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EFFECTS OF AEROBIC TRAINING ON TARGETED HEART RATE ZONE

Irfan Ullah[1], Syed Sher Baz Khan[2], Rahmat Gul[3], Akhair Ullah[4*]

ABSTRACT

Reduced targeted heart rate zone is an indication of fitness of an athlete and Reduced targeted heart rate zone is an indication of fitness of an individual and the main purpose of the current study was to investigate the "effects of aerobic training on targeted heart rate zone among college students". The study was experimental in nature. The population of the study comprised of all those students (male) who were boarding in hostel with age range 18-22 years of Government Post Graduate College Karak, Khyber Pakhtunkhwa (KP), Pakistan. The sample of fifty (n-50) healthy, sedentary, and volunteer subjects for the study was determined through Physical Activity Readiness Questionnaire (PAR-Q). Resting heart rate of each subject was taken by digital heart rate monitor as pre-test. Targeted heart rate zone was calculated through the formula [(220-age-RHR) x percentage of intensity+ RHR]. The subjects were randomly divided into two equal groups each of 25 subjects. The experimental group underwent aerobic training at moderate intensity (50% to 70% of the Maximum Heart Rate) for eight weeks while the control group carried on their routine life activities. There were four training sessions per week and each session comprised of 30 minutes besides warm up and warm down. After eight weeks aerobic training, the post-test of resting heart rate of each subject of both group was conducted as the procedure adopted for the pr-test. The pre-test data and post-test date was analyzed with the help of SPSS version 20 by applying the descriptive statistical sources mean, minimum, maximum and standard deviation to show the difference between pre-test and pos-test. The results of the study showed that there was descriptively decrease in targeted heart rate zone of subjects of the experimental group while control group showed no improvement. In light of the findings of the study, it is concluded that aerobic exercises play important role in the reduction of targeted heart rate zone and this quality paves the way to show good performance in daily physical and sports activities.

1. Assistant Professor of Health & Physical Education, Higher Education Department (Colleges), Peshawar, KP. irfanullah949@gmail.com
2. MS Scholar, Sarhad University, Peshawar. ssbazkhan@gmail.com
3. Lecturer in Physical Education and Sports Sciences, Shaheed Benazir Bhutto University Sharingal Dir Uper (Wari Campus) , rahmatsports@gmail.com
4. Lecturer in Sports Sciences and Physical Education , UST, Bannu akhairullah56@gmail.com

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INTRODUCTION

In the field of physical training, due attention is paid to various factors associated with the performance and output. Performance is to accomplish an activity to gain the specific target (Luqman, Jabeen, Khan, Ullah& Manzoor, 2021).Targeted heart rate zone is one of those basic aspects that ensures to train an individual/athlete within specified limits in order to lessen the chances of over training and detraining. Targeted heart rate zone is the zone in which the lower and upper intensity of the aerobic/anaerobic activity is kept right and avoid the chances of injuries. This enables the trainers to ensure the performance of an activity more safely, efficiently and goals oriented (Uth, Sorensen, Overgaard, & Pedersen, 2004). For calculating the targeted heart rate zone, Resting Heart Rate (RHR) and Maximum Heart Rate (MHR) play key role. The MHR is the highest beats per minute (bpm) which can be achieved during full physical exertion. The way to determine MHR is to subtract the age of a person from two hundred and twenty (220- Age). For example, the MHR of a person of 40 years age will be 180 (220-40=180) (Tanaka, Monahan, & Seals, 2001).The intensity range of the aerobic activity is 50 to 85 percent of the MHR. There are two methods to fix the targeted heart rate zone. One is based on Age-Predicted Maximal Heart Rate (APMHR) in which the age of a person is subtracted from the figure 220 and the derived figure is multiplied by the lower and upper intensity of an activity in order to determine the targeted heart rate zone i.e., (220-age) x percentage of intensity (Proff, 2021). The other method is of Dr. Karovenin who takes into account both the MHR and RHR of a person for which the formula is; [(220-age-RHR) x percentage of intensity+ RHR] (Villafaina *et al.,* 2022)

Frequency also needs while designing training program. In order to achieve the desired results of cardiovascular fitness of the beginners, the frequency should be 3 to 5 days per week and intensity of the activity should be 50% to 70% of the heart rate reserve. The intensity of anaerobic is 86% to 100% of MHR. The minimum and maximum duration of the session is 20 and 60 minutes respectively excluding the time of warm up and warming down (Slimani, et al., 2018).

Aerobic and anaerobic are the two types of physical activities. Anaerobic means 'absence of oxygen" and anaerobic exercises are those exercises in which energy is supplied to the working muscles in the form of Adenosine triphosphate (ATP). The ATP is produced from carbohydrates (CHO) which is found in the form of glycogen or glucose. The oxidation process occurs in the absence of oxygen (O_2)and hence pyruvic acid is released during this process. The pyruvic acid causes production of lactic acids which are accumulated in the muscles. These lactic acids inhabit muscles contraction and causes fatigue. The carbon dioxide(CO_2) is not expelled from the body in the amount as it is produced and hence the activity lasts for shorter time (Courteix, Obert, Lecoq, Guenon, & Koch, 1997). These have lower impact on the cardiovascular system and generally last for shorter periods of time. Some of the types of anaerobic activities are rowing, weight lifting; jumping and sprinting (Irving *et al.,* 2008).

The word aerobic means "with oxygen" (Wilmore & Knuttgen, 2003). The nature of

the aerobic activity may be determined on the basis of intensity. Here intensity means the heart Beats per minute (bpm) (Raglin & Wilson, 1996). The lower and upper intensity of the aerobic activity is 50 % and 85 % of the MHR respectively. Further, the Aerobic activity is divided into moderate activity and vigorous activity. The former intensity range is 50% to 70% of the MHR, while for the latter; it is 71% to 85% of the MHR (Medbo *et al*., 1988).

Aerobic activities are supplied with enough O_2 for metabolism in the mitochondria of the cell (Khattak, Islam & Manzoor, 2020). The sources of fuel are carbohydrates (CHO), fats and proteins. The energy is produced in the form of adenosine triphosphate (ATP) for the working muscles (Perry, Heigenhauser, Bonen, & Spriet, 2008). The body prefers to use CHO for energy as it provides faster energy than fat and hence required energy is provided to the working muscles. This is why that aerobic activity can be sustained for longer periods (Erikssen & Rodahl, 1979).

Aerobic activities are brisk walking, climbing the stairs, swimming, dancing, running, cycling, hockey, and basketball (Garber *et al.,* 2011). Many physical and health benefits are associated with the regular performance of aerobic activities. These are helpful in improving the physical fitness level of an individual and hence one may perform the routine tasks without undue fatigue (Sesso, Paffenbarger, & Lee, 2000). The efficiency of the circulatory system enhances because of the enhancement of RHR. The function of the respiratory system improves owing to the improvement of tidal volume and strengthening of respiratory muscles (Gormley *et al.,* 2008) and the health of the skeletal muscles is enhanced (Kohrt, Bloomfield, Little, Nelson, & Yingling, 2004). Aerobic activities are also helpful in managing the body weight and thus the risks of obesity can be overcome. Additionally, the immune system against the viral diseases is strengthened. The regular participation in aerobic activities is helpful in relaxing the mood because of the releasing of endorphin hormones of the body. The resistance quality to withstand fatigue is enhanced. Aerobic activities build stronger and denser bones (Talanian, Galloway, Heigenhauser, Bonen, & Spriet, 2007).

Warm up and warming down are also necessary while performing aerobic activities. There are established benefits of the warm up before performing of any sort of physical activity. It prepares an individual for the hard physical exertion. It improves the contraction and relaxation capacity of the muscles. The speed, strength, and elasticity of the muscles are also enhanced (Woods, Bishop, & Jones, 2007). After taking part in physical activity, the importance of warming down cannot be denied. The main purpose of the warming down after the participation in exercise is to promote recovery and bring back the body to its pre-exercise level. Warming down of the body after doing aerobic activity plays important role in avoiding the risks of fainting and placing undue stress on the heart. It brings back the HR to normal (Karvonen, 1992).

Prior to starting of the aerobic training, there are other certain factors that should be kept in mind in order to achieve the optimum results without being prone to injuries. These factors are mode, intensity, frequency, duration, progression and variation (Kerse, Elley, Robinson, & Arroll, 2005).

Cultural and ethical issues have own role as barrier for participation in the physical activities (Manzoor, Ullah & Khan, 2020). It has been shown in the literature review of Hamoudat (2008); Ghassab & Oudat (2007) and Al-Rashidi (2006) that physical fitness

has been decayed among college students because of lack of physical activities. Viewing this situation, the researcher decided to conduct a study to investigate the "effects of aerobic training on targeted heart zone among college students".

Objectives of the Study

1. To identify the effects of eight-week aerobic training on targeted heart rate zone among college male-students of the age group 18-22 years.
2. To suggest a list of recommendations

Hypothesis

1. Aerobic training improves the targeted heart rate zone among college male-students of the age group 18-22 years.

METHODS AND MATERIAL

POPULATION

Population is the aggregate of all the subjects, objects or members that are directly related to the problem under taken. In experimental research, it refers to the subjects which the researcher selects for the study in connection with collection of the necessary data (Banerjee, *et al.,* 2007). The population for this study comprised of all the male-students who were boarding in the hostel of government Post Graduate College Karak KP, Pakistan. The range of the age was 18 to 22 years.

EXCLUSION CRITERIA

In order to ensure the convenience and select the healthy, sedentary and volunteer subjects, physical activity readiness questionnaire (PAR-Q) was used and the questionnaire carried all the relevant queries with the reference to the desired characteristics. The students who did not live in hostel were not the part of population. Students with acute or chronic respiratory illness, past or present smoking history, having any type of physical deformity, systemic illness and on chronic medication were also not made as part of population. In addition to that, those students who had already been taking part in aerobic or anaerobic activities regularly were not included in the population of the study.

SAMPLE AND SAMPLING

Population refers to all the individuals who are directly related with the study in order to solve the specific problem under taken and sample is the portion of population. But due to various factors like large size of populations, socioeconomic conditions and time limitations, it becomes unmanageable for the researcher to contact the whole population and promptly interact with the subjects. When the study of the whole population in order to reach certain conclusions is not possible, then the volume of the population is reduced through certain procedure which is called sampling (Schillewaert, Langerak, & Duhamel, 1998). After the application of PAR-Q, a sample of fifty subjects (n-50) was selected randomly.

RESEARCH DESIGN

Research design is a plan for the solution of a problem (Jones & Lyons, 2004). The current study was experimental in nature with pre-test and post-test design. The

population of the study comprised of male students of Government Post Graduate College Karak Khyber Pakhtunkhwa (kp), (Pakistan). The age limit of the subject was between 18 to 22 years. The sample of 50 healthy and sedentary volunteer subjects for the study was determined through PAR-Q. Before formation of two groups, the RHR of each subject was taken for three consecutive days. The average RHR of each subject was calculated. In the next stage, the subjects were listed in ascending order on the basis of their RHR. The odd numbers formed experimental group (25 subjects) and the even numbers formed controlled group (25 subjects). Eight weeks aerobic training was given to the experimental group. There were four sessions per week. Each session comprised of 30 minutes excluding the time of warm up and cooling down. The intensity of the training zone was 50% to 70% of MHR computed on the basis Dr. Kerovenin method [(220-age-RHR) x percentage of the intensity – RHR]. The control group was allowed to take part in their routine life activities and was not given any type of treatment.

CALCULATION OF TARGETED HEART RATE ZONE

On the basis of average RHR, the targeted heart rate zone of each subject was calculated by applying the Dr. Karovenin method. According to the Dr. Karovenin method, the age of each subject was subtracted from two hundred and twent- two (220). Next the RHR was subtracted from the derived figure and then multiplied by the moderate intensity of an aerobic activity (50%-70%). In the last, RHR was added to the calculated figure. The formula was; [(220-age-RHR) x intensity of the activity + RHR].

TREATMENT TO EXPERIMENTAL GROUP

The aerobic training protocol was designed for experimental group and was initiated and continued for the period of eight weeks. There were four sessions per week (Monday, Wednesday, Friday and Saturday) each of 30 minutes excluding the time of warm up and cooling down. The intensity of exercises was 50% to 70% of the MHR computed on the basis of Dr. Karovenin formula.

Control Group

The subjects of control group were allowed to continue their daily routine life activities. No treatment was given to the control group.

Administration of Aerobic Training

The aerobic training was given to the experimental group comprised of 25 subjects. The exercises involved in the protocol were practically demonstrated to the subjects by the researcher. One session was reserved for practically demonstration of the exercises by the subjects. The aerobic exercises jogging, stepping up and down and brisk walk were the part of training. The duration of the training was 30 minutes excluding the time of warm up and warm down. There were four sessions per week on alternate days.

DATA ANALYSES

Table 1. ***Description of the Sample***

Group	N	Min age	Max age	Mean age	Std. Deviation
Control Group	25	18 years	22 years	20.72 year	1.1372
Experimental Group	25	18 years	22 years	20.84 year	0.9433

The above table indicates that the minimum and maximum age of each subject of both groups is 18 to 22 years respectively. Likewise, the mean age of control group is 20.72 years, while of the experimental group, it is 20.84 years.

Table 2. ***Description of Pre-test and Post-test of Targeted Heart Rate Zone (lower & upper) of the Experimental Group.***

Variables	Tests	N	Mean
Targeted Heart Rate Zone	Pre test	25	Lower.138.16 bpm Upper. 162.4 bpm
	Post test	25	Lower.136.96 bpm Upper.161.8 bpm

The table shows the pre-test and post-test of lower and upper targeted heart rate zone of the experimental group. The pre-test mean values of lower and upper targeted heart rate zone are 138.16 bpm and 162.4 bpm respectively while the pos- test mean values are 136.96 bpm and 161.8 bpm.

Table 3. ***Difference of mean values between the Pre-test and Post-test of Targeted Heart Rate Zone of the Experimental Group.***

Variable	Mean Difference
Targeted Heart Rate Zone	Lower= 1.2 bpm Upper= 0.6 bpm

The analyzed data indicates that the difference of means of pre-test and post-test of lower and upper Targeted Heart Rate Zone are 1.2 bpm and 0.6 bpm respectively. It shows that Targeted Heart Rate Zone has been improved descriptively after aerobic exercises treatment.

Table 4. ***Pre-test and Post-test of Targeted Heart Rate Zone (lower & upper) of the Control Group.***

Variables	Tests	N	Mean
Targeted Heart Rate zone	Pre-test	25	lower.138.16 bpm Upper.162.48 bpm
	Post-test	25	Lower.138.14 bpm Upper.162.46 bpm

The above table shows that the pre-test's mean values of lower and upper targeted heart

rate zone of the control group are 138.16 bpm and 162.48 bpm respectively, whereas the post-test mean values are 138.14 bpm and 162.46 bpm.

Table 5. *Difference between mean values of Pre-test and Post-test of Targeted Heart Rate Zone of the Control Group.*

Variable	Mean difference
Targeted Heart Rate Zone	Lower= .02 Upper= .02

The analyzed data of the above table show the pre-test and post-test's' mean difference of lower and upper Targeted Heart Rate Zone of the control group which is .02 bpm and .02 bpm respectively and it clearly indicates that there is no improvement in targeted heart rate zone. Hence the hypothesis that aerobic exercises improve the targeted heart rate zone among college male-students of the age group 18-22 years is accepted because there is no effect of daily routines on targeted heart rate zone.

CONCLUSION

On the basis of findings, it was concluded that aerobic training improves the Targeted Heart Rate Zone. The targeted heart rate zone plays important role while performing physical activity. It helps to design the precise type of training program and achieve the desired objectives in good manner. It also helps in to determine and impart the right type of training to a player without prone to injuries. In this study, the pre-test mean values of the lower and upper targeted heart zone of the experimental group were 138.16 bpm and 162.4 bpm respectively, where as in control group, the pre-test mean values of upper and lower targeted heart zoneswere 138.16 bpm and 162.48 bpm.

The intensity of training fluctuated between 50% to 70% of MHR computed through Kerovenin method, [(220-age-RHR) x percentage of the intensity – RHR]. The control group was allowed to take part in their daily routine life activities.

After eight weeks treatment to the experimental group, the data was analyzed. In experimental group the post-test the mean values of lower and upper targeted heart rate zone were 136.96 bpm and 161.8 bpm respectively. In control group, the post-test mean values of lower and upper targeted heart rate zone were 138.14 bpm and 162.46 bpm respectively. According to the above stated figures, the study concluded that aerobic training improves the targeted heart rate zone among college male-students of the age group 18-22 years. With the stated quality, a person can perform physical routine tasks with fewer efforts and more efficiently without exerting and having too much fatigued.

RECOMMENDATIONS

On the bases of findings and conclusion of the study, the following recommendations are being proposed. As the results show that aerobic training improves targeted heart rate zone therefore, it is recommended that awareness should be created among the people about the importance of aerobic exercises so that they may take part in aerobic exercises for improving their physical efficiency. Besides other academic responsibilities, it is also the duty of physical education teachers at school and college level to prepare the students for various sports activities. Therefore, it is recommended for physical education teachers to motivate and promote aerobic exercises among students in their institutions that will pave the way to more fit students. As noted during the study, most of the students were not aware of the benefits of aerobic exercises, therefore it is suggested that aerobics training program should be made part of the

curriculum at school and college levels. It is also recommended that the coaches and trainers should plan the aerobic exercises protocol in the light of the targeted heart zone. It is further proposed that more in-depth studies should be conducted to verify the findings of the study.

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