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EFFECTS OF AEROBIC TRAINING VERSUS CROSS-TRAINING UPON CARDIO-RESPIRATORY ENDURANCE OF MIDDLE DISTANCE RUNNERS

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Abstract

The basic purpose behind this study was to determine the effects of aerobic training versus cross-training upon cardio-respiratory endurance of middle distance runners. In this study a total of 60 male college's middle distance runners between the age of 17 to 21 years participated. Therefore, two groups, one was Experimental Group (EG) with n=40 and Control Group (CG) with n=20 were established. The EG was further divided into Aerobic Training A and Cross Training B. EG was given prescribed training, while CG remained as usual. Data were collected two times; T_1 pre-test and T_2 post-test after eight weeks. The statistically significant difference was observed by using T-test between pre- and post-test results. Results demonstrated that there existed significant effect of cross training on cardiovascular fitness of middle distance runners between the age of 17 to 21 years. The effect of cross training was measured as a dominant training method for the cardiovascular fitness of middle distance runners as compare to aerobic training and control group. Before the treatments the groups were same in cardiovascular endurance but due to aerobic training and cross training the middle distance runners reduce their weight and BMI as well as improve their cardiovascular endurance after the treatment.

Keywords: Aerobic training, cross training, cardiorespiratory endurance & middle-distance runners

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Introduction

Cardiorespiratory endurance is the ability to perform for long duration without undue fatigue. This capacity is produced by involving the large group of muscle by giving them moderate level to high level intense exercise. The major role is played by the oxygen which transfer from the environment to bloodstream by the efficient working ability of lungs. The enrich blood pumped by the ventricle of the heart towards arteries, where the nervous system does the remaining job by regulating the flow of blood. This system also use the energy provided by the blood for the smooth working of the human body during any exercise program (Fahey, Insel, & Roth, 2014).

Muscles use energy to work for the extended period of time, therefore the aerobic system performs a key role in the presence of oxygen by providing fuel for energy. However, this aerobic capacity can only be improved by overloading the components of cardiorespiratory endurance. Walking for a while, swimming for some duration of time, bicycling are the renowned activities in the development of cardiorespiratory endurance. Besides these activities experts suggests jogging, skipping roping are best exercises by which an athlete develop their cardiorespiratory endurance. Research indorsing the facts aerobic exercise is essential for a physical fitness components of sports-participants (Dar, 2016). Likewise, research shows that aerobic training provides an opportunity to athletes to develop stamina or aerobic capacity (Kulothungan, 2016).

Cross-training is a sort of exercise that involves participating in two or more athletic activities at the same time in order to give diversity, fitness, and injury avoidance. Cross training is a relatively new sports idea in which a training regimen incorporates the usage of one separate athletic discipline to improve abilities or fitness in another. Instead of doing one exercise with greater exertion, it is easier to execute two distinct exercises with moderate exertion. Any non-running activity counts as cross training for a distance runner. Only two or three different activities should be performed to receive the optimum outcomes from cross training (Kulothungan, 2016).

Previous studies reveal that training has to be performed with relatively aerobic exercise, resistant training, high-vs. low-intensity training (Enoksen, Shalfawi & Tønnessen, 2011) or circuit training (Khattak, Islam & Manzoor, 2020) to enhance an important component of cardiorespiratory endurance. However, little studies have so far been examined this relationship combing aerobic training and cross-training with beginners of middle distance runners. As a result, this aspect of sports training needs more detailed information on how to periodize the daily training process in distinct training periods to improve the knowledge of middle-distance training.

There has been scarcity of modern well-controlled trials to date to determine the best model for improving cardiorespiratory performance in beginner middle-distance runners. The purpose of this study was to see how two different intervention training regimes, aerobic training and aerobic cross-training, affect cardiorespiratory endurance in a group of middle-distance male runners. This exercise based study may contribute in literature of sports training and coaching about the periodization of training volume and intensity in order to get the best potential results in a group of male middle-distance runners.

Literature Review

Research reveals that cross-training athletes are frequently faster and less prone to injury than runners who just prepare by running. Including alternate activities in the training routine can help enhance overall performance as well as performance in chosen sector (Helmy-Abou-Gamil, 2017). Cross training helps body recover from injuries faster, in part, because other activities can immediately improve the condition caused by usual activity. For example, eccentric calf muscle strengthening can help with Achilles tendinitis, which is caused by overuse. Increased aerobic capacity is one of the advantages of cross training. This is because if limit to one activity, will burn out after a certain amount of time and will only be able to pause and recharge (Krause, 2009).

Despite some debate regarding the necessity of fundamental motor skills in the maintenance of physical activity levels. There are varieties of programs which are best in use for the development of different motor fitness components of the athlete. As a result, a reduced training program will have a detrimental influence on fitness (Kumar, 2016). The aerobic metabolism has a significant impact on athletes' performance in competitions lasting between 3 and 10 minutes. Several methods have been devised to obtain credible information regarding middle and long distance runners' aerobic capacity. The measurement of blood lactate concentration which is accumulating during constant physical activity are preferred in addition to respiratory parameters. Individual Anaerobic Threshold (IAT) assessment serves as an objective measure of aerobic endurance. Addressing the basic training concepts is a function of improving a middle distance runner. There is a slim probability that the athlete will race quicker if these ideas are not thoroughly covered. The underlying assumption of competitive distance running is that a badly conditioned athlete will improve their performance the most by concentrating on improving their aerobic capacity. However, in order to work hard, a middle distance runner must have both aerobic and anaerobic ability (Kulothungan, 2016).

The aerobic and anaerobic capacity of middle-distance runners in track and field determine their performance (Ingham et al., 2008). The duration of middle- and long-distance running contests emphasizes the importance of aerobic capacity. In 800-meter running, runners rely equally on aerobic and anaerobic energies, however in 1,500-meter running, the aerobic energy system provides 80% of the energy required (Spencer & Gastin, 2001). This emphasizes the tight link between aerobic capacity and middle-distance running performance.

Development of Research Hypotheses

H_1 There is a significant effect of aerobic training on cardiorespiratory endurance of middle-distance runners.

H_2 There is a significant effect of cross training on cardiorespiratory endurance of middle-distance runners

H_3 The effect of cross training is measured as a dominant training method for the cardiovascular fitness of middle distance runners as compared to aerobic training

Method and Materials

Research Design

The pre-post-intervention was used during this experimental research. The representatives of the study were included from non-sporting college boys from Government Associate College Piplan, Mianwali, Punjab. In this research the following criteria was adapted for the respondents to be included as participants.; a) Participant of the study free from cardiovascular disease, b) must having the range of age within 17-21 years, c) voluntarily participation, and d) having no smoking habits.

Control v/s Experimental Group

The population of this particular study consisted of 60 non-sporting college boys. These subjects were selected on random basis. The researcher made it sure that the subjects are physically and medically fit to undergo the prescribed training programs. The participants were randomly divided in to two groups. Different ways are adopted to randomly assign participants to group. However, the researcher followed the suggested steps for random assignment and an equal number of participants in each group. Keeping in view the nature of the study, Group A underwent aerobic training, group B engaged in aerobic cross training and group C was labeled as control group.

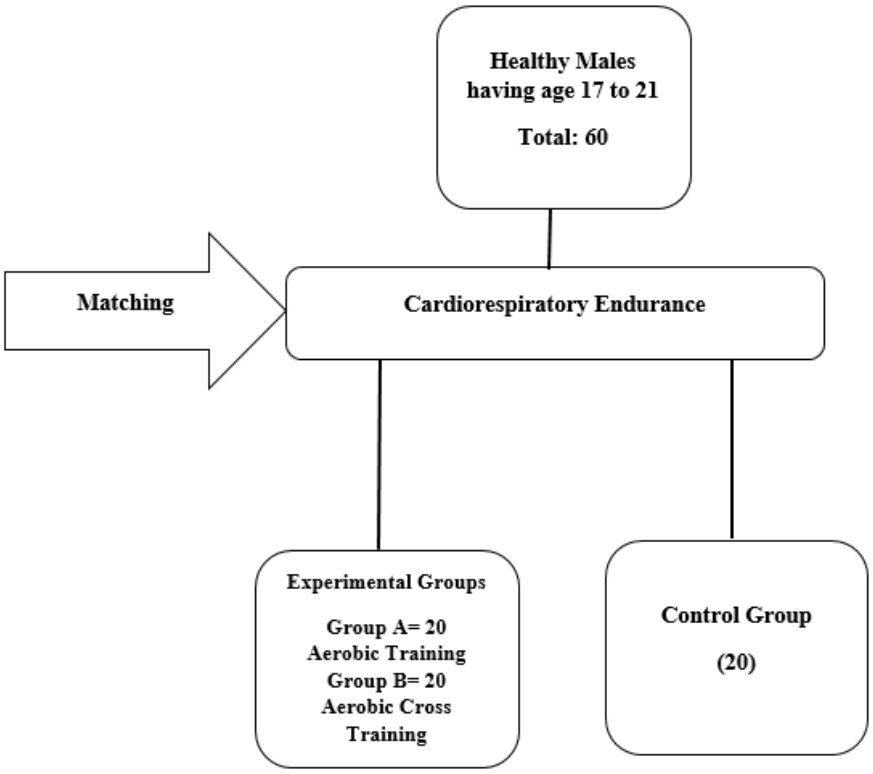

Figure 1 Showing the Control Group and Experimental Group

Methods of Data Collection

Before, collecting the required data, each participant underwent a physical activity readiness questionnaire-based screening for heart rate, blood pressure, and other health hazards after being accepted into the research successfully and before any testing sessions (PAR-Q). The CSEP advises using this form as a common screening tool for persons who appear to be in good health before engaging in exercise programmes or evaluations. Participants' height, weight, and body mass index were measured at this time; these measurements were utilised to develop participant-specific test protocols and analyse the resulting data in the outcomes variables.

Aerobic training and aerobic cross training were arranged as per the proposed schedule of 6-week. The pre- and post-test data on the criterion variables were collected as per the procedure before and after the training schedule of 06 weeks. A proposed diagram is given to explain the process. The data was obtained twice before and after the completion of 6 week exercise intervention program. A glimpse to accomplishment of process was shown in the shape of diagram.

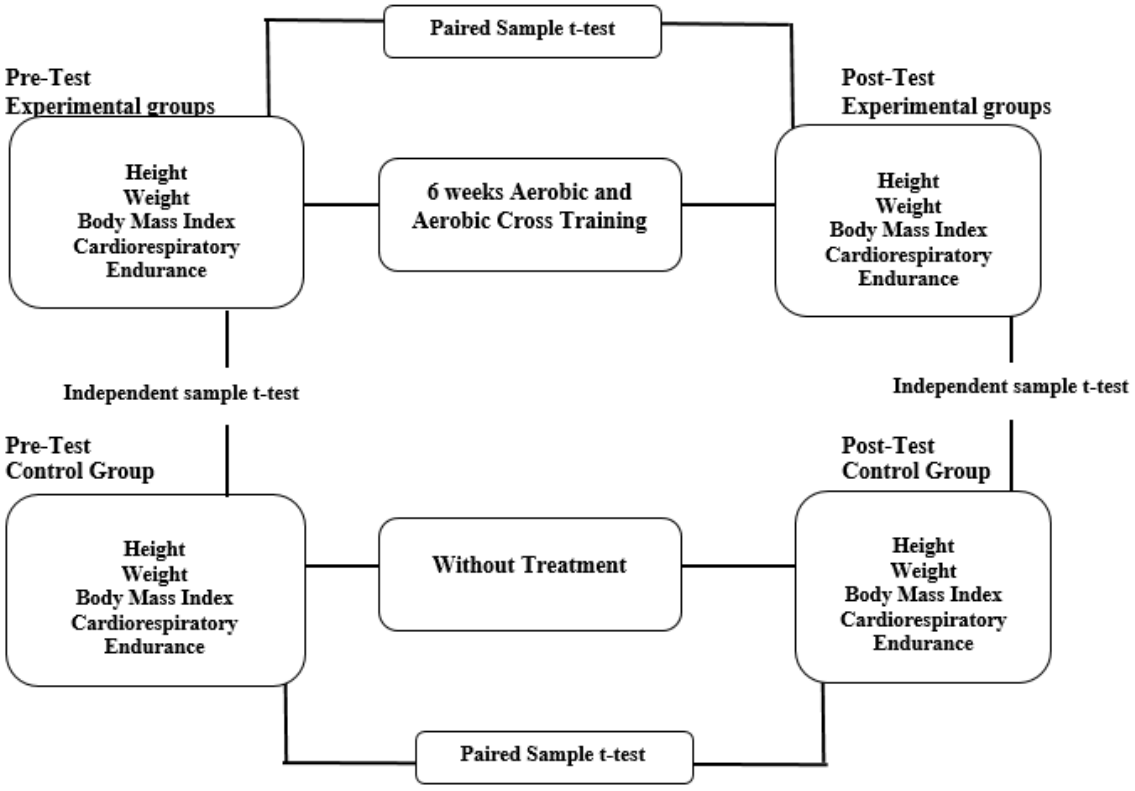

Figure 2 Showing the Pre- and Post-Intervention Data Collection

Results and Discussion

Table 1

Anthropometric Measurements as a whole in Age, Weight, Height and BMI

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	60	17.00	21.00	20.2833	1.60604
Height (cm)	60	159.00	188.00	172.6533	7.32108
Weight (kg) pre	60	55.00	93.00	67.1500	9.08869
Weight (kg) post	60	52.00	85.00	63.7833	7.81153
Body Mass Index in Pre-test	60	17.59	31.08	22.5388	2.77339
Body Mass Index in Posttest	60	16.54	29.35	21.4502	2.74524

In Table 1 descriptive statistic showing the mean and standard deviation of respondents in respect of their age, height, weight pre, weight post, BMI in pre and BMI in post. Mean age of the respondents was 20.28±1.60, mean height was 172.65±7.32 cm, mean weight in pre was 67.15 kg, mean weight in post was 63.78±7.81 kg, mean BMI in pretest was 22.53±2.77 and mean of BMI in posttest was 21.45±2.74. Total respondents were 60 where the least age was 17 years and last limit of age was 21 years, least height was 159 cm and last limit of height was 188 cm, lest value

of weight in pretest was 55 kg and last was 93 kg, minimum weight in posttest was 52 kg, and maximum was 85 kg, least BMI in pretest was 17.59 and last was 31.08, least BMI in posttest was 16.54 and last was 21.45. Table 4.1 showed that descriptively variation occur in weight and BMI after the treatment.

Table 2

Differences between Pre- and Post of Control Group and EXP-A (Aerobic training Group) in Cardio-respiratory Endurance

Measurements	*Pretest CRE*	*Posttest CRE*		
	Mean ± SD	*Mean ± SD*	*T*	*Sig.*
Aerobic Training EXP-A	54.35±2.05	61.50±2.48	-13.138	.000
Control Group	53.70±2.34	53.05±2.01	1.748	.097

In Table 2 the cardiorespiratory endurance of experimental group was obtained by using a paired sample t-test was applied to measure the mean difference between pretest and posttest cardio-respiratory endurance of experimental group A (Aerobic training) and control group. Statistical difference was found between pretest and posttest cardio-respiratory endurance of experimental group A (t=-13.138, Sig.= .000 < α= 0.05). However, statistically no significant difference was found between pretest and posttest cardio-respiratory endurance of control group (t=-13.138, Sig.= .097 > α= 0.05). Hence the study analyzed that after the treatment experimental group A (aerobic training) improve their cardio-respiratory endurance where the control group is not.

Table 4.3

Differences between Pre- and Post of Control Group and EXP-B (Cross-Training Group) in Cardio-respiratory Endurance

Measurements	*Pretest CRE*	*Posttest CRE*		
	Mean ± SD	*Mean ± SD*	*T*	*Sig.*
Cross-Training (EXP-B)	54.00±2.07	61.35±2.20	-16.376	.000
Control Group	53.70±2.34	53.05±2.01	1.748	.097

In Table 3 a paired sample t-test was applied to measure the mean difference between pretest and posttest cardio-respiratory endurance of experimental group B (cross training) and control group. Statistically significant difference was found between pretest and posttest cardio-respiratory endurance of experimental group B (t=-16.376, Sig.= .000 < α= 0.05). On the other

hand, statistically no significant difference was found between pretest and posttest cardio-respiratory endurance of control group (t=1.748, Sig.= .097 B α= 0.05). Hence the study analyzed that after the treatment experimental group A (cross training) improve their cardio-respiratory endurance where the control group is not.

Discussion

The reason behind conducting this research to examine the effects of aerobic and cross aerobic training programs on cardiorespiratory endurance of middle-distance runners. To achieve this purpose, several hypotheses were formulated: H1 Aerobic training has a significant effect on cardiorespiratory endurance of middle-distance runners. H2 Cross-training has a significant effect on cardiorespiratory endurance of middle-distance runners. H3 Cross training has more positive effects as compared with aerobic training on cardiorespiratory endurance of middle-distance runners.

The first hypothesis was about the effect of aerobic training on cardiorespiratory endurance of middle-distance runners and the data identifies that aerobic training produced positive improvement in cardiorespiratory endurance of middle-distance runners. Table 4.6 indicates that improvement in the mean score for cardiorespiratory variable ranged between (54.35) for pre-test and (61.50) for post-test. The researcher think that this effect is due to the recommended training program as it includes jogging, running, vertical jumps and knee bent sit-ups. The intensity of this sort of exercise is determined by the heaviest weight that can be maintained for 15 to 30 minutes with 3 repetitions. The load in question enhances endurance. Additionally, applying (15RM) loads benefits strength endurance because this kind of endurance can increase significantly by about (50%) over the course of a few weeks. According to the evidence, middle-distance runners' cardiorespiratory endurance may be increased after six weeks of aerobic exercise.

The study's findings are in agreement with those of past investigations. The literature shown a significant increase in VO2max following the administration of the aerobic training intervention for 8 weeks (Patel & Vardhan, 2021). The combination of low-intensity, high-intensity, and high-intensity interval training increased athletes' aerobic endurance and competition performance, according to the findings (Borrego-Sánchez et al., 2021). A study found that a significant improvement was measured in the variables of body composition, resting heart rate, and aerobic power after making the daily exercise routine or training for the duration of less than 2 hours and 30 minutes a week. Furthermore, high-intensity exercise was more successful in

raising relative peak oxygen uptake. High-intensity exercise appears to provide slightly more cardiorespiratory advantages, although both types of training appear to advance health (Hottenrott, Ludyga, & Schulze, 2012).

The second hypothesis was about the effect of cross training on cardiorespiratory endurance of middle-distance runners and the table 4.6 reported significant increase in cardiorespiratory variable ranged between (54.00) for pre-test and (61.35) for post-test. The researcher think that this effect is due to the recommended training program as it includes plyometric drill, weight training strength work and sprints. The same results showed that cross-training may be the technique that high school runners should use into early season training to enhance their running performance (Foster et al., 1995).

The present study indicated that both aerobic and cross training groups significantly reduced their hip and waist circumferences. Same results have been obtained that runners who also engage in cross-training had higher levels of strength than runners who did not. Cross-training participants showed noticeably stronger hip and knee flexion and extension muscles. The CrossFit group had, specifically, 25% more hip flexor strength, 88% more hip extensor strength, 42% more knee flexor strength, and 34% more knee extensor strength (Bradley, 2017).

Supporting to the third hypothesis, it has been confirmed that subjects included in cross training produced had, especially more cardiorespiratory endurance than the group of aerobic training. Concurrent endurance and strength training has been found to improve endurance capacity more than just endurance training (Guglielmo, Greco, & Denadai, 2009). According to Smith et al (2013) taking part in a ten-week Cross-based training programme had positive effects on aerobic fitness. Although the two groups exercised for about the same amount of time each week, the Cross training group spent at least half of that time in classes specifically for Cross training. Strength training is a part of most, but not all, of these classes. As the run-only group does not engage in any strength training, this probably explains the variations in strength observed between the two groups (Bradley, 2017).

Improvements in body cardiorespiratory fitness may result from changes in participants' eating habits throughout the intervention period in addition to aerobic or cross-training sessions. Because energy intake was not measured in the current study and there was no information on how the exercise programme affected appetite, it is unclear whether or not subjects significantly changed their diet. The fact that aerobic power could only be determined through a stage test was another study disadvantage. On the one hand, this made it impossible to accurately capture in a

laboratory setting how the two training regimens affected performance over a two-hour period. Additionally, because this study examines two training regimens with equivalent total labour durations, the effects of the variables training intensity and frequency cannot be assessed independently. Since an athlete would prefer to modify training variables in accordance with perceived stress, Seiler and Tennessen (2009) came to the conclusion that matching training programmes by exercise length appears sensible in a laboratory. The current study's objective was to offer middle-distance runners two training plans that may accommodate any time restrictions and improve both their performance and health. Middle-distance runners might thus compare the outcomes of various training plans depending on the overall effort load.

Conclusion

Aerobic training has a significant impact on cardiovascular fitness of middle distance runners aged 17 to 24 years. There is significant effect of cross training on cardiovascular fitness of middle distance runners aged 17 to 24 years. The effect of cross training was measured as a dominant training method for the cardiovascular fitness of middle distance runners as compare to aerobic training and control group. Before the treatments the groups were same in cardiovascular endurance but due to aerobic training and cross training the middle distance runners reduce their weight and BMI as well as improve their cardiovascular endurance after the treatment.

Recommendations

1. Results of the current study revealed the both aerobic and cross training produced positive effects on cardiorespiratory endurance od the subjects. Therefore, the sports trainers, coaches and physical education teachers are advised to adopt these training to improve the important fitness component of cardiorespiratory endurance.
2. The trainer may start using these training programs, that it should be included in the sports training guidelines. Additionally, it should be adopted by educational institutions, various clubs and other provincial as well as national training centers of the country.

Policy Implications

This research work discusses the advantages of two training programmes, namely aerobic and cross aerobic training, on runners' performance, despite the fact that many experienced runners still avoid exercise out of concern that it will increase their muscle mass and subsequently reduce

their capacity for performance. We can infer from the findings that training regimens that included both aerobic and cross-aerobic exercise enhanced cardiorespiratory endurance. Coaches are advised to include it in the training regimen of well-trained endurance athletes. Additionally, time trial performance improved as a result of training interventions, which is very important for distance runners because time trial is a real predictor of running performance. However, it is equally crucial for practitioners that their successes can be sustained over time by regular endurance training. Additionally, coaches need to remember that following a 12-week programme, continued endurance training can help preserve the benefits for a number of weeks.

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