Journal of Positive School Psychology http://journalppw.com
2023, Vol. 7, No. 1, 1924-1932

Pulmonary Functions In Sport: Assessing The Effects Of Aerobic Exercise Program In University Football Players

Syed Yawer Ali Shah[1] , Dr. Wasim Khan[2] , Akhair Ullah[3] , Muhammad Hamad Aslam[4] , Abdul Basit[5] , Seema Ihsan[6] , Sabir Hussain[7]

[1]*Lecturer, Department of Sports Sciences and Physical Education, University of Science and Technology, Bannu, Khyber Pakhtunkhwa, Pakistan.*
[2]*Assistant Professor/HoD, Department of Sports Sciences and Physical Education, Gomal University, Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan*
[3]*Lecturer, Department of Sports Sciences and Physical Education, University of Science and Technology, Bannu, Khyber Pakhtunkhwa, Pakistan.*
[4]*Visiting Lecturer, Department of Physical Education and Sports Sciences, Islamia University of Bahawalpur, Multan, Punjab, Pakistan.*
[5]*M.Phil Scholar, Department of Sports Sciences and Physical Education, Gomal University, Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan*
[6]*Lecturer, Department of Health and Physical Education, Government Girls Degree Colleges, Bannu, Khyber Pakhtunkhwa, Pakistan.*
[7]*PET, Government Rifah e Aam High School, Multan, Punjab, Pakistan.*

Abstract

Objective: The aim of this study was to evaluate the effect of aerobic exercise programs on pulmonary functions in football players at university level. **Methods:** Thirty (30) players were distributed into two groups. Group 1 (n=15) was given an aerobic exercise regimen. Group 2 (n=13) was accepted as the control group. Pulmonary functions including [Vital Capacity (VC), Forced Vital Capacity (FVC), Forced Expiratory Volume (FEV1) and Forced Expiratory Rate (FEV1/FVC) were assessed before and after intervention. **Results:** The results indicated that football players' basic pulmonary function parameters, measured prior to the intervention, were VC=3.70, fvc=4.50, FEV=3.20 and FEVI/FVC=.67. However, the same parameters were found better in post-test results and measured as VC=3.60, FVC=4.50, FEV=3.10 and FEVI/FVC=.66. **Conclusion:** It has been concluded that aerobic exercises are efficient in improving pulmonary functions. Since the improvements in pulmonary function tests were greater in the players who performed the aerobic exercise as compared with those players who did not receive any exercise intervention. Hence, it has been recommended that football players should be encouraged to perform this exercise program.

Keywords: Aerobic exercise, pulmonary functions, football players & experimental study

INTRODUCTION

Participation in a regular physical exercise produces positive changes in sport-participants, whose performance largely depends upon various events in some important organs such as heart, lungs and muscles. Literature endorsed that athletes have better lung function as compared with sedentary people (Degens et al., 20123; McKenzie, 2012).

Research indicated that adaptations of the maximum aerobic capacity (Vo2 Max) play a well significant role in predicting cardio-respiratory condition. The finding of the study further substantiates that cardio-respiratory condition is considered as one of the influential factor affecting sports performance (McKenzie, 2012). Variety of protocols is used to evaluate Vo2 Max. Some perceives Bruce treadmill test as an effective method (Chavda et al., 2013), while other considered spirometry test as an effective method in the indirect evaluation of VO2Max (Zhang, Hu & Shan, 2017). Some important pulmonary functions include Pulmonary Functions [Vital Capacity (VC), Forced Vital Capacity (FVC), Forced Expiratory Volume (FEV1) and Forced Expiratory Rate (FEV1/FVC)] (Garcıa-Rıo et al., 2013). The diminution of inspiratory and expiratory muscle strength and even résistance, which can alter the respiratory flow, are some factors that could alter the ventilatory mechanics. The study aimed at evaluating how aerobic exercise can be a determining factor for the condition of pulmonary functions in football players. Additionally, the study aimed at comparing different puylmonary functions including [Vital Capacity (VC), Forced Vital Capacity (FVC), Forced Expiratory Volume (FEV1) and Forced Expiratory Rate (FEV1/FVC)] in experimental group and control group.

PURPOSE STATEMENT

Various factors such as morphological, functional, and psychological have an influence on the effectiveness of football players. These factors determine appropriate playing tactics as well as success of players participating in the game of football. The game of football is recognized as one of the prolonged, high intensity intermittent games that need repeated sprints for 90 minutes (Barros et al., 2007; DiSalvo et al., 2006; Novack et al., 2018). Likewise, a player requires average exercise intensity that is closed to the anaerobic threshold of 80-90% of maximum heart rate (HR). The ability to perform intense exercise declines towards the end of a match, as well as immediately after the most intense periods of the game. In this context, the implementation of a well-developed aerobic fitness training program helps soccer players to maintain repetitive high-intensity actions during a soccer match, accelerate their recovery process, and maintain their physical condition at an optimum level throughout the entire game and competition season.

METHOD AND MATERIALS

Plan of Work and Design Adopted

Research design is considered as framework of any research methods and techniques which the researcher selects to conduct a study (Siedlecki, 2020). Keeping in view the nature of the study, the researcher used field experimental design in the current study. Field experimental studies are conducted in a natural setting (Guo et al., 2019). As the aerobic intervention was given in a natural setting, therefore; field experimental research design was considered appropriate.

Study's Participants and Sampling

The participants of the current study comprised of football players, those who participated at Intercollegiate and Intervarsity level representing University of Science and Technology, Banuu (USTB). For this purpose, thirty (30) volunteer football players were taken. These players were divided into different groups on random basis. In an experimental study data collected from an experimental group is comparatively analyzed with data from a control group. Therefore, two identical groups were made on the basis of the pre-test. The independent variable remained changed for the experimental group, while the control group was kept constant (Kirk, 2009). The following figure is showing experimental group and control group.

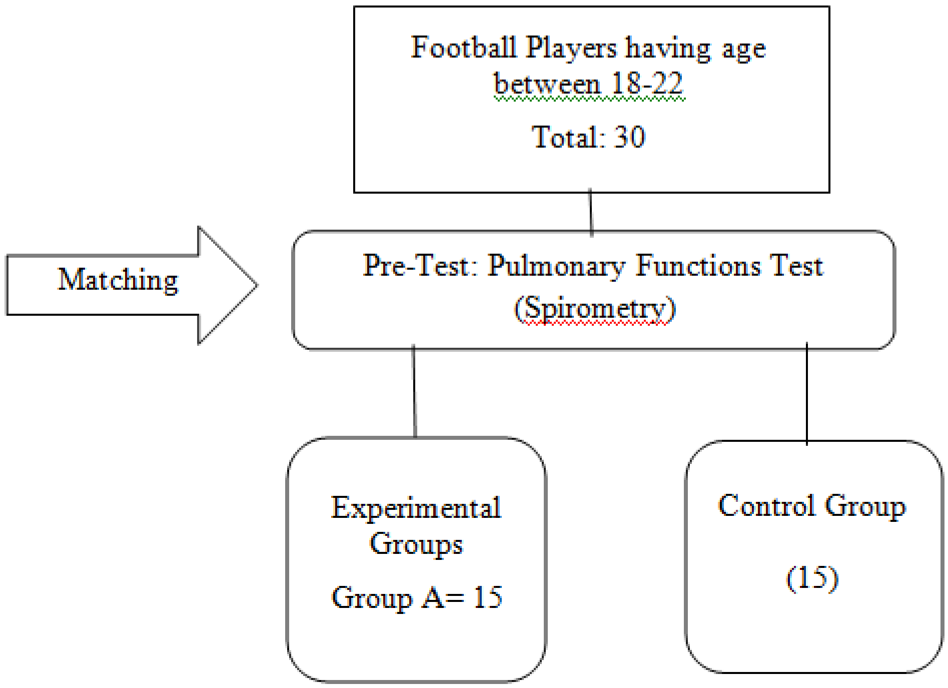

Figure.1: Showing the Control Group and Experimental Group

Treatment Studied

Table 1 Aerobic Exercise Protocol for 06 Weeks

Duration	Frequency of Exercise Protocol	One Session Duration	Nature of Activity	Description of Activities
Six weeks	Five sessions per week (Monday, Tuesday, Wednesday, Thursday, Friday).	40 minutes regular with 2 minutes rest between exercises (Time of Warm up and Cool down including).	Aerobic Exercises (65% of MHR by Karvonen equation).	Warming Up 05 min, Slow Running on track (10 mins), Rope Jumping (08 mins), Push ups (03 mins), Crunches (03 mins), Cool down(05 mins).

Parameters/Variables Studied

Independent variables

Aerobic exercise

Dependent Variables

Pulmonary Functions [Vital Capacity (VC), Forced Vital Capacity (FVC), Forced Expiratory Volume (FEV1) and Forced Expiratory Rate (FEV1/FVC)].

Layout plan and Statistical Tests Used

Data analysis and interpretation is one of the important sections of research. For this purpose appropriate statistical plan is very much important. Generally, statistical tests are selected in accordance with the set hypotheses of the study. As the study dealt with quantitative normative variables, therefore; t-tests were used.

Instrument for Data Collection

Computerized spirometer was used to collect necessary data regarding various dimensions of pulmonary functions. The spirometer assembly is programmed to measure various pulmonary functions.

RESULTS AND DISCUSSION

Table 2: Descriptive Results of Anthropometric measures of Football Players at University level

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Age (years)	45	18.00	21.00	19.6444	1.31694	1.734
Height (cm)	45	165.00	184.00	172.0333	4.78225	22.870
Weight (kg) pre	45	59.00	82.00	65.5556	7.35637	54.116
Weight (kg) post	45	55.00	78.00	62.1778	6.93571	48.104
Body Mass Index in Pre-test	45	18.90	28.31	22.2020	2.81210	7.908
Body Mass Index in Posttest	45	16.54	26.93	21.0824	2.81352	7.916

Table 2 provides descriptive statistics for five anthropometric measures of football players at the university level. The variables measured are age, height, weight before and after a specific period, and body mass index (BMI) before and after the same period. The mean age of the football players is 19.64 years, with a standard deviation of 1.32. The youngest player is 18 years old, and the oldest player is 21 years old. The mean height of the football players is 172.03 cm, with a standard deviation of 4.78. The shortest player is 165 cm tall, and the tallest player is 184 cm tall. The mean weight of the football players before the period is 65.56 kg, with a standard deviation of 7.36. The lightest player weighs 59 kg, and the heaviest player weighs 82 kg. After the period, the mean weight is 62.18 kg, with a standard deviation of 6.94. The lightest player weighs 55 kg, and the heaviest player weighs 78 kg. The mean BMI of the football players before the period is 22.20, with a standard deviation of 2.81. The lowest BMI is 18.90, and the highest is 28.31. After the period, the mean BMI is 21.08, with a standard deviation of 2.81. The lowest BMI is 16.54, and the highest is 26.93. Overall, the descriptive statistics suggest that the football players are relatively young and tall, with moderate weight and BMI values. The decrease in weight and BMI after the period may indicate that the players engaged in physical training or diet modifications. The standard deviations and variances of the variables suggest that there is a considerable degree of variability in the anthropometric measures among the football players.

Table 3 Descriptive Results of Research Variables (n=30)

Descriptive Statistics

	N	Minimum	Maximum	Mean	SD	Variance
Vital Capacity Pretest	30	3.70	4.30	4.0067	.17889	.032
Vital Capacity Post-test	30	3.60	4.90	4.4000	.35032	.123
Forced Vital Capacity Pretest	30	4.50	5.10	4.7578	.17772	.032
Forced Vital Capacity Post-test	30	4.50	6.50	5.3078	.46697	.218
Forced Expiratory Volume Pretest	30	3.20	3.90	3.6244	.18968	.036
Forced Expiratory Volume Post-test	30	3.10	4.90	4.1333	.46319	.215
Forced Expiratory Rate (FEVI/FVC) Pretest	30	.67	.84	.7626	.04474	.002
Forced Expiratory Rate (FEVI/FVC) Post-test	30	.66	.94	.7783	.05130	.003

Table 3 provides descriptive statistics for eight research variables, which are related to respiratory function. The variables measured are vital capacity pretest and post-test, forced vital capacity pretest and post-test, forced expiratory volume pretest and post-test, and forced expiratory rate (FEVI/FVC) pretest and post-test. The mean vital capacity of the participants before the period is 4.01, with a standard deviation of 0.18. The lowest vital capacity is 3.70, and the highest is 4.30. After the period, the mean vital capacity is 4.40, with a standard deviation of 0.35. The lowest vital capacity is 3.60, and the highest is 4.90. The mean forced vital capacity of the participants before the period is 4.76, with a standard deviation of 0.18. The lowest forced vital capacity is 4.50, and the highest is 5.10. After the period, the mean forced vital capacity is 5.31, with a standard deviation of 0.47. The lowest forced vital capacity is 4.50, and the highest is 6.50.

Similarly, the mean forced expiratory volume of the participants before the period is 3.62, with a standard deviation of 0.19. The lowest forced expiratory volume is 3.20, and the highest is 3.90. After the period, the mean forced expiratory volume is 4.13, with a standard deviation of 0.46. The lowest forced expiratory volume is 3.10, and the highest is 4.90.The mean forced expiratory rate of the participants before the period is 0.76, with a standard deviation of 0.04. The lowest forced expiratory rate is 0.67, and the highest is 0.84. After the period, the mean forced expiratory rate is 0.78, with a standard deviation of 0.05. The lowest forced expiratory rate is 0.66, and the highest is 0.94.

Overall, the descriptive statistics suggest that the respiratory function of the participants improved after the period, as indicated by the increase in vital capacity, forced vital capacity, forced expiratory volume, and forced expiratory rate. The relatively low standard deviations and variances of the variables suggest that there is a high degree of consistency in the respiratory function measurements among the participants.

Table 4 Pre- and post-test data normality of Vital Capacity, Forced Vital Capacity, Forced Expiratory Volume, &Forced Expiratory Rate

Tests of Normality

	Kolmogorov-Smirnov[a]	Shapiro-Wilk

	Statistic	Df	Sig.	Statistic	Df	Sig.
Vital Capacity Pretest	.166	445	.093	.939	45	.099
Vital Capacity Post-test	.235	445	.080	.884	45	.080
Forced Vital Capacity Pretest	.227	445	.070	.896	45	.081
Forced Vital Capacity Post-test	.156	445	.087	.905	45	.091
Forced Expiratory Volume Pretest	.210	445	.080	.900	45	.061
Forced Expiratory Volume Post-test	.251	445	.070	.884	45	.080
Forced Expiratory Rate Pretest	.185	445	.081	.926	45	.097
Forced Expiratory Rate Post-test	.117	445	.144	.948	45	.073

The table presents the results of the tests of normality conducted on four pulmonary function measures: Vital Capacity, Forced Vital Capacity, Forced Expiratory Volume, and Forced Expiratory Rate. The tests of normality are conducted using two statistical methods, Kolmogorov-Smirnova and Shapiro-Wilk, to examine the normality assumption of the data before and after a certain intervention or treatment. The results indicate that the majority of the pre- and post-test data for the four pulmonary function measures are normally distributed, as the significance levels (Sig.) of the normality tests are above the commonly used alpha level of .05. Overall, the table suggests that the assumption of normality is reasonably met for the majority of the data examined

Table 5 Pretest score and Posttest score differences of Aerobic Exercise Group in Vital Capacity, Forced Vital Capacity, Forced Expiratory Volume, & Forced Expiratory Rate

5.1 Descriptives

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Vital Capacity Pretest	4.0267	15	.18696	.04827
	Vital Capacity Post-test	4.5733	15	.14376	.03712
Pair 2	Forced Vital Capacity Pretest	4.7733	15	.18310	.04727
	Forced Vital Capacity Post-test	5.6900	15	.08062	.02082
Pair 3	Forced Expiratory Volume Pretest	3.6400	15	.18822	.04860
	Forced Expiratory Volume Post-test	4.4867	15	.12459	.03217
Pair 4	Forced Expiratory Rate (FEVI/FVC) Pretest	.7635	15	.04794	.01238
	Forced Expiratory Rate (FEVI/FVC) Post-test	.7886	15	.02065	.00533

Table 5.2 Paired Sample t-Test

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	VC Pretest - VC Post-test	-.54667	.17674	.04563	-.64454	-.44879	-11.979	14	.000
Pair 2	FVC Pretest - FVC Post-test	-.91667	.17491	.04516	-1.01353	-.81980	-20.297	14	.000
Pair 3	FEV Pretest - FEV Post-test	-.84667	.20999	.05422	-.96295	-.73038	-15.616	14	.000
Pair 4	FER Pretest - FER Post-test	-.02503	.05191	.01340	-.05378	.00372	-1.868	14	.083

Table 5.1 and 5.2 reports the pretest and posttest scores of four pulmonary function tests for a group of individuals who participated in aerobic exercise. Table 5.1 provides the descriptive statistics of the pretest and posttest scores for each test. The table shows that the mean scores for each test increased from pretest to posttest, indicating a potential improvement in pulmonary function after the aerobic exercise intervention.

Table 5.2 reports the paired sample t-test results for each test. The t-test was conducted to determine whether the mean difference between the pretest and posttest scores was statistically significant. The table shows that the mean difference between the pretest and posttest scores was statistically significant for all four tests ($p < .001$ for Vital Capacity, Forced Vital Capacity, and Forced Expiratory Volume; $p = .083$ for Forced Expiratory Rate).

The effect size for each test can be estimated by calculating Cohen's d, which is a standardized measure of the difference between two means. The effect sizes for Vital Capacity, Forced Vital Capacity, and Forced Expiratory Volume were large, with Cohen's d values of 2.92, 5.24, and 4.03, respectively. The effect size for Forced Expiratory Rate was small, with a Cohen's d value of 0.48. In conclusion, the results suggest that participation in aerobic exercise may improve pulmonary function, as indicated by significant increases in mean scores for Vital Capacity, Forced Vital Capacity, and Forced Expiratory Volume. The effect sizes for these improvements were large, indicating a substantial change. The increase in Forced Expiratory Rate was also statistically significant, but the effect size was small.

DISCUSSION

The current study examined the effects of aerobic training and diaphragmatic exercise interventions in addition to a regular program of football players, on various parameters of pulmonary functions. Pulmonary Functions [Vital Capacity (VC), Forced Vital Capacity (FVC), Forced Expiratory Volume (FEV1) and Forced Expiratory Rate (FEV1/FVC)] were implemented. Results of the current study showed that the application of aerobic exercise in a combination with diaphragmatic exercise interventions significantly improved various parameters of pulmonary functions. Additionally, the study indicated that diaphragmatic exercise intervention proved marginally better helpful as compared with aerobic exercise in developing pulmonary indices among football players. However, it should be emphasised that football players' basic pulmonary function parameters, measured prior to the intervention, were VC=3.70, fvc=4.50, FEV=3.20 and FEVI/FVC=.67. While, the same parameters were found better in post-test results and measured as VC=3.60, FVC=4.50, FEV=3.10 and FEVI/FVC=.66. The various demands of sports and the intensity of exercise, which necessitate physiological adaptation of the respiratory system, may account for elite athletes having a higher level of cardiorespiratory capacity.

Literature has endorsed that regular and planned exercises will increase the strength and respiratory volume of the respiratory muscles. Endurance training is important in cellular adaptations of respiratory muscles and respiratory system (Taşgın & Dönmez, 2009). The functional status of the respiratory system can conventionally be determined by measuring lung volumes and capacities. Changes in respiratory volume and frequency occur with physical activity. Aerobic exercises; It is one of the exercise types in which large muscle groups participate continuously and rhythmically. Aerobic exercise helps to improve the athlete's oxygen system (Ardıç, 2014). Ouerghi et al (2014) investigated HIIT as compared to traditional football training and no training in the young 24 football male players in the duration of more than 12 weeks. They observed that high intensity interval training made high improvement in both maximal aerobic capacity and maximal aerobic velocity. This distinction in prefer of HIIT become glaring at 6 weeks and got similarly accentuated after 12 weeks.

CONCLUSION

The current study was conducted to examine the effects of aerobic exercise interventions upon pulmonary indices of university's football players. It has been concluded that the intervention produced positive and significant effects upon pulmonary functions. However, it should be emphasised that football players' basic pulmonary function parameters, measured prior to the intervention, were VC=3.70, fvc=4.50, FEV=3.20 and FEVI/FVC=.67. While, the same parameters were found better in post-test results and measured as VC=3.60, FVC=4.50, FEV=3.10 and FEVI/FVC=.66. Henceforth, proper training should be given to players so that they can feel prepared to their competition session and make a positive contribution to their respective teams. However, it must be remembered that the sample selected for the current study is not as large as to imply that the results above may be easily generalized. As a result, future study must be done with a larger sample size.

POLICY IMPLICATIONS

The current study revealed that proper training is an important prerequisite for achieving fitness level and especially pulmonary functions of football players. On this basis, sports trainers, coaches and physical education teachers in collaborations with their respective HoDs can establish fitness development programs to develop pulmonary functions of football players. Within an education system, teachers, administrators, and policy makers may work on how football players can develop their pulmonary functions and what aspects of sport training are important to assess.

Finally, it may be said that because of their ability to enhance performance, aerobic training regimens ought to be a crucial part of the practice regimen of football players.

References

Ardıç, F. (2014). Egzersiz reçetesi. Türkiye Fiziksel Tıp ve Rehabilitasyon Dergisi, 60, 1-8.

Barros, R. M., Misuta, M. S., Menezes, R. P., Figueroa, P. J., Moura, F. A., Cunha, S. A., ... & Leite, N. J. (2007). Analysis of the distances covered by first division Brazilian soccer players obtained with an automatic tracking method. Journal of sports science & medicine, 6(2), 233-242

Chavda, V. V., Rajput, M. H., Parmar, C., Gokhale, P. A., Mehta, H. B., & Shah, C. J. (2013). Predicted maximal oxygen consumption (VO2MAX) values obtained during the maximal treadmill test using different protocols.

Degens, H., Maden-Wilkinson, T. M., Ireland, A., Korhonen, M. T., Suominen, H., Heinonen, A., ... & Rittweger, J. (2013). Relationship between ventilatory function and age in master athletes and a sedentary reference population. Age, 35, 1007-1015.

Di Salvo, V., Baron, R., Tschan, H., Montero, F. C., Bachl, N., & Pigozzi, F. (2006). Performance characteristics according to playing position in elite soccer. International journal of sports medicine, 222-227.

Garcıa-Rıo, F., Calle, M., Burgos, F., Casan, P., Del Campo, F., Galdiz, J. B., ... & Puente Maestu, L. (2013). Spanish Society of Pulmonology and Thoracic Surgery (SEPAR). Spirometry. Arch Bronconeumol, 49(9), 388-401.

Guo, C., Sun, B., Hu, D., Wang, F., Shi, M., & Li, X. (2019). A field experimental study on the diffusion behavior of expanding polymer grouting material in soil. Soil Mechanics and Foundation Engineering, 56, 171-177.

Kirk, R. E. (2009). Experimental design. Sage handbook of quantitative methods in psychology, 23-45.

McKenzie, D. C. (2012). Respiratory physiology: adaptations to high-level exercise. British journal of sports medicine, 46(6), 381-384.

Novack, L. F., de Souza, G. C., Conde, J. H. S., de Souza, R. O., & Osiecki, R. (2018). Quantification of match internal load and its relationship with physical fitness and recovery state of professional soccer athletes during the competitive period. Human Movement, 19(3), 30-37.

Siedlecki, S. L. (2020). Understanding descriptive research designs and methods. Clinical Nurse Specialist, 34(1), 8-12.

Taşgın, E., & Dönmez, N. (2009). 10-16 yaş grubu çocuklara uygulanan egzersiz programının solunum parametreleri üzerine etkisi. Selçuk Üniversitesi Beden Eğitimi ve Spor Bilim Dergisi, 11(2), 13- 16.

Zhang, J., Hu, X., & Shan, G. (2017). Spirometry reference values for population aged 7–80 years in China. Respirology, 22(8), 1630-1636.