



DIFFERENCES IN PEAK EXPIRATORY FLOW RATE AND PERCENT BODY FAT BETWEEN MIDDLE-AGED INDIVIDUALS PARTICIPATING IN DIFFERENT EXERCISE PATTERNS

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Abstract

Middle age can be described as a vulnerable phase in which unfavorable shifts in body composition and pulmonary function significantly increase the likelihood of developing chronic non-communicable diseases. The present study examined differences in percent body fat and peak expiratory flow rate (PEFR) among middle-aged individuals following distinct exercise patterns in Shivamogga, Tumkuru and Chickmagalur districts. A total of 140 participants aged 35–50 years were purposively selected and categorized into four groups: yoga practitioners, gym training participants, intermittent exercise practitioners, and a passive lifestyle group ($n = 35$ in each group). Percent body fat and PEFR were measured using standard procedures. The yoga, gym, and intermittent exercise groups showed lower mean percent body fat (24.52%, 25.99%, and 26.50%, respectively) compared with the passive lifestyle group (29.08%). Correspondingly, PEFR was higher in the active groups (92.53 L/min, 91.21 L/min, and 86.53 L/min) than in the passive group (66.29 L/min). One-way ANOVA revealed significant between-group differences for both percent body fat ($F = 8.83$, $p < .001$) and PEFR ($F = 14.67$, $p < .001$). These findings suggest that regular engagement in structured exercise, particularly yoga and gym training, is associated with more favorable body

composition and lung function in middle-aged adults.

Keywords: Yoga, Gym Training, Intermittent Exercise, Peak Expiratory Flow Rate, Percent Body Fat and Middle-Aged Adults.

Introduction

Middle age can be described as a vulnerable phase in which unfavorable shifts in body composition and pulmonary function significantly increase the likelihood of developing chronic non-communicable diseases (Ajmani et al., 2019). Rising physical inactivity and sedentary behavior promote excess adiposity, which is closely linked with impaired lung function, including reductions in peak expiratory flow rate (PEFR) and other spirometric indices (Steele et al., 2009; Wannamethee et al., 2005). Regular engagement in structured physical activity such as yoga, gym-based resistance and aerobic training, and intermittent or interval-type exercise is consistently reported to enhance body composition and improve pulmonary function across diverse populations (Chodzko-Zajko Ross & Thomas, 2010).

Yoga, which integrates postures, breathing exercises (pranayama), and relaxation or meditation, has been shown to increase respiratory muscle strength, expand chest wall mobility, and improve ventilatory efficiency, thereby producing favorable changes in PEFR,



forced vital capacity (FVC), and forced expiratory volume (FEV1) (Madhavi & Ganaraja, 2024). Gym-based exercise and intermittent exercise typically combine aerobic and resistance components, contributing to reductions in body fat and improvements in cardiorespiratory fitness and lung function parameters, including dynamic lung volumes and flow rates (Ross et al., 2015). Nevertheless, direct comparative evidence examining yoga, gym training, intermittent exercise, and passive lifestyle patterns within a single middle-aged cohort remains limited, particularly in Indian settings (Ajmani et al., 2019).

Within Karnataka, where traditional yoga practice coexists with widespread availability of modern fitness centers, it becomes particularly relevant to explore how distinct exercise patterns are associated with key health markers such as percent body fat and PEFr in middle-aged adults (Ajmani et al., 2019). Clarifying these relationships can assist physical education professionals, clinicians, and policymakers in formulating targeted exercise prescriptions and public-health strategies aimed at optimizing body composition and respiratory health in individuals aged 35–50 years (Chodzko-Zajko et al., 2009).

Methodology

The purpose of the study was to investigate the extent to which different habitual exercise patterns—yoga, gym training, and intermittent exercise—are associated with differences in percent body fat and peak expiratory flow rate among middle-aged individuals in Karnataka, when compared with peers leading a passive lifestyle. A total of 140 middle-aged individuals from Shivamogga, Tumkuru and Chickmagalur districts were purposively selected as subjects. Their age ranged from 35 to 50

years. The participants were assigned into four groups of 35 subjects each:

Quasi-Exp. Group I: Yoga (N=35)

Quasi-Exp. Group II: Gym (Weight Trg.) (N=35)

Quasi-Exp. Group III: Intermittent Ex. (N=35)

Control Group: Passive Lifestyle (N=35)

All participants were free from acute respiratory illness and major cardiovascular or musculoskeletal conditions that would contraindicate exercise testing, as per self-report and basic screening.

In this context, the yoga group comprised participants engaged in regular, structured sessions that included asanas, pranayama, and relaxation or meditation several times per week, a pattern consistent with earlier interventions showing reductions in body fat and improvements in pulmonary function indices (Vedala et al., 2014; Chahal et al., 2023).

The gym training group regularly attended fitness centers and performed combined resistance and aerobic exercises using weight machines, free weights, and cardiovascular equipment, mirroring established gym-based programs known to enhance body composition and cardiorespiratory performance (Ross et al., 2015).

The intermittent exercise group primarily engaged in interval-like activities, such as bouts of brisk walking, jogging, or intermittent-effort sports on multiple days per week, aligning with evidence that intermittent or interval training can improve PEFr and body mass-related indices (Ajmani et al., 2019).

By contrast, the passive lifestyle group reported minimal planned physical activity and predominantly sedentary daily routines, a pattern consistently associated with higher adiposity and reduced lung function (Steele et al., 2009; Wannamethee et al., 2005).



Omron Karada Body Scanner for Percent Body Fat:

The Omron Karada Body Scanner uses bioelectrical impedance analysis (BIA) to estimate percent body fat. A weak electrical current passes through the body via hand and foot electrodes; body fat resists the current more than lean tissue, allowing calculation of body fat percentage based on impedance, height, weight, age, and gender. Enter personal data (age, gender, height) via the display unit. Barefoot, step onto foot electrodes with weight evenly distributed; grasp hand electrodes and extend arms at 90° to body. Results display body fat percentage (classified as low/normal/high/very high), alongside BMI, visceral fat, and skeletal muscle.

Spirofy Equipment for Peak Expiratory Flow Rate (PEFR):

Spirofy is a portable spirometer that measures PEFR using a turbine-based flow sensor with a central mesh for linear flow detection across rates, capturing peak flow alongside FEV1, FVC, and FEF25-75. Calibrate device with 3L syringe at slow, medium, fast flows until "Ready for Test." Instruct subject: Sit upright or stand; apply nose clips; inspire maximally to total lung capacity (pause ≤ 2 seconds). Expire forcefully, rapidly, and completely into mouthpiece until no air remains (avoid initial inhalation errors). Three acceptable maneuvers were repeated and highest PEFR (L/min) was recorded. The app enabled report printing/sharing.

Mean and standard deviation were calculated for percent body fat and PEFR in each group. One-way analysis of variance (ANOVA) was applied to determine whether there were significant differences among the four groups for each variable. When significant F-ratios were observed, post-hoc comparisons were be employed (LSD), although the provided data primarily included the omnibus ANOVA

results. Similar statistical approaches are reported in related literature examining exercise and yoga effects on PEFR and body composition.

Findings

The raw data was subjected to suitable statistical techniques and the results are given in following tables.

TABLE 1.
DESCRIPTIVE RESULTS OF PERCENT BODY FAT AND
PEAK EXPIRATORY FLOW RATE IN MIDDLE AGED
INDIVIDUALS PARTICIPATING IN DIFFERENT
EXERCISE PATTERNS

Exercise Patterns	Percent Body Fat (Mean \pm SD)	Peak Expiratory Flow Rate (Mean \pm SD)
Yoga	24.52 \pm 2.82	92.53 \pm 13.82
Gym training	25.99 \pm 4.90	91.21 \pm 17.47
Intermittent exercise	26.50 \pm 3.40	86.53 \pm 18.85
Passive lifestyle	29.08 \pm 3.71	66.29 \pm 23.73

The results indicate that the Yoga Group recorded the lowest mean percent body fat, followed by the Gym Training Group and the Intermittent Exercise Group. The Passive Lifestyle Group showed the highest percent body fat, indicating poor body composition due to physical inactivity. Further, the findings reveal that the Yoga Group attained the highest PEFR values, followed closely by the Gym Training Group. The Passive Lifestyle Group exhibited the lowest PEFR, reflecting reduced pulmonary efficiency. In order to realize the objectives of the study, One way Analysis of Variance was employed to examine the differences in percent body fat and Peak Expiratory Flow Rate of middle aged individuals pursuing different exercise patterns. The results are provided in table 2 as below.



TABLE 2.
 SUMMARY OF ANOVA FOR DIFFERENCE IN PERCENT
 BODY FAT AND PEAK EXPIRATORY FLOW RATE IN MIDDLE
 AGED INDIVIDUALS PARTICIPATING IN DIFFERENT
 EXERCISE PATTERNS

Variables	Source	Sum of squares	df	Mean Square	F	p
Percent Body Fat	Between Groups	378.908	3	126.303	8.828	.000
	Within Groups	1945.771	136	14.307		
	Total	2324.679	139			
Peak Expiratory Flow Rate	Between Groups	15566.277	3	5188.759	14.668	.000
	Within Groups	48111.143	136	353.758		
	Total	63677.420	139			

From table 2 it is evident that there is significant difference in percent body fat between Yoga (24.52 ± 2.82), Gym training (25.99 ± 4.90), intermittent training (26.50 ± 3.40) and control groups (29.08 ± 3.71) under investigation. Similarly, the peak expiratory flow rate significantly differed between Yoga (92.53 ± 13.82), Gym training (91.21 ± 17.47), intermittent training (86.53 ± 18.85) and control groups (66.29 ± 23.73) under investigation.

In order to assess group wise differences in percent body fat, Least Significant Difference post hoc test was employed and the results are presented in table 3 as below.

TABLE 3.
 SUMMARY OF POST HOC TEST ON GROUP WISE
 DIFFERENCES IN PERCENT BODY FAT BETWEEN
 THE THREE EXERCISING GROUPS.

Exercising groups	Mean Difference (I-J)	Sig.
Yoga Grp. (24.52 ± 2.82)	Gym Training Grp. (25.99 ± 4.90)	1.47
	Intermittent EX. Grp. (26.50 ± 3.40)	1.98*
	Passive Lifestyle Grp. (29.08 ± 3.71)	4.55*
Gym Training Grp. (25.99 ± 4.90)	Intermittent Ex. Grp. (26.50 ± 3.40)	0.50
	Passive Lifestyle Grp. (29.08 ± 3.71)	3.08*
Intermittent Ex. Grp. (26.50 ± 3.40)	Passive Lifestyle Grp. (29.08 ± 3.71)	2.57*

* Significant at 0.05 significance level.

From table 3 it is evident that there is significant difference in percent body fat between Yoga group and intermittent exercise group; and Yoga group and passive lifestyle group under investigation. Similarly, there is

significant difference between gym training group passive lifestyle group. Further, significant difference is also found between intermittent exercise group and passive lifestyle group.

In order to assess group wise differences in peak expiratory flow rate, Least Significant Difference post hoc test was employed and the results are presented in table 4 as below.

TABLE 4.
 SUMMARY OF POST HOC TEST ON GROUP WISE
 DIFFERENCES IN PEAK EXPIRATORY FLOW RATE
 BETWEEN THE THREE EXERCISING GROUPS

Exercising groups	Mean Difference (I-J)	Sig.
Yoga Grp. (92.53 ± 13.82)	Gym Trg. Grp. (91.21 ± 17.47)	1.31
	Intermittent Ex. Grp. (86.53 ± 18.85)	6.00
	Passive Lifestyle Grp. (66.29 ± 23.73)	26.24*
Gym Trg. Grp. (91.21 ± 17.47)	Intermittent Ex. Grp. (86.53 ± 18.85)	4.68
	Passive Lifestyle Grp. (66.29 ± 23.73)	24.92*
Intermittent Ex. Grp. (86.53 ± 18.85)	Passive Lifestyle Grp. (66.29 ± 23.73)	20.23*

* Significant at 0.05 significance level.

From table 4 it is evident that there is significant difference in peak expiratory flow between Yoga group and intermittent exercise group; and Yoga group and passive lifestyle group under investigation. Similarly, there is significant difference between gym training group passive lifestyle group. Further, significant difference is also found between intermittent exercise group and passive lifestyle group. The above results are graphically presented in figure 1 as below.

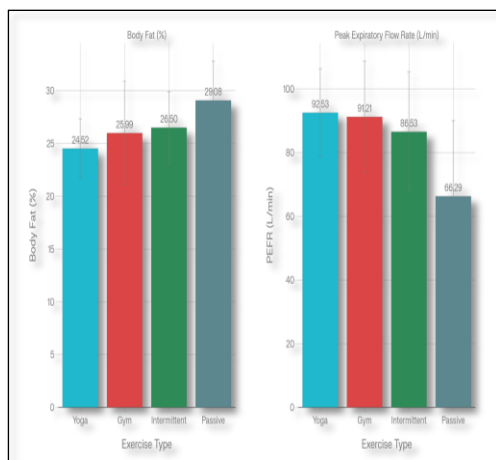


Figure 1. Graphical depiction of differences in percent body fat and peak expiratory flow of middle-aged individuals with varied exercise pattern.

Discussion on Findings

Active groups' lower body fat (24.52-26.50%) vs passive (29.08%) reflects exercise-induced fat metabolism, with yoga's holistic approach (postures + breathing) yielding superior results. Higher PEFR in yoga (92.53 L/min) and gym (91.21 L/min) demonstrates enhanced respiratory muscle strength and airway patency from structured training, while passive group's 66.29 L/min indicates mechanical restriction from adiposity. Significant ANOVA confirms exercise pattern systematically impacts both outcomes.

Conclusion

On the basis of the results of the present investigation it is concluded that the exercise effects significantly vary between different types of exercise groups. Yoga practicing group had the least percent body fat as compared to other three groups. Furthermore, yoga practicing group exhibited significantly better peak expiratory flow rate as compared to Gym training, intermittent training as well as

control groups. Lastly, Gym training and intermittent training groups were significantly better than control groups.

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