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The intervention of the fit India fitness training protocol on muscular endurance of college students: An experimental study

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Abstract
The Government of India launched the Fit India Movement to encourage individuals to embrace fitness practices, including yoga and physical exercise, to improve health and well-being. This study aimed to investigate the impact of the Fit India Fitness Protocol (FIFP) on the muscular endurance of college students. To achieve this purpose, a total of 80 male students were selected as subjects randomly from KLE Law College, Bangalore, Karnataka, aged between 18 to 24 years. We divided the participants into four groups: group I followed the physical fitness protocol, group II followed the yoga protocol, group III followed the combined physical fitness and yoga protocol, and group IV served as the control group. All three experimental groups trained five days a week for 12 weeks, while group IV served as the control group, carrying out their daily routines. To determine the significant difference in muscular endurance, we measured the criterion variable of Law College students using the partial curl-up test. We used analysis of covariance (ANCOVA) as a statistical technique to determine the significance of the effect on muscular endurance among the control and intervention groups of college students. We also applied the Bonferoni post-hoc test to determine the significance between the treatment groups. The result indicated significant improvements in muscular endurance for all intervention groups compared to the control group. The combined group showed the most significant improvement in muscular endurance. These findings show that the Fit India Fitness Protocol, particularly when incorporating yoga with physical fitness exercises, was an effective intervention for enhancing muscular endurance and overall health in college students.

Keywords: Fit India movement, yoga, physical fitness, muscular endurance

Introduction
A wealthy nation is a burden, and a fit nation is an asset. We refer to fitness as an acceptable change in one's surroundings. In today's world, physical education is a crucial topic that demands our full attention. People today are more aware of fitness's benefits, how to achieve it, and different perspectives. They have earned the knowledge they now possess about physical fitness. The advantages of physical fitness are neither well-defined nor easily understood.

Fitness is the ability of the heart, blood vessels, lungs, and muscles to perform at their best. For the human body, physical fitness is like fine-tuning an engine. It is a physical state of well-being that enables people to carry out everyday tasks with energy, lowers their chance of health issues brought on by inactivity, and builds a foundation of fitness for engaging in a range of physical activities. It makes it possible to reach one's full potential. One way to define fitness is as a state that promotes optimal appearance, sensation, and performance. In simpler terms, fitness refers to the ability to persevere, stand up, tolerate stress, and persist in situations that an unfit individual could not, and it is a fundamental element of health and well-being. Individuals can only reach their full potential when they are in excellent physical health. Regretfully, a large number of individuals in our culture lack the necessary physical exercise to maintain excellent health and physical fitness.

Physical exercise helps achieve the Sustainable Development Goals and provides various social, environmental, and economic benefits in addition to its health benefits.

The UN general assembly approved the global action plan for non-communicable diseases, which includes early mortality prevention. Goals include reducing physical inactivity by 10% by 2025 (WHO).

Yoga

Yoga is a method of physical, mental, and spiritual health care that teaches self-control via a sequence of postures and exercises, breathing exercises, relaxation techniques, and meditation techniques. Yoga's primary advantages are its physical and mental therapeutic effects. You may slow down the aging process with yoga. Autointoxication or self-poisoning are the major causes of this artificial condition, known as aging. We may greatly lessen the catabolic process of cell degeneration by maintaining a clean, flexible, and well-lubricated body. Combining yoga asana, pranayama, and meditation is necessary to reap the full advantages of the practice (Iyengar, 2001) [3].

Fit India Movement 2019

The Fit India movement, launched on 29th August 2019, on the occasion of National Sports Day of the 114th birth anniversary of Major Dhyanchand, aims to make fitness an integral part of the daily life of every Indian citizen. The Ministry of Health and Family Welfare is closely working with the Fit India Mission toward achieving this objective through appropriate policy measures and behavioral changes. The mission of the movement is to bring about behavioral changes and move towards a more physically active lifestyle. Fit India proposes to undertake various initiatives and conduct events to achieve this mission.

The Fit India Movement, launched by the Government of India, has encouraged individuals to embrace fitness practices, including yoga and physical exercise, to improve health and well-being. (Fit India 2019) [1].

Muscular Endurance

Muscular endurance, the ability of a muscle group to sustain repeated contractions or maintain a continuous contraction over time, is a foundational aspect of physical fitness that supports overall health and performance. It plays a critical role in everyday activities and athletic performance, helping to prevent fatigue and injury while enhancing physical capabilities. In the context of college students, muscular endurance can impact their daily lives, academic engagement, and physical health by improving strength, stability, and resilience under physical and mental stress.

Muscular endurance is a crucial component of physical fitness, enabling individuals to sustain prolonged physical activities. This quality is especially vital for college students, who often encounter physical and psychological demands that necessitate physical resilience and stamina.

Methodology

The study aimed to determine how physical fitness, yoga, and The Fit India fitness program's combined intervention protocol significantly improved the muscular endurance of college students. . In order to achieve the objectives of the study, we conducted a random selection of 80 male Law College students from KLE Law College in Bengaluru, Karnataka. The participants were aged between 18 and 24 years. The researcher categorized the chosen subjects into four equal groups: group I participated in physical fitness training, group II engaged in yoga training, group III adhered to a combined training protocol, and group IV functioned as the control group. Each group consists of 20 subjects. The duration of the intervention program was established at 12 weeks, with sessions occurring 5 days each week. The Fit India physical practices, yoga, and a combination of both intervention training programs and the control group were identified as independent variables, while muscular endurance was designated as the dependent variable, measured through partial curl-up training. All subjects were assessed on the chosen dependent variables, both prior to and immediately following the experimental period. The data obtained from the experimental groups and control group in both pre and post assessments were statistically analyzed using ANCOVA to identify significant improvements. The significance level was established at a 0.05 confidence level for all cases.

Objectives

1. To investigate the effects of a physical fitness intervention program following the Fit India fitness protocol on the muscular endurance of college students.
2. To investigate the impact of a yogic intervention program aligned with the Fit India fitness protocol on the muscular endurance of college students.
3. To investigate the impact of a combined physical fitness and yoga intervention program, in accordance with the Fit India fitness protocol, on the muscular endurance of college students.

Hypotheses

1. The investigator hypothesized that the Fit India Fitness protocol, which includes 12 weeks of physical fitness exercises, could significantly improve the muscular endurance of college students.
2. The hypothesis proposed that a 12-week yoga training program, following the Fit India yoga protocol, could lead to significant improvements in the muscular endurance of college students.
3. It was assumed that the combination of physical fitness exercise and yoga training groups of the Fit India fitness protocol significantly improves muscular endurance when compared with the individual effects of the physical fitness exercise group and yoga training group of college students.

Analyses of the data

Table 1: Descriptive statistics of pre, post and adjusted post-test mean scores of muscular endurance

Groups	Tests	Min	Max	Mean	SD Error of Mean	S D	Adjusted Post (For Pre-Test) Mean
Control	Pre	12	21	15.25	0.566	2.531	15.516
	Post	13	21	15.35	0.488	2.183	
Physical Fitness	Pre	10	22	15.75	0.750	3.354	18.773
	Post	15	26	19.05	0.659	2.946	
Yoga	Pre	10	19	15.30	0.529	2.364	17.672
	Post	13	21	17.55	0.505	2.259	
Combined	Pre	13	20	15.45	0.456	2.038	19.739
	Post	17	25	19.75	0.502	2.245	

Interpretation: The table 01 displays the descriptive statistics of the Muscular Endurance analyses conducted pre and post-training for the experimental and control groups. The data shows that for the control group, the pre-test mean and standard deviation (SD) of muscular endurance were 15.25 and 2.531, respectively, with a post-test mean of 15.35 (SD=2.183) and an adjusted post-test mean of 15.516.

In the physical fitness group, which followed the Fit India protocol, there was a marked improvement in muscular endurance. The pre-test mean was 15.75 (SD=3.354), increasing significantly to a post-test mean of 19.05 (SD=2.946), with an adjusted post-test mean of 18.773. The yoga intervention group also showed a notable increase in muscular endurance, with a pre-test mean of 15.30 (SD=2.364), which rose to a post-test mean of 17.55 (SD=2.259) and an adjusted post-test mean of 17.672. The combined protocol group demonstrated the most substantial improvement in muscular endurance, with a pre-test mean of 15.45 (SD=2.038), which increased to a post-test mean of 19.75 (SD=2.245) and an adjusted post-test mean of 19.739.

Although there was an increase in muscular endurance across all groups from baseline to post-test, the combination group showed the largest increase, followed by the Physical Fitness and yoga group. In the absence of any intervention, the Control group exhibited little improvement. This shows that college students may benefit from specialized training programs, especially those that combine yoga with physical fitness exercise training, in order to increase their muscular endurance.

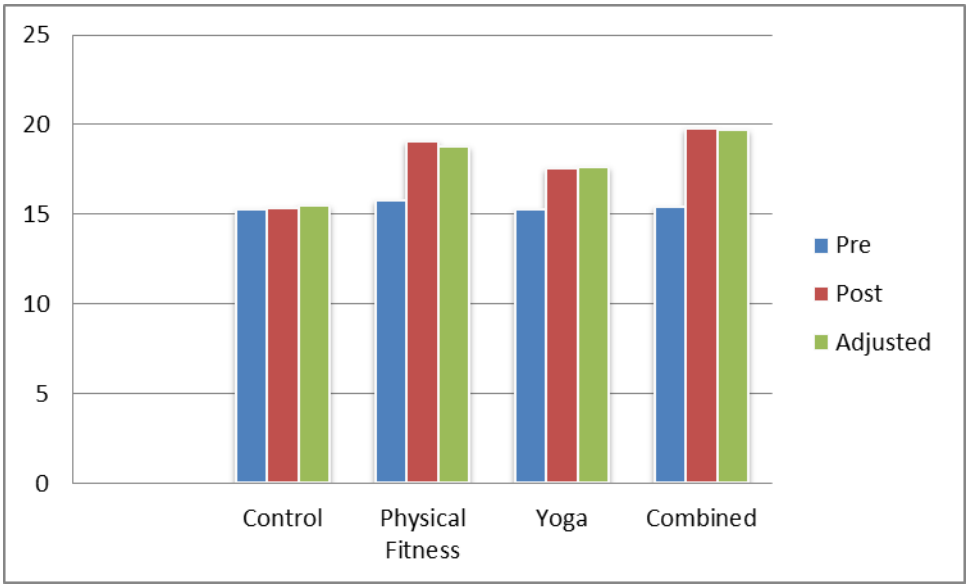

Fig 1: Pre, post and adjusted post-test mean scores of muscular endurance

Interpretation: Figure 01 provides a visual representation of table 4.7. Across both experimental and control groups, the multiple bar chart reveals that the experimental groups' muscular endurancehas increased when comparing the adjusted (for pre-test) post-test mean score with the pre-test mean score.

Table 2: Analysis of covariance (ANCOVA) results of the intervention program on muscular endurance

Source	Sum of Squares	DF	Mean Square	F-ratio	p-value
Pre Muscular Endurance	408.981	1	408.981	782.116	< 0.05*
Between Groups	197.061	3	65.687	125.617	<0.05*
Within Groups	39.219	75	0.523		-

*Indicates significant (<0.05)

Inference: Since the p-value is less than 0.05, at the 5% level of significance, after adjusting for pre-intervention fitness scores of muscular endurance we found that there is a statistically significant difference in post-intervention fitness scores of Muscular Endurance between the various intervention groups such as physical fitness, yoga, and combined groups, including the control. Nonetheless, after the training program, the individuals in the experimental groups showed a significant increase in muscular endurance in contrast to the control group, which did not receive the intervention.

Table 3: Bonferroni post hoc test analysis of adjusted post-test means of experimental and control groups on muscular endurance

Groups				Mean Difference	P-Value
Physical Fitness	Yoga	Combined Training	Control		
19.05	-	-	15.35	3.257	< 0.05*
-	17.55	-	15.35	2.156	< 0.05*
-	-	19.75	15.35	4.223	< 0.05*
19.05	17.55	-	-	1.101	< 0.05*
19.05	-	19.75	-	0.966	< 0.05*
-	17.55	19.75	-	2.067	< 0.05*

*Indicates significant (<0.05)

Research also confirms a connection between the pre-test and post-test muscular endurance scores. Since the effect of the training program is significant, a post hoc test was employed to determine the significance source. The results are presented in the next table.

Inference: The adjusted mean scores of muscular endurance between control and physical fitness, control and yoga, control and combined group, physical fitness and yoga, and yoga and combined show statistically significant differences, because respective p-values, which were below the 0.05 threshold of significance in all the training groups.

The combination group adjusted post-test mean of muscular endurance scores is significantly higher than that of the control, physical fitness, and yoga groups.

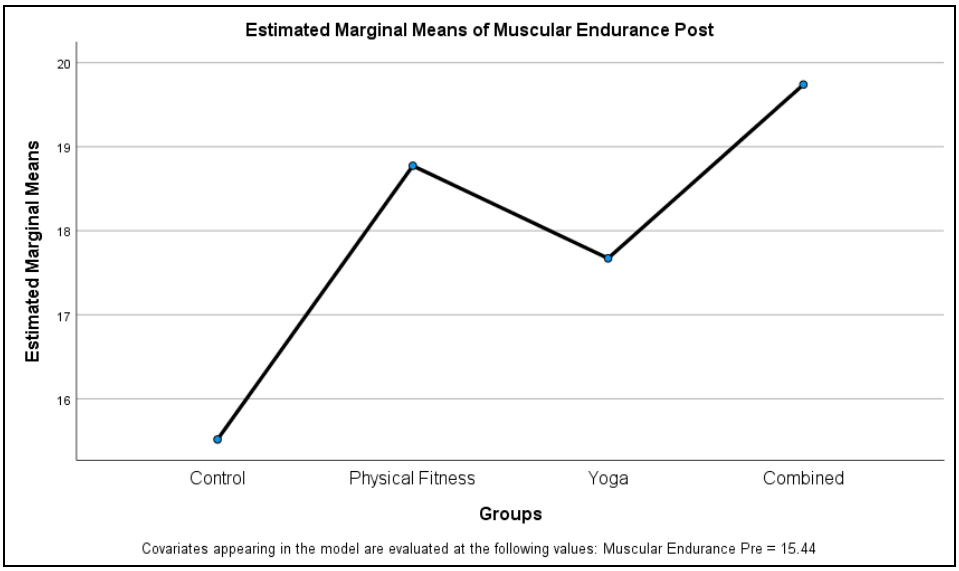

Fig 2: Profile plot showing adjusted post-test mean score muscular endurance experimental and control groups

Interpretation: The graphical depiction demonstrated that the combined group outperformed all other groups in terms of effectiveness, with the physical fitness group coming in second, yoga coming in third, and the control group coming in last in terms of relevance.

Table 4: Percentage of relative changes in experimental groups concerning control group

Control group	Physical Fitness	Yoga	Combined Training
	24.104%	14.322%	28.664%

Interpretation: Table 4.10, above shows that college students in the physical fitness, yoga, and combination groups showed improvements in muscular endurance of 24.104%, 14.322%, and 28.664%, respectively. The gain in muscular endurance in the combined group is larger than the other two experimental groups.

Discussion of Findings

The study results reveal a significant difference in muscular endurance improvements among the experimental groups compared to the control group, following 12 weeks of training under the Fit India protocol. The intervention groups—physical fitness, yoga, and combined training—all showed considerable enhancements in muscular endurance, as indicated in Tables 4.6 through 4.10 and Figures 4.3 and 4.4. The findings across these groups are discussed below.

- **Physical Fitness Group:** The 12-week physical training program following the Fit India protocol notably improved muscular endurance in college students. This protocol, which emphasizes strength, endurance, and flexibility exercises, is effective in enhancing muscular endurance through dynamic strength training and cardiovascular conditioning. By engaging in regular physical exercises, muscle fibers adapt, allowing them to sustain longer contractions. These findings align with Ullah's (2023) [5] study on circuit training, which similarly reported that 12 weeks of structured circuit exercises significantly improved muscular endurance among college students. A related study by Mola and Bayeta (2020) on sports science students also found that 12 weeks of circuit training substantially boosted physical endurance.
- **Yoga Group:** The yoga intervention, over the 12-week period, also led to significant improvements in muscular endurance among college students. Yoga involves controlled movements and prolonged static poses, such as Suryanamaskara, which strengthen core stability and promote muscular endurance. A stronger core supports muscle endurance by providing a stable foundation for various physical activities. Similar findings were noted by Divya (2023) [4], whose research demonstrated that yoga practices notably improved flexibility and muscular endurance in students. Another study by Prasad Sahu (2018) also reported significant increases in muscular endurance among college students after regular yoga practice.
- **Combined Group:** The combined protocol of both physical fitness exercises and yoga produced the greatest gains in muscular endurance over 12 weeks. This combination appears to have a synergistic effect, where the strength and endurance benefits of physical fitness exercises complement the flexibility and stability gained through yoga. This dual approach likely enhances muscle activation by incorporating both dynamic (isotonic) and

static (isometric) contractions, leading to a more balanced improvement in endurance. This finding aligns with Kurakuri's (2019) research, which found that combined training significantly enhanced muscular endurance and overall fitness among college students.

Conclusion

This study provides evidence that both physical fitness and yoga protocols can independently improve muscular endurance in college students. However, combining these protocols yields the most substantial improvements, suggesting that an integrated training regimen is more effective in enhancing muscular endurance. These findings underscore the potential benefits of incorporating diverse forms of physical activity to optimize physical performance.

Recommendations

Based on the study results, the following recommendations are made:

1. College fitness programs should consider adopting a combination of physical fitness and yoga exercises to maximize muscular endurance gains.
2. The Fit India physical fitness program should be implemented across all educational institutions to promote lifelong health and well-being among students.
3. Further research with a larger sample size is needed to generalize these findings to broader college populations.
4. Future studies could explore the long-term effects of combined fitness protocols on other physical and psychological variables, such as stress resilience and mental focus.

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