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EXTENDED ABSTRACT

Sport-Specific Impacts on Pulmonary Function: A Comparative Analysis of Swimmers and Long-Distance Runners

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I. Introduction

This study compares pulmonary function of FVC, FEV1, and PEF, between trained swimmers and long-distance runners to investigate sport-specific respiratory adaptations [1]. Despite existing research in isolated domains, limited comparative data hinders cross-sport understanding. This analysis aims to clarify how training environments and respiratory demands influence lung capacity, contributing to optimized endurance training programs [2].

II. Methods

Thirty-six Sukma-level athletes (13–21 years; 18 swimmers, 18 runners; balanced by gender) were assessed using Schiller PC Spirometry SP-250. FVC, FEV1, and PEF values were analyzed. Independent t-tests compared group differences; normality was checked using the Shapiro-Wilk test. Descriptive statistics and Cohen's d quantified effect size, with significance set at $p < 0.05$.

III. Results and Discussion

A. FVC Comparison

Swimmers had significantly higher FVC (3.92 L) than runners (2.59 L), $p < 0.001$, *Cohen's d* = -2.21. This suggests that aquatic training induces greater lung volume due to breath-holding, resistance, and controlled breathing, supporting superior inspiratory development in swimmers as a sport-specific respiratory adaptation.

B. FEV1 Comparison

Swimmers recorded greater FEV1 (3.24 L) than runners (2.19 L), $p < 0.001$, $d = -1.91$. This indicates stronger respiratory muscles in swimmers, likely due to repetitive underwater breath control and rapid exhalation, essential for efficient gas exchange during stroke cycles and enhancing overall respiratory efficiency.

C. PEF Comparison

PEF was significantly higher in swimmers (5.23 L/min) than runners (3.52 L/min), $p = 0.002$, $d = -1.10$. The higher peak flow reflects stronger expiratory power, likely from water resistance and forced exhalation training during swimming, contributing to more forceful and rapid ventilation capacity.

D. Lung Capacity and Endurance

A positive correlation was found between pulmonary function and endurance performance, particularly in swimmers. This highlights the training benefits of breath control and resistance breathing, suggesting water-based methods may enhance endurance in land-based athletes and inform training or athlete selection in endurance sports.

Table I
Demographic Descriptive

Variables	Swimmers	Runners
Sample Size (*N*)	18(10M,8F)	18(11F,7M)
Mean Age (*Years*)	15.00 ± 1.24	14.72 ± 1.53
Height (CM)	166.17 ± 5.96	157.61 ± 11.30
Weight (*KG*)	57.83 ± 6.71	41.72 ± 9.05

**Demographic descriptive for swimmers and runners*.

Table II
Results for Swimmers and Runners

Assessment	Swimmers	Runners
FVC (*L*)	3.01 ± 5.05	1.48 ± 3.75
FEV1 (*L*)	2.27 ± 4.20	0.93 ± 3.13
FEV1/FVC%	70 ± 99	63 ± 95
PEF (*L/MIN*)	2.51 ± 8.55	0.96 ± 8.35

**Mean and range for swimmers and runners*.

A. Forced Vital Capacity (FVC)

Fig. 1 Forced Vital Capacity (FVC) distribution in swimmers shows an upward shift compared to controls, indicating greater total lung capacity and enhanced ability to inhale and exhale larger air volumes.

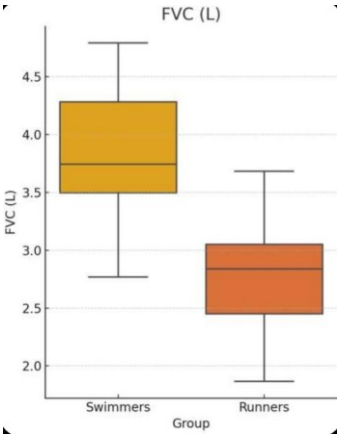

Fig. 1 The comparison of FVC between swimmers and runners.

B. Forced Expiratory Volume in 1 Second (FEV1)

Fig. 2 Swimmers exhibit elevated FEV1 values, indicating a greater volume of air exhaled in the first second, suggestive of stronger and more efficient respiratory musculature.

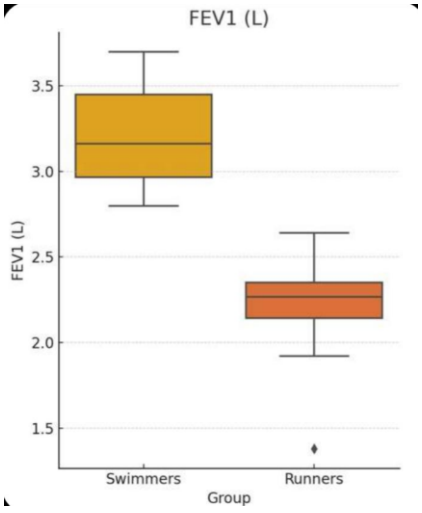

Fig. 2 The comparison of FEV1 between swimmers and runners.

C. Peak Expiratory Force (PEF)

Fig. 3 Swimmers demonstrate significantly higher Peak Expiratory Flow (PEF), reflecting enhanced ability to expel air rapidly, likely a result of breath-hold and water resistance training adaptations.

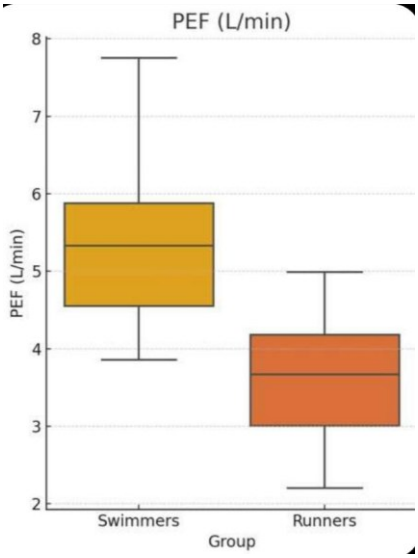

Fig.3 The comparison of PEF between swimmers and runners.

IV. Conclusions

Swimmers demonstrated significantly greater pulmonary function than runners, with FVC, FEV1, and PEF all showing large effect sizes. These findings highlight sport-specific respiratory adaptations and suggest breath-controlled, resistance-based training can enhance lung capacity, potentially improving endurance outcomes across athletic disciplines.

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References

[1] Sable, M., Vaidya, S. M., & Sable, S. S. (2012). Comparative study of lung functions in swimmers and runners. *Indian Journal of Physiology and Pharmacology*, 56(1), 100–104. Retrieved from https://pubmed.ncbi.nlm.nih.gov/23029972/.

[2] Armour, J., Donnelly, P. M., & Bye, P. T. (1993). The large lungs of elite swimmers: an increased alveolar number? *European Respiratory Journal*, 6(2), 237–247. Retrieved from https://pubmed.ncbi.nlm.nih.gov/8444296/.

[3] R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, "High-speed digital-to-RF converter," U.S. Patent 5 668 842, Sept. 16, 1997.