

Impacts of Aerobic Exercises on Cognition Developments of Students with Intellectual Disabilities

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Abstract:- The main purpose of this study is to investigate the effect of aerobic Training on cognitive performance improvement in elementary students with intellectual disabilities (ID). The population in this study consisted 72 students with ID and 36 cases were selected by simple random sampling, and they divided randomly in two equal control and experimental groups. The training program consisted of 16 weeks moderate-intensity aerobic exercises with an intensity of 55-75 HR. These exercises were performed three sessions a week and each session take 45-minutes, 15 minutes warming up, 30 minutes main and 5 minutes cool down exercise. After 16 weeks of intervention, a significant change was observed in vocabulary and comparative reasoning at ($p < 0.05$). 16 weeks of aerobic training had shown a significant improvement in vocabulary knowledge and comparative reasoning cognitive performance in children with intellectual disabilities in the experimental group than control group at ($P < 0.05$). In general it can be concluded that Aerobic exercise training can be used as an effective method to improve the cognitive performance in children with intellectual disabilities.

Keywords:- Aerobic Exercise, Cognition Developments, Intellectual Disabilities.

I. INTRODUCTION

Intellectual disability (ID) is a disability characterized by significant limitations in cognitive functioning, adaptive behavior, and conceptual, social, and practical skills. In addition, when compared with their typically developed peers, persons with intellectual disabilities are more likely to be obese, less likely to be physically active, and are twice as likely to develop a chronic disease [1]. Although, they are more limited than their normal peers in how well and how quickly they can learn and they scored the least result and repeat each class levels [2]. The percentages of ID who completed primary education are significantly lower than persons with non-disabilities [3] and often have cognitive problems associated with carrying out exercise[4]. The worldwide and Ethiopian prevalence of intellectual disabilities is 1.3% [5]. ID is associated with lower levels of thyroid hormones. In relation to these, thyroid hormone deficiency during fetal and postnatal development may cause

retarded brain maturation, intellectual deficits and in some cases neurological impairments [6].

Previous studied reported that, an aerobic exercise increases cognition developments [7, 8, 9 &10]. Aerobic physical exercise can improves cognitive performance for an at-risk group without any cost and adverse impacts associated with most pharmaceutical therapies for some adults with intellectual disabilities [11]. Similarly, research findings clearly indicated that an eight weeks aerobic running has shown improvements in 13-14 years children cognition [12]. For example, play therapy as an aerobic exercise significantly increased visual perception, visual memory and attention & concentration of testes. Play therapy in addition to excitement and entertainment for children can enhance the mental efficacy in visual perception, visual memory and attention & concentration of educable students with intellectual disabilities [13]. Moreover, rhythmic aerobic exercise movements would improve the cognition performances such as attention and memory functioning as well as general learning in educable children with intellectual disability at age range of 9-16 years [14].Therefore; we designed the present study to investigate the effects of 16 weeks aerobic exercises on cognition change response differences of children with intellectual disabilities. This was done by using a pre and post-test research design and using vocabulary knowledge and comparative reasoning as outcome markers. Based on the finding of the study, the life style and participation of the students with intellectual disability in social and economical activities might be enhanced to support their family and their country at large. The study may also serve as a spring board to those who are interested to conduct further similar researches in the area especially by including diet as one of the variables among others.

II. MATERIALS AND METHODS

Pre- test and post-test research design on the effects of 16 weeks of aerobic exercise on vocabulary knowledge and comparative reasoning cognition sub-components of individuals with intellectual disabilities in Dessie was employed. The study has two groups. These are the experimental and control groups. The subjects of this research were free from epilepsy and autism disorders. The whole number of the population was 72 and in the current study 36 of them were randomly selected and placed in to

experimental and control groups. Then all participants were randomly divided into two 18 participants for each control and experimental groups. After explanation of the purposes of the study and the privacy of information for the participants and their guardians, they were completely satisfied to cooperate in the participation of the study. When inviting the experimental group to participate in the process of orientation about how to conduct an aerobic exercise before the beginning of the main exercise protocol, the guardians of the control group's committed that these children do not participate in any exercise class except the school's exercise classes in the 16-weeks process of this study.

Both groups were evaluated in terms of cognitive Function by Wechsler Intelligence Scale of Children-Revised (WISC-R) which has sub –scales such as vocabulary to measure vocabulary knowledge and similarity to measure comparative reasoning measures before and after the exercise intervention. The validity of this test has been reported 0.97

The training program consisted of 16 weeks moderate-intensity aerobic, exercises and conducted after receiving the

parental consent. These exercises were performed three sessions a week and each session took 45 minutes. Each session consisted of 10 minutes of warm-up exercises, 30 minutes of main aerobic workout and five minutes cool-down exercises.

In this study paired t-test was used to compare the pre and post-test differences on the effects 16 weeks aerobic exercise on comparative reasoning and vocabulary knowledge change responses of those children with intellectual disabilities. The significance level was considered as $P \leq 0.05$.

Approval of ethical clearance of the protocol was obtained from health research and ethical review Committee of Mekelle University, registration NOERCO775/2016 and informed consent dispatched for all participants and participant guardians before testing and commencing the study. Concerning the ethical conditions of the research, the researcher made sure that no one was being affected by this research study. Only 6ml of blood was taken from the subjects during each pre and post test periods.

III. RESULTS

Variables	Aerobic group		Control group	
	M	SD	M	SD
Age (year)	14.44	1.199	14.389	1.145
Height (cm)	1.50	.042	1.49	.046
Mass	49	5.89	48.16	6.148

Table 1:- Demographic characteristics of aerobic and control groups individuals with intellectual disabilities
Where M = mean, SD = standard deviation

In this study, 36 students with intellectual disabilities were studied. Table 1 shows mean and standard deviation of age, height and mass of the students with ID. The age, height and mass of the students with ID treated with aerobic exercise are age (M = 14.44, SD = 1.199), height in meter (M = 1.50, SD = .042) and mass in kilogram (M = 49, SD = 5.89) and the control group age (M = 14.389, SD = 1.145); height in meter (M = 1.49 SD = .046) and mass in kilogram (M = 48.16 SD = 6.148).

variables	Groups	Tests	M±SD	t-value	p
Comparative reasoning	Aerobic	Pre-test	6.556±2.915	3.449	.003
		Post-test	7.5±3.03412		
	control	Pre-test	6.778±2.556	.399	.695
		Post-test	6.889±2.867		
Vocabulary knowledge	Aerobic	Pre-test	14.1111±3.46221	4.082	.001
		Post-test	15.667±3.926		
	control	Pre-test	14.3333±2.56676	-.566	.579
		Post-test	14.1667±3.03412		
Working memory	Aerobic	Pre-test	3.722±1.274	3.796	.001
		Post-test	5.333±2.02920		
	control	Pre-test	3.778±1.896	.566	.579
		Post-test	3.889± 1.745		
Short term memory	Aerobic	Pre-test	3.5±.98518	5.333	.0001
		Post-test	4.2222±1.21537		
	control	Pre-test	3.556±1.149	.697	.495
		Post-test	3.667±1.237		

Table 2:- The average and standard deviation of individual's comparative reasoning and vocabulary knowledge change responses results in the control and experimental groups using paired t-test

Where, M = mean and SD = standard deviation*. The mean difference is significant at ($p < 0.05$).

Results in Table 2 shows the mean and standard deviation scores in the experimental and control groups in comparative reasoning and vocabulary knowledge change responses in pre-test and post tests. Thus the results of the aerobic group in comparative reasoning ($t = 3.449$, $p = .003$); vocabulary knowledge ($t = 4.082$, $p = .001$); working memory ($t = 3.796$, $p = .001$) and short term memory ($t = 5.333$, $p = .0001$) and the control group in comparative reasoning ($t = .399$, $p = .695$); vocabulary knowledge ($t = -.566$, $p = .579$); working memory ($t = .566$, $p = .579$) and short term memory ($t = .697$, $p = .495$).

IV. DISCUSSION

The main objective of this study was to investigate the effects of aerobic exercise on cognition change responses of students with intellectual disabilities. Based on the findings aerobic exercise intervention alone had shown a significant change response in vocabulary knowledge and comparative reasoning were increased after the training when compared with before training.

The results of this study are consistent with the previous studies [8, 9, 10, 11, 12, 13, 14 & 15] that reported aerobic exercise has shown improvements in children cognition. Indeed, aerobic exercise has increased visual perception, visual memory and attention & concentration [13], attention and memory functioning [14], vocabulary knowledge and comparative reasoning [8] & working memory [15].

All these improvements in the components of cognition using aerobic exercise are because of individuals with ID have poor cardio respiratory endurance [16] deficiency in thyroid hormones [17], have Lower rates of brain metabolism

and blood flow [18]. All these poor physiological qualities of individuals with ID are improved by aerobic physical exercise [19], beneficial for improving aerobic capacity in people with mild and moderate stroke [20], increase the cardio respiratory system to deliver oxygen to the working muscles rather than the ability of the muscles to consume the oxygen is limiting [21]. Indeed; aerobic exercise increases brain's gray matter volume [22].

In this study a significant improvement in vocabulary knowledge and comparative reasoning in response of aerobic exercise might be the specific characteristics of those children with ID and the methodological differences in the type, intensity and frequency of the training protocol. Thus, the researcher believed that four months of aerobic intervention program possibly are being too long for improving in vocabulary knowledge and comparative reasoning of in children with intellectual disabilities.

Aerobic exercise has on a number of physiological and psychological implications. It can improve the cardio respiratory endurance and new blood vessels, enabling to provide adequate amounts of nutrients & oxygen to each brain cells of ID. It can increase the surface areas of brain cell mitochondria, brain capillaries, growth of nerve cells, levels of neurotransmitters, neural network density which are the centers of cognition. All this confirms that aerobic exercise has a potential to improve the central nervous system and its task that is cognitions. Thus, aerobic physical exercise has a therapeutic and parents can use it as a treatment to improve the physiological causes of cognition impairment' and life style of their students with ID. Thus students with ID should be motivated to undertake regular aerobic exercise to enhance their participation in educational, social and economical activities. Although, the results of the

study were used as a spring board to those who are interested to conduct further similar research works in this study area especially by including diet as one of the variables among others. However, the limitation of this study was problems of working with students with ID such as lack of parental involvement and lack of timely presence of the subjects in the training session.

V. CONCLUSION

Aerobic exercise training can be used as an effective method to improve the cognitive performance in children with intellectual disabilities.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interests and that all material contained therein has been duly acknowledged.

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ETHICAL STANDARDS

The experiments comply with the current laws of health research and ethical review Committee of Mekelle University proved the study and informed consent dispatched for all participants and participant guardians before testing and commencing the study.

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