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EFFECT OF AEROBIC EXERCISE VS AEROBIC-RESISTANCE EXERCISE ON LUNG FUNCTION AND NICOTINE DEPENDENCE IN YOUNG ADULT SMOKERS – AN EXPERIMENTAL STUDY

Physiotherapy

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ABSTRACT

Background: Cigarette smoking is a major risk factor for cardiovascular disease and premature mortality, contributing to impaired lung function—reflected in reduced FEV1, FVC, and FEV1/FVC ratio—and increased nicotine dependence as indicated by higher FTND scores. While smoking cessation is crucial, it is often challenging due to withdrawal symptoms and cravings. Exercise, particularly aerobic and resistance training, has shown potential to enhance pulmonary function and reduce nicotine dependence. However, there is limited evidence on the combined effect of aerobic-resistance exercise with smoking cessation. This study aims to evaluate its impact on lung function and nicotine dependence in young adult smokers. **Aim:** Investigate the effect of Aerobic Exercise vs Aerobic-Resistance Exercise on Pulmonary Function and Nicotine Dependency in Young Adult Smokers. **Methodology:** 32 participants were recruited and divided into Group A (Aerobic Exercise + Smoking Cessation) and Group B (Aerobic-Resistance Exercise + Smoking Cessation). The intervention was administered 5 days/week for 6 weeks. Pre and post-intervention data were collected and analyzed using Microsoft 360 (paired and unpaired t-tests). **Result:** Both groups showed significant improvements. However, Group B demonstrated more pronounced enhancements in FEV1 and FVC, as well as a greater reduction in nicotine dependence. **Conclusion:** Aerobic-resistance exercise significantly improves pulmonary function and reduces nicotine dependence more effectively than aerobic exercise alone in young adult smokers.

KEYWORDS

Aerobic Exercise, Aerobic-Resistance Exercise, Nicotine Dependence, Pulmonary Function.

INTRODUCTION

Cigarette smoking is a major modifiable risk factor for cardiovascular and respiratory diseases and remains one of the most significant public health challenges worldwide. According to the World Health Organization (WHO), In 2020, 22.3% of people worldwide smoked, with 36.7% of males and 7.8% of women using tobacco. India ranks as the second-largest consumer and the third-largest producer of tobacco in the world. The increasing prevalence of smoking among youth is alarming, especially as tobacco addiction often starts during adolescence or early adulthood.

Young smokers are particularly vulnerable due to the early onset of physiological deterioration caused by tobacco smoke. This includes decreased pulmonary function, systemic inflammation, increased oxidative stress, and impaired immune responses. Lung function parameters such as Forced Expiratory Volume in 1 second (FEV1), Forced Vital Capacity (FVC), and FEV1/FVC ratio are commonly used to assess respiratory health. These parameters are significantly lower in smokers compared to non-smokers.

Nicotine, the addictive substance in tobacco, exerts its effects by binding to nicotinic acetylcholine receptors (nAChRs) in the central nervous system. This action triggers a cascade of neurotransmitter releases, leading to pleasurable sensations and psychological dependence. Over time, tolerance and physical dependence develop, making smoking cessation a complex and challenging process. Withdrawal symptoms such as irritability, anxiety, craving, and difficulty concentrating often hinder efforts to quit.

Traditional approaches to smoking cessation include behavioral counseling, pharmacotherapy (e.g., nicotine replacement therapy), and cognitive behavioral strategies. However, these strategies may not be universally effective, and there is growing interest in incorporating lifestyle modifications such as physical activity to enhance cessation outcomes.

Exercise, particularly aerobic and resistance training, has shown promise as an adjunctive therapy. Aerobic exercises improve cardiorespiratory fitness, enhance lung ventilation, reduce inflammation, and alleviate withdrawal symptoms. Resistance exercises, on the other hand, improve muscular strength, posture, and thoracic expansion, which collectively contribute to better respiratory mechanics.

Combined aerobic-resistance training may offer synergistic benefits by simultaneously targeting cardiovascular and musculoskeletal systems. Despite the established individual benefits of aerobic and resistance exercises, there is limited evidence comparing their combined effects on lung function and nicotine dependence in young adult smokers.

This study aims to bridge this gap by evaluating the impact of aerobic versus aerobic-resistance exercise, along with standardized smoking cessation counselling, on improving pulmonary function and reducing nicotine dependence in young adult smokers.

MATERIALS & METHODOLOGY

Study Design: Experimental study conducted over a period of 10–12 months.
Population: 32 young adult smokers aged 18–26 years residing in Vadodara.
Sampling Method: Convenience sampling
Intervention Duration: 6 weeks, 5 sessions/week

Inclusion Criteria
- Regular smoking of 3–5 cigarettes/day for at least 1 year
- FTND score indicating low to moderate nicotine dependence
- Willingness to participate and provide informed consent

Exclusion Criteria
- Presence of comorbidity cardiopulmonary diseases
- Former or occasional smokers

Intervention Protocols:
Grouping:
- Group A: Aerobic exercise + Smoking cessation counselling
- Group B: Aerobic + Resistance exercise + Smoking cessation counselling

Group A: Aerobic exercise through brisk walking or treadmill walking (30–45 minutes/session) at moderate intensity (RPE 12–14).
Group B: Combination of brisk walking (15 minutes) and resistance training (15 minutes) involving major upper limb muscles with progression from yellow to red resistance bands.

Warm-up and Cool down training for 10 min each.

Smoking Cessation Counselling: Delivered using the 5A's (Ask, Advise, Assess, Assist, Arrange) and 5R's (Relevance, Risk, Rewards, Roadblocks, Repetition) framework recommended by the Ministry of Health and Family Welfare, India.

Outcome Measures:
- Pulmonary Function Test: FVC, FEV1, FEV1/FVC ratio.
- Fagerström Test for Nicotine Dependence (FTND).

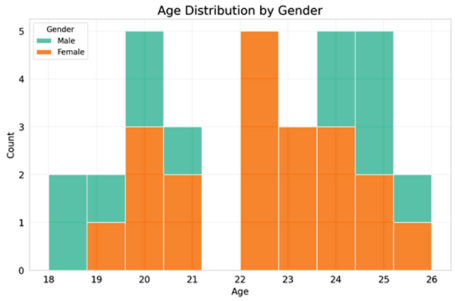
STATISTICS AND RESULTS

Statistical Analysis: Data were analyzed using Microsoft Excel 360.

Paired t-tests were used for within-group comparisons and unpaired t-tests for between-group comparisons. A p-value <0.05 was considered statistically significant.

RESULTS

Demographics: The study population had a mean age of approximately 21.5 years. Males constituted 37.5% of the participants(n=12), while females accounted for 62.5% (n=20).



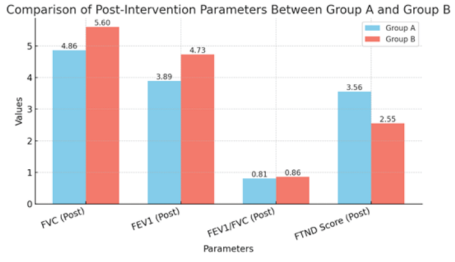
Pulmonary Function Outcomes:

Both groups showed significant improvements in FVC and FEV1 values post-intervention.

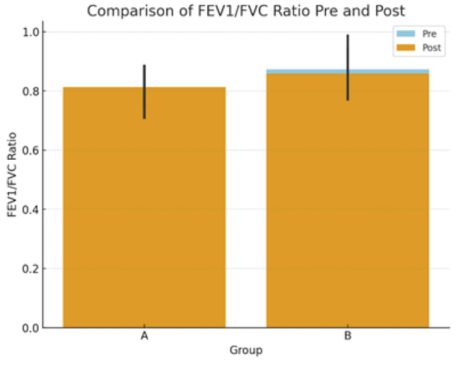
Parameter	GROUP A	GROUP B	t- value	p - value	Significance
FVC (Post)	4.86 ± 0.56	5.60 ± 0.75	3.16	0.0037	Significant
FEV1 (Post)	3.89 ± 0.47	4.73 ± 0.61	-4.34	0.00015	Highly Significant
FEV1/FVC (Post)	0.812 ± 0.147	0.858 ± 0.168	-0.83	0.416	Not Significant (NS)
FTND Score (Post)	3.56 ± 2.22	2.55 ± 1.38	1.55	0.132	Not Significant

Graphical Results:

1. Post Intervention Comparison Between Groups.



2. Clustered Bar Graph-Comparison of FEV1/FVC Pre & Post Between the Groups.



These results suggest that combining resistance exercises with aerobic training significantly enhances pulmonary outcomes and reduces nicotine dependence more effectively than aerobic training alone.

DISCUSSION

The present study demonstrated that both aerobic and aerobic-resistance exercises positively influence pulmonary function and nicotine dependence among young adult smokers. The findings are consistent with previous research suggesting the efficacy of physical activity in enhancing respiratory health and facilitating smoking cessation.

Participants in Group B (aerobic-resistance) exhibited greater improvement in lung function parameters, indicating that resistance training plays a critical role in optimizing respiratory mechanics. The targeted strengthening of respirator and upper extremity muscles likely contributed to improved ventilation and gas exchange efficiency.

Additionally, the psychological benefits of resistance training—such as enhanced self-esteem, reduced stress, and better mood—may have compounded the impact of aerobic activity in reducing withdrawal symptoms. Group B participants also demonstrated a more substantial decrease in FTND scores, suggesting a reduced dependency on nicotine. This effect may be due to improved physical well-being, increased endorphin release, and enhanced motivation to quit smoking.

These outcomes reinforce that while aerobic exercise offers substantial benefits, the integration of resistance training results in a more holistic improvement in both physiological and psychological domains. The current findings highlight the potential for exercise-based interventions to complement standard smoking cessation strategies.

It is also noteworthy that the structured format of the exercise sessions, supervised implementation, and motivational counselling contributed to higher adherence and completion rates. This suggests the feasibility and practicality of implementing similar programs in clinical and community settings.

Limitations & Future Scope

Limitations: The present study, though insightful, was limited by a relatively small sample size, which may affect the generalizability of the findings to broader populations. The intervention period was limited to six weeks, which may not have been sufficient to capture the long-term effects of the exercise regimens on pulmonary function and nicotine dependence. Moreover, the study relied on self-reported data for smoking habits and adherence to the intervention, which may introduce recall or reporting bias. The absence of biochemical verification methods, such as nicotine levels, also limits the objective assessment of nicotine reduction. Additionally, the study population was restricted to a specific geographic and age group, which may not represent diverse smoker demographics.

Future Scope: Future research should aim to include larger and more diverse sample sizes. The use of biochemical markers, such as blood or urinary nicotine levels, inflammatory markers (CRP) could provide a objective measure of nicotine consumption. Longitudinal studies are needed to evaluate the sustainability of pulmonary improvements and smoking cessation outcomes beyond the six-week time-frame. The integration of digital tools, including wearable fitness trackers and mobile health apps, may offer innovative ways to monitor adherence, personalize exercise prescriptions, and enhance participant engagement in future interventions.

Clinical Implications

Structured aerobic-resistance exercise programs can be integrated into smoking cessation protocols to improve adherence, motivation, and clinical outcomes. Physiotherapists play a vital role in promoting pulmonary rehabilitation and should incorporate exercise counselling as part of Smoking cessation therapy.

Summary

This experimental study evaluated the effect of aerobic vs. aerobic-resistance exercise on lung function and nicotine dependence in young adult smokers. Over a 6-week period, both groups demonstrated significant improvements. Group B (aerobic-resistance) showed superior outcomes in FVC, FEV1, and FTND scores. These findings support the inclusion of combined exercise regimens alongside behavioural counselling for optimal respiratory and smoking cessation outcomes.

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