EFFECTS OF TYPE SPORTS ON PULMONARY FUNCTION TESTS: A COMPARATIVE STUDY IN NEPALESE SETTINGS

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Abstract:

Introduction: Due to regular exercises, athletes tend to have an increase in pulmonary capacity when compared to non-exercising individuals. Intensity and severity of sports engaged in by the athletes probably determines the extent of strengthening of the inspiratory muscles with a resultant increase in the pulmonary functions.\(^1\),\(^2\) So, this study has been carried out to establish a relationship between the type of sports and pulmonary functions in Nepalese athletes.

Methods: This study has adopted a cross sectional observational comparative research design. Spirometry was conducted in 84 different national level athletes [25.71 (± 4.55) years]. The athletes were from five different sport groups. Out of them, there were 16 weight lifters, 41 footballers, 10 swimmers, 8 marathon runners and 9 sprinters. Among them weight lifters, marathoners and sprinters were selected from the National sports council, Triputeshower, Kathmandu and footballers and swimmers were from the Nepal army club, Kathmandu, Nepal.

The spirometry was done in sitting position using MIR SPIROLAB II spirometer based on American Thoracic Society (ATS) recommendations. Pulmonary function was assessed based on Forced Expiratory Volume in first second (FEV\(_1\)), Forced Vital Capacity (FVC) and Peak Expiratory Flow Rate (PEFR) expressed as percent predicted for the age, sex, height, weight and race.

Results: When comparing the mean values of FVC, FEV\(_1\) and PEFR among the five different sport groups, as expected, athletes who have more strenuous respiratory muscles exercise had significantly superior pulmonary function parameters. For example weight lifters and swimmers had 111.84 and 109.56 percentage of predicted values on FVC (P=0.008) respectively. But marathoners, footballers and sprinters had 105.83, 99.25 and 98.34 percentage of predicted values respectively. Similarly, weight lifters, swimmers, marathoners, footballers and sprinters had 110.63, 110.15 and 110.28, 102.52 and 99.23 percentages of predicted values on FEV\(_1\) (p=0.090) respectively. Swimmers, marathoners, footballers, weight lifters and sprinters had 106.03 and 107.34, 104.37, 102.08 and 86.58 percentage of predicted values on PEFR (p=0.027) respectively.

Conclusion: Athletes who have most strenuous respiratory muscle exercise like swimming and weight lifting have better pulmonary function tests (PFTs) compared to other athletes like sprinters who have less strenuous muscle exercise.

Key words: athletes, FEV\(_1\), FVC, and PEFR, pulmonary function test

Introduction:

Pulmonary function is governed by genetic, environmental and nutritional factors and confirms that physical training during growth help in developing a greater endurance in respiratory muscles. Lung size may increase by a strenuous and prolonged strength training
regimen during adolescence.\textsuperscript{3} significant
difference in pulmonary functions is found
among types of athletic training. Swimmers
have better pulmonary functions because in
swimming the load of water pressure against the
chest wall and elevated airway resistance as the
result of immersion causes increase in the
exercise of respiratory muscles.\textsuperscript{4, 5} American
athletes have superior lung volumes compared
to Indian athletes, because of athletic training
from the childhood in American athletes.\textsuperscript{6} Vital
capacity of Indians is lower than that of
Caucasians, but the age related decline is much
greater for caucacians.\textsuperscript{7}

Besides sedentary lifestyles, respiratory
performance is affected by various factors like
air pollution.\textsuperscript{7} Ethnic variations as well as the
variation in age, body size and level of physical
fitness influence the pulmonary function tests.\textsuperscript{8}
Pulmonary function shows variation owing to
differences in growth and because of the
possibility that those subjects would not have
reached their adult weight for body mass index
(BMI).\textsuperscript{9} Pulmonary function values in health are
also influenced by some unknown variables and
there are wide ranges of normalcy.\textsuperscript{9, 10, 11}

Training improves physical working capacity. A
trained sportsman has a resting bradycardia and
a greater maximum O\textsubscript{2} consumption ability
(VO\textsubscript{2}max) but small percentages of athletes
develop exercise induced bronchospasm and
thereby reduced PFTs.\textsuperscript{9, 11}

Methods:

This is the cross sectional observational
comparative study. Spirometry was conducted in 84 [mean age 25.71 (± 4.55) years] national
level athletes from different sports. The athletes
were from five different sport groups. Out of
them, 16 were weight lifters, 41 were
footballers, 10 were swimmers, 8 were
marathon runners and 9 were sprinters. Among
them weight lifters, marathoners and sprinters
were selected from the National Sports Council,
Tripureshower, Kathmandu and footballers and
swimmers were from the Nepal Army Club,
Kathmandu, Nepal. Data was collected based on
ATS questionnaires. The athletes were selected
based on the mutually exclusive and non-
overlapping sampling technique. Those athletes
failing to perform the test successfully and those
having respiratory or cardiovascular diseases
according to the ATS questionnaires and
smokers were rejected from the study. Before
having a spirometry performed, subjects were given
instructions about the procedures and side effects of
the test. The subjects were recommended not to wear
tight clothing that may interfere or make it difficult
to take a deep breath. And they were also requested
not to eat a large meal, drink alcohol, or do vigorous
exercise for a few hours before the test.

The person being tested was asked to take in a
full breath and then seal his lips around the
mouthpiece of the spirometer. The person then
had to blow out as hard and fast as possible for
at least six seconds, which is the approximate
time it takes for normal lungs to empty. A nose
clip was applied to ensure no air escapes from
the nose. This routine was repeated at least three
times to ensure that the test was done correctly
and to ensure accuracy of the results. Pulmonary
function was assessed based on FEV\textsubscript{1}, FVC and
PEFR expressed as percent predicted for the
age, sex, height, weight and race.

Spirometry was conducted in sitting position
using MIR SPIROLAB II spirometer based on
ATS recommendations. During the procedure
the mean temperature and relative humidity in
the city of Kathmandu was 22\textdegree C and 96% respectively. Body temperature and pressure
saturation (BTPS) was autocorrected by the
MIR SPIROLAB II spirometer. Statistical
analysis: Non probability purposive judgment
sampling method was used for this study.
Analysis of variance (ANOVA) was used for
inter-sport group’s comparison.
Results:

When comparing the mean values of FVC, \( FEV_1 \) and PEFR among the different sport groups, as expected, athletes who have more strenuous respiratory muscles exercise had significantly superior pulmonary function parameters. Weight lifters, swimmers and marathoners had 111.84, 109.56 and 105.83 percentage of predicted values on FVC \((P=0.008)\) respectively. Footballers and sprinters had 99.25 and 98.34 percentage of predicted values respectively. Weight lifters, swimmers and marathoners had 111.84, 109.56 and 110.28 percentages of predicted values on \( FEV_1 \) \((p=0.090)\) respectively. Footballers and sprinters had 102.52 and 86.58. Swimmers and marathoners had highest recordings, 106.03 and 107.34 percentage of predicted values on PEFR \((p=0.027)\) respectively and footballers had 104.37, and weight lifters had 102.08 percentages of predicted values. But sprinters had 86.58, the lowest value recorded.

Comparison of mean percentage predicted values on FVC, \( FEV_1 \) and PEFR

A statistically significant differences were found among the five different groups of athletes in FVC % of predicted, \( F(4, 79)=3.743, p=0.008 \), and in PEFR% of predicted, \( F(4, 79)=2.895, p=0.027 \) but the difference was not significant in \( FEV_1 \) % predicted \( F(4, 79)=2.087, p=0.090 \).

Discussion:

Out of the five sport groups, weight lifters and swimmers had the highest initial lung parameters (FVC and \( FEV_1 \)). This is expected because in swimming, there is strenuous exercise of the respiratory muscles because the load of the water pressure against the chest wall and elevated airway resistance as the result of immersion could comprise a conditioning stimulus as well as the requirement that inspirations must occur rapidly from functional residual capacity during short intervals between strokes. Similarly, weight lifters have strong body muscles including the respiratory muscles.
resulting higher pulmonary functions. Sprinters had lower pulmonary parameters (FVC, FEV1, PEFR) compared to the athletes from other sports because short running practice does not improve respiratory muscles strength.

Doherty M, Dimitriou L in British journal of sports medicine 1997 state that running does not improve respiratory muscles strength but in this study pulmonary parameters (FVC, FEV1, and PEFR) have been recorded higher in marathon runners probably because of the cross sectional nature of the present study and the results cannot exclude some factors like training hours, genetic endowment, sample size etc. The result of this study concludes that the type of sports determines the pulmonary functions.

Athletes who have strenuous respiratory muscles exercise have better pulmonary function tests than those who have less strenuous muscle exercise. But other longitudinal studies are recommended to study about the changes in respiratory muscle strength in relation with time, training patterns (training duration, intensity) and contribution of genetic factor.

References:


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