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Kefelegn Zenebe
 Lecturer, Department of Sport
 Science, Wollo University,
 Amhara, Dessie, Ethiopia

Soumitra Mondal
 Prof., Department of Sport
 Science, Mekelle University,
 Tigray, Mekelle, Ethiopia

Kesatie Legesse
 Assist. Prof., Department of
 Sport Science, Mekelle
 University, Tigray, Mekelle,
 Ethiopia

Mahmud Abdulkader
 Assist. Prof., Institute of Medical
 Microbiology and Immunology,
 Mekelle University, Tigray,
 Mekelle, Ethiopia

Correspondence
Kefelegn Zenebe
 Lecturer, Department of Sport
 Science, Wollo University,
 Amhara, Dessie, Ethiopia

Impacts of aerobic exercises on thyroid hormonal change responses of females' children with intellectual disabilities

Kefelegn Zenebe, Soumitra Mondal, Kesatie Legesse and Mahmud Abdulkader

Abstract

The study was aimed to investigate the impacts of 16 weeks aerobic exercise on plasma level of thyroid hormones concentration changes in females' individuals with intellectual disabilities. A total of eight female children with intellectual disabilities were taken through purposive sampling. The training program consisted of 16 weeks moderate-intensity aerobic exercises with an intensity of 45-75 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. The plasma level of triiodothyronine (T3) and thyroxin (T4) thyroid stimulating hormone (TSH) were measured before and after 16 weeks aerobic exercise. After 16 weeks of intervention, a significant change was observed in the plasma level of thyroid (T3 and T4) and thyroid stimulating (TSH) hormones at ($p < 0.05$). In general, it can be concluded that aerobic exercise had an impact on the change responses of thyroid and thyroid stimulating hormones in blood serum in female children with intellectual disabilities.

Keywords: Aerobic exercise, thyroid hormones, thyroid stimulating hormones, intellectual disabilities

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]. However, proportional secretion of T4 and T3 accelerates growth and stimulates activities in nervous systems [7]. Therefore, Thyroid hormones are important for normal brain and nervous system development and function [8]. Previous studied reported that, an aerobic exercise increases total serum T3 and T4 [9, 10]. Consequently, moderate intensity level can increase T4 concentration in the blood [11]. A progressive decrease or an improvement in serum TSH was associated with aerobic exercise [12]. On the contrary to these, 12 weeks aerobic exercise had shown an insignificant change in the plasma levels of TSH T3 and T4 hormones in sedentary women [13]. These hormonal fluctuations are dependent on the intensity, duration and type of exercise and individuals' age variation [14] and still contradictory results were seen on the effects of aerobic exercise on thyroid hormone change responses [15]. However, little information has been seen on the effects aerobic exercises on thyroid hormones change responses of individuals with ID.

Therefore, we designed the present study to investigate the effects of 16 weeks aerobic exercises on hormonal change response differences of children with intellectual disabilities. This was done by using a pre and post-test research design and using T3, T4 and TSH 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 t

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.

Materials and Methods

Pre- test and post-test research design on the effects of 16 weeks of aerobic exercise on the thyroid hormonal change responses of individuals with intellectual disabilities in Dessie was employed.

The study has one group which is aerobic experimental group. The subjects of this research were free from epilepsy and autism disorders. The whole number of the population was 8 and all are taken as a sample and placed in to aerobic experimental group. 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.

In order to measure the plasma level of TSH (thyroid-stimulating hormone) and thyroid hormones (T3 and T4), the blood samples were drawn from individuals 48 hours before the first training session and after 16 weeks training 48 hours after the last training session. Samples of Blood specimen were collected by qualified laboratory technicians in the sitting position. Six milliliters of venous blood were drawn from each subject from the vein in each pre and post-tests. The blood samples were drawn into tubes containing anticoagulant. All blood samples were preserved in the frozen condition at -20°C and were conserved until analysis process. All variables were measured using the Auto Bio laboratory kits by the ELISA method.

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 were used to compare the differences among the pre and post test results of the data and independent t- test was used to compare the intergroup variation on the effects 16 weeks aerobic exercise on thyroid hormonal change responses of individuals 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.

Results

Table 1: Demographic characteristics of female students with intellectual disabilities

Variables	Exercise group	
	M	SD
Age (year)	14.62	1.88
Height (cm)	1.489	0.041
Mass	48.63	7.008

Where, M = mean, SD = standard deviation

In this study, female students with intellectual disabilities were studied. Table 1 shows mean and SD of age height and mass of the students with ID age (M = 14.62, SD = 1.88); height in meter (M = 1.489, SD = 0.041) and mass in kilogram (M = 48.63, SD = 7.008).

Table 2: The average and standard deviation of individual's thyroid hormone change responses results using paired t-test

S/N	Tests	M±SD	t-value	P
T3	Pre-test	1.566±.281	2.936	.022
	Post-test	1.812±.182		
T4	Pre-test	6.92±1.083	3.227	.015
	Post-test	8.27±1.741		
TSH	Pre-test	1.433±.312	-3.163	.028
	Post-test	1.142±.059		

Where, T3 = triiodothyronine, T4= Tetra iodothyronine, TSH= thyroid stimulating hormone, 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 group in thyroid and thyroid stimulating hormonal change responses in pre-test and post test T3 ($t = 2.936$, $p = .022$); T4 ($t = 3.227$, $p = .015$) and TSH ($t = -3.163$, $p = .028$) respectively.

Discussion

The main objective of this study was to investigate the effects of aerobic exercise on thyroid and thyroid stimulating hormonal concentration change responses of female students with intellectual disabilities. Based on the findings aerobic exercise intervention had shown a significant change response in the plasma levels of thyroid stimulating hormone (TSH) and thyroid hormones (T3, T4). The T3 and T4 level were increased whereas TSH level was reduced after the training when compared with before training.

The results of this study are consistent with the previous studies [9, 10, 11, 12 & 16] that reported Serum TSH was found significantly decreased and T3 and T4 were significantly increased after three months of aerobic exercise intervention in hypothyroid patients. Acute aerobic exercise performed at moderate intensity induced significantly increases in total serum T3 and T4. This confirms that aerobic exercise may enhance the thyroid hormones concentration in the serum. However the present study were in contrast with the previous studies [8, 13 & 17] that reported aerobic exercise had no a significant effect on thyroid hormone concentration. These variations might be due to the specific characteristics of students with intellectual disabilities. Individuals with ID have deficiency of thyroid hormones [18], reduced activities of cardio respiratory endurance caused due to poor aerobic endurance and reduced heart mass [19] and lower aerobic fitness levels compared with their equivalent able peers [1, 2 & 20]. Thus, pang *et al.*, [21] confirmed that all these can be improved by physical exercising.

In this study a significant improvement in T3, T4 & TSH in response of aerobic exercise might be the specific characteristics of those females' 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 achieving the equilibrium in thyroid and thyroid stimulating hormones homeostasis of ID. An investigation on thyroid and thyroid stimulating hormonal change responses in relation students with ID that was uncovered by other researchers should be considered as the

strength of this study. 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.

Aerobic exercise has an impact in energy expenditure; reduce body fat mass, increase the lung function of ID, increase the metabolism of lactic and fatty acids, affect hormonal concentration changes and play a significant role to increase brain function which linked with the cognition developments of ID and improve academic achievements. All this confirms that aerobic exercise has a potential to modify the functions of thyroid hormones. Thus, aerobic physical exercise has a therapeutic effect 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. An investigation on thyroid and thyroid stimulating hormonal change responses in relation students with ID that was uncovered by other researchers should be considered as the strength of this study. 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. 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.

Conclusion

In general, it can be concluded that moderate-intensity aerobic exercise with 55-75% of maximum heart rate was an efficient method to improve the plasma concentration of thyroid T3, T4 and TSH in female students with ID.

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