor (arithmetic, coding, information, digit span). Thus, among the 45 students in second year of elementary school who had learning disabilities, by providing a list of the ACID total grades which obtained from the sum of fourACID reagent subtests, 30 students were selected from low scores. Then by random sampling they were divided into two control and test groups each one with 15 people.After objectives and performance and also confidentiality of information were explained to parents, students and parents were willing to cooperate with consent and voluntary. The test group was invited to participate in the process of aerobic exercise training before the original exercise protocol, and the control group family committed that their children do not participate in any exercise class at 8 weeks of the study, but school sport classes.

2-2. Main research tools

Wechsler Intelligence Scale of Children-Revised (Wisc-R)

Wechsler Intelligence Scale of Children (Wisc) was produced in 1949 by Wechsler to evaluate children's intelligence. One of the features of this scale is that unlike similar individual scales it is not adjusted for age levels,but it is like subtests in which questions are ordered by difficulty. Each subtest measures a different ability and in total it calculates the general intelligence. Wisc scale is the descending form of Wechsler Adult Intelligence Scale (Wais) that many of its questions are selected from Wais scale and simpler new questions are added to it (Gary-Gras, 2007).

Wisc scale was revised in 1974, 25 years after its development and after that was named Wechsler Intelligence Scale of Children-Revised (Wisc-R). This scale has six verbal subtests (information processing, similarities, arithmetic, vocabulary, understanding and digit span) and six non-verbal or practical subtests (picture completion, picture arrangement, cube design, symbol search and mazes). Mazes and digit span have storage aspect. Therefore, by the use of WISC-R three types of verbal, practical and generalIQ are achieved. WISC-R test is one of the most accepted and most frequently used intelligence tests to evaluate children. The validity of this test is reported 0.97 for general IQ, 0.97 for verbal IQ and 0.93 for practical IQ by the use of two halves (Segal et al., 2004).

2-3. Procedure

To start the research, it was coordinated by a professional aerobics instructor for aerobics exercise program. Before starting work, special letter of satisfaction for participation in the 8 weeks, per week 3 sessions aerobic training program, was completed by parents of children. Each session includes a 10 minute warm-up such as slow movements and stretching, 30 minutes of aerobic exercises involve impact movements and eventually 5 minutes cool down activities. The exercise program used in this study followed Gallahue and Ozmun recommendations about physical education programs and four levels of classified growth rhythmic movements (Bradinova et al., 2005). It was tried as far as possible, to use movements in which the two main elements of children's actions that means stability and mobility exist. In the early sessions the exercise was taught from simple to difficult and in the next sessions a chain of motion was used by their combination. Exercises were performed as group training. To do that the motion was done by the instructor and children at the same time coordinated their movements with the instructor and other participants in group. A list of the gestures used in the research is: step in place, Step 7, Step 8, knee, leg movements, hamstring, L. movement and biceps. Practice sessions' music was selected by the instructor with the rhythm that its aim is to use 60 to 65 percent of heart rate reserve in subjects. Subjects' heartbeatwas controlled with electronic stethoscope during the practice and the amounts of subjects' stored heart beat were calculated by the Karvonen formula. Heart rate was measured at 8 Am, after 15 minutes of rest and in a sitting position (Dashti Khovidaki, 2010).

At the end of the practice period the evaluation process of the posttest was done for both groups and the results of pretest and posttest were controlled andstatistical analysis was performed. In the statistical analysis, in order to compare two groups, first all of quantitative variables were tested for normality by the Kolmogorov-Smirnov test and their normality was proved. Then, in order to compare two groups MANOVA statistical model was used. The significance level of test analysis and all analyses were $P \leq 0.05$, and all analyses were performed by the use of SPSS software version 18.

FINDINGS

The average age of participants was 7.6 ± 1.3 years and mean and standard deviation of subjects' demographic characteristics are specified in Table 2.

According to Table 3, the mean of posttest ACID reagent in the experimental group compared to the control group increased and the greatest increase has been in general information subtest. To evaluate the efficacy of 8 weeks of aerobic training on performance of children Wechsler acid subtests, posttest scores of control and experimental groups were compared by the use of covariance analysis.

According to Tables 3 and 4 in general information subtest the experimental group posttest mean (10.80) is significantly more than the control group posttest mean (8.60) (p=0.03). This difference is in favor of the experimental group. Furthermore, in arithmetic subtest the experimental group posttest mean (8.73) is significantly more than the control group posttest mean (7.53) (p=0.02). In digit span subtest the experimental group posttest mean (11.20) is also more than the control group posttest mean (10.20). This difference is in favor of the experimental group and its significance level is p=0.04. These results indicate that performing aerobic exercise increases the performance of students in these three subtests. According to the results in coding subtest there is not a significant difference between experimental and control groups.

Table 2: Mean and standard deviation of female students' height, weight and body mass index with learning disability

Body Mass Index (Kilogram per Squar Meter)		Height (Meter)		Weight (Kilograms)		Number	Age (year)
Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean		
2.2	15.5	8.8	123.5	5.6	23.8	30	8

Table 3: Mean and standard deviation in pretest and posttest in subtests of ACID reagent profile in both experimental and control groups

Aerobic		Control		Groups
posttest	pretest	posttest	pretest	
M±SD	M±SD	M±SD	M±SD	Statistics
10.80±3.27	9.73±3.47	8.60±3.13	9.07±3.17	General Information
7.87±3.02	7.40±3.29	9.40±2.66	8.73±1.87	Coding
8.73±3.53	8.13±3.37	7.53±3.83	7.73±4.06	Arithmetic
11.20±2.36	10.73±2.40	10.20±2.07	10.33±2.16	Digit Span

Table4. Covariance analysis to compare the experimental and control groups in the subtests of Wechsler ACID

Size of Effect	Significance Level	F	Mean Squares	Total Squares	Components
0.15	0.03 •	5.21	17.63	17.63	General Information
0.17	0.02 •	6.10	4.80	4.80	Arithmetic
0.13	0.04 •	4.32	2.70	2.70	Digit Span
0.03	0.35 •	0.89	2.70	2.70	Coding

DISCUSSION

The results of this study showed that aerobic exercise increases the performance of the three information, arithmetic and digit span subtests of four subtests of Children Wechsler ACID profile in students with learning disability. Students with learning disability who did aerobic exercise for 8 weeks in comparison to students who did not do aerobic exercise had a significantly better performance in three of the four subtests of Children Wechsler ACID profile.

Wechsler test is one of the most sensitive tests to brain damage, mental retardation and learning disabilities that the significant increase in test scores in the experimental group can attest to changes in the level of learning disability in research group (Gary Gras, 2007). Flexibility of brain has many applications and implications to increase neural activities and intelligence based on physical activities.One of the important issues in this field is to examine the role of physical activities and especially rhythmic movements in cognitive, emotional or behavioral functions. The findings of Bakhshipour, Ahmadi and Nazer (2013), Abedi and Dehghani (2012) and Ghasemi Kahrisangi (2011), also showed that aerobic rhythmic exercise improves the performance of subjects in the scales of attention problems, memory and learning problems and sensorimotor performance and reduces these problems. These exercises also increase problem solving skills, program planning and emotional and behavioral organizing skills in children with learning disability. In explaining the results can say that aerobic movements learning is based on the fact that they can improve the ability of paying attention in children with learning disability by providingsystematic and concerted opportunities which are accompanied by music and a certain rhythm. In performing aerobic program movements visual and auditory attention and active memory are required. During the implementation of a systematic program these skills strengthen in children. So, it can be effective on main factors causing the disorder or rather on the clinical characteristics of children including obtained ACID profile from Children Wechsler scores analysis (Abedi et al., 2012).

Ghanaie Chaman Abad (2007) investigated the effect of rhythmic movements learning on digit span function of children with specific learning disabilities. His results showed that there is a positive relationship between rhythmic movements learning and digit span of students with specific learning disabilities. That means students with learning disabilities who are affected by these variables, have a higher levels of digit span. These findings are consistent with the view that recent theories of sensori motor related to learning and progress determine critical move in cognitive development. In addition, movement plays a fundamental role in human cognitive activities and it seems that we basically think with our body movements. As mentioned by the centers for disease control and prevention, physical activity have effects on brain physiology by increasing brain capillaries, blood flow, oxygen, production and development of nerve cells in the hippocampus (the center of learning and cognitive functions), the levels of neurotransmitters, the development of neural connections, neural network density and brain tissue volume. Thesechanges can improve cognitive functions such as attention, information processing, storage and retrieval information, increasedpositive feeling and decreased pain sensitivity (Christopher, 2013). In a research Gobble-Hall concluded that aerobic exercises (rhythmic and aerobic exercises that increase the need of body to oxygen) have a positive effect on the behavioral situation and cognitive function of people with learning disabilities and abilities coupled with them (Gobble-Hall et al., 1993). Researchers found that a molecule called Irezin which is produced in body during endurance exercisescan have neuroprotective property. Researchers could artificially activate genes involved in learning and memory by increasing the amount of Irezin in the blood of mice. Irezin increase in blood can increase the activity of genes involved in learning and cognitive functions (Vran & White, 2013).Rhythmic movements not only provide an effective tool for education and training the basic motor skills, but also can affect cognitive, attention and muscle processesand growth ofpersonal relations and social skills (Carmeli et al., 2008).

Evidences show that people with learning disabilities in four subtests of Wechsler, that means math, coding, general information and digit span have a low performance which is named ACID profile.Some studies report that people's cognitive action arises after participating in physical exercise. Stamford (1974) in his studies concluded that physical exercises cause a significant increase in general information subtest and Wechsler Adult Intelligence Scale-Revised. Stamford believed that increase in general information subtest will show increase in cognitive changes. Kazemi (2010) investigated the effect of executive functions on Wechsler ACID profile performance among children with learning disabilities and concluded that executive functions training causes an increase in Wechsler ACID profile performance among children in information, coding and arithmetic subtests. In general information scale subject's knowledge domain, public information and long-term memory are measured. In implementation of arithmetic subtest, factors such as memory, attention and concentration, math and reasoning ability are measured (Wechsler, 1974).

These findings may explain the rhythmic games are effective on cognitive subtests (attention, memory, sensorimotor function, problem solving-planning, behavioral-emotional organizing) and thus executive functions are important to the learning process. These abilities help a child to evaluate his performance, remove potential obstacles and assess his progress. Therefore, by environmental enrichment and preparation for group play especially games with rhythm and music movement, growth and development of executive functions will be achieved. Because sensori motor functions are important mediating functions, they make sophisticated and targeted systems which are considered to be the basis of recognition and improvement of sensori motor skills in a child is effective in all-round development of child and likely growth and strengthening of sensori motor systems in children in early childhood is the foundation of cognitive skills growth, particularly cognitive system. So in addition to strengthening the sensory-motor skills, rhythmic movement games can affect other cognitive and metacognitive processes.

Other possible explanations for this effect are that the musical and movement aspect of rhythmic movement games would build and strengthen connections between neurons in the cortex in a process similar to the process of evolution in the brain. In other words, movements along with music made neurotransmitter cycles among neurons which stimulate the higher parts of the nervous system that are related to memory and cognition. Moreover, in rhythmic movement games child is obliged to respect preset patterns in the game and in the case of repetition and practice, memory will improve especially active memory. Repeated orders in a rhythmic motion enable children to predict components of other movements. Rhythm keeping in a rhythmic movement game in children with mental disability boosts memory and reduces the problems with performance scales. Several mechanisms have been proposed to explain the relationship between movement therapy and cognitive function:

A. Movement therapy directly affects the structure and function of brain. Movement therapy increased aerobic capacity to strengthen the cerebral blood flow, improve the utilization of oxygen and glucose in brain, accelerate the transfer of biochemistry and increase the blood antioxidant enzyme glutathione peroxidase (GSH-PX) for the rapid elimination of free radicals.
B. Movement therapy can expand the synthesis of nerve growth factors such as brain-derived neurotrophic factor, insulin-like growth factor, increase of communication between nerve synapses and even increase of processing capacity of nerves.

C. Movement therapy stimulates the release of calcium and increases the secretion of dopamine and acetylcholine by adjusting the levels of neurotransmitters. These factors are highly effective for maintaining neural functions, fostering positive spirit and increase of cognitive function (Radak et al., 2001). Children with learning disabilities benefit of movement therapy in several levels. Tactile and movement stimulation achieved through these movements will get stronger sense of body image and sensory integration of the other modules. Movement activities are enjoyable and involve the entire child's body and help him to maintain his focus (Ghanaie & Karashki, 2011).

CONCLUSION

According to the obtained results in this study, it seems that an 8-week aerobic training improves Wechsler ACID profile of children with learning disability. Since childis required to follow the preset patterns in the rhythmic movement games, by exercise and repetition improvement of memory, especially active memory provided. Repetition in rhythmic movements enables children to predict what will happen and in other words, with the help of their memory, children predict the next components of one movement. Keeping rhythm in rhythmic movement games in children with learning disability boosts memory and reduces the problems with performance scales. Therefore, due to the effectiveness of rhythmic movements and according to the capacity and efficiency of the components of Wechsler ACID profile in students with learning disability, it is recommended that children's training centers allocate a part of their program to rhythmic movements. Instructors in centers of learning and behavioral disability can consider rhythmic movement programs as a new approach in the treatment of special learning disabilities in their treatment plans. Aerobic exercise does not require much space and resources. On the other hand, aerobic exercise is low-cost, low-risk and non-invasive and is far from quick movements. So it is recommended that experts use these exercises as a complementary and non-drug treatment along with drug treatments to help children with learning disability. Furthermore, it is suggested to parents of children with learning disability to use these kinds of sports in the early intervention program for children at home and additional classes.

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