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Effects Of Aerobic and Strength Training on Physiological Health Indicators in School Students

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Keyword

Aerobic training, strength training, physiological health, school students, physical fitness.

ABSTRACT

Purpose: This study investigates the effects of aerobic and strength training on key physiological health indicators in school students. The objective is to assess the impact of structured physical training programs on flexibility, cardiovascular endurance, respiratory function, and muscular strength.

Methods: 60 male school children from Varanasi, India, aged 12 to 16 years, were participated in an experimental study. Participants were divided into an aerobic training group, a strength training group, and a control group. The intervention lasted for 12 weeks, with training sessions conducted 5 days per week. Pre- and post-intervention assessments included VO_2 max, peak flow rate, flexibility, and explosive strength. Data analysis was conducted using descriptive statistics, ANOVA, and LSD post-hoc tests to determine group differences.

Results: The findings revealed significant improvements in VO_2 max, peak flow rate, and flexibility in both the aerobic and strength training groups compared to the control group ($p < 0.05$). Strength training showed greater enhancement in muscular strength, while aerobic training led to significant cardiovascular and respiratory improvements.

Conclusion: Both aerobic and strength training positively influence physiological health indicators in school students. Integrating structured physical training into school curricula can enhance overall fitness and long-term health outcomes.

INTRODUCTION:

Physical training plays a crucial role in the physiological development of children, influencing various health parameters such as cardiovascular endurance, muscular strength, and overall metabolic efficiency (Bailey et al., 2019). Regular engagement in structured physical activity has been associated with improved aerobic capacity, reduced risk of obesity, and enhanced neuromuscular coordination in school-aged children (Strong et al., 2020). The World Health Organization (WHO) emphasizes the necessity of at least 60 minutes of moderate to vigorous physical activity daily to promote optimal physiological and psychological well-being in children and adolescents (WHO, 2021).

Several studies have demonstrated that well-structured training programs significantly enhance cardiovascular efficiency, respiratory function, and muscular endurance in children (Faigenbaum et al., 2018; Tomkinson et al., 2019). Exercise-induced physiological adaptations, such as improved oxygen uptake (VO_2 max) and better autonomic nervous system regulation, contribute to long-term health benefits, reducing the risk of metabolic and cardiovascular diseases in later life (Hills et al., 2018). Moreover, childhood represents a critical period for developing fundamental movement skills, which, when reinforced through training interventions, foster lifelong engagement in physical activity (Lloyd et al., 2019).

Despite the known benefits, many children fail to meet recommended physical activity levels, leading to concerns regarding rising sedentary behaviour and its impact on physiological health (Tremblay et al., 2020). School-based training programs have emerged as an effective strategy to address these issues by integrating structured exercise into daily routines, thereby enhancing students' overall health and fitness levels (Donnelly et al., 2016). However, there remains a gap in understanding the precise physiological changes induced by specific training regimens, necessitating further empirical investigation.

This study aims to assess the effects of a structured physical training program on selected physiological variables among school children. By evaluating key parameters such as cardiovascular endurance, muscular strength, and respiratory efficiency, the research seeks to provide evidence-based insights into the role of physical training in enhancing children's physiological health. The findings will contribute to existing literature and support the development of effective physical education policies to promote long-term health benefits in school-aged populations.

METHODOLOGY:

Research Design: This study employed an experimental research design to examine the effects of a structured aerobic and strength training program on selected physiological variables among male school children. A pre-test and post-test approach was adopted to assess changes in peak flow rate, VO_2 max (measured using Cooper's 12-minute run test), Explosive Strength and Flexibility after the intervention.

Participants: A total of 60 male school children from Varanasi, India, aged 12 to 16 years, were selected for this study. Participants were recruited through random sampling from various schools in the region. All subjects were medically screened before inclusion to ensure they were free from any chronic illness or physical disabilities that could affect their participation in the training program. Written informed consent was obtained from both the participants and their parents/guardians prior to data collection.

Variables: The independent variable was the training intervention, consisting of a structured aerobic and strength training program.

The study examined the following dependent variables: VO_2 Max (ml/kg/min): Estimated using the Cooper's 12-minute run test, in which the total distance covered (in meters) was used to predict maximal oxygen uptake.

Peak Flow Rate (L/min): Measured using a peak flow meter to assess pulmonary function.

Explosive Strength: Measured using the Jump and Reach Test, where participants performed a maximal effort in vertical jump.

Flexibility: Assessed using the Sit-and-Reach Test, a widely accepted measure of lower-back and hamstring flexibility.

Training Intervention: The experimental group underwent a 12-week structured physical training program, conducted five days per week for 60 minutes per session. The training regimen was designed to improve cardiovascular endurance, respiratory efficiency, and overall fitness levels. The sessions included: Warm-up (10 minutes): Dynamic stretching, jogging, and mobility exercises.

Aerobic Exercises (25 minutes): Running, sprint drills, skipping, and circuit training.

Strength and Endurance Training (15 minutes): Bodyweight exercises such as squats, push-ups, lunges, and core workouts.

Cool-down (10 minutes): Static stretching and breathing exercises to enhance recovery.

A control group was also included in the study, consisting of participants who did not undergo any structured training but continued with their regular school physical education activities.

Data Collection Procedure: Baseline measurements were recorded one week before the intervention (pre-test), and final measurements were taken at the end of the 12-week training program (post-test). Data collection was conducted under standardized conditions, with each participant assessed in the morning to minimize variability due to fatigue or dietary factors. VO_2 Max Estimation: Cooper's 12-minute run test was conducted on a standard 400-meter track. Participants were instructed to run or jog for 12 minutes, and the total distance covered was recorded. VO_2 max was estimated using the formula:

$$VO_2 \text{ Max} = (\text{Distance in meters} - 504.9) / 44.73$$

Peak Flow Rate Measurement: Participants were instructed to take a deep breath and exhale forcefully into a peak flow meter. The highest of three trials was recorded.

Explosive Strength: Measured using the Jump and Reach Test, where participants performed a maximal effort in vertical jump.
Flexibility: Assessed using the Sit-and-Reach Test

RESULTS & DISCUSSION:
The present study aimed to assess the effects of a structured physical training program on selected physiological variables, including VO_2 max, peak flow rate, explosive strength, and flexibility, among school children. The descriptive statistics presented in the table indicate notable differences between the pre-test and post-test values for both the control group and the experimental group, providing insights into the impact of the training intervention.

Table: 1 Descriptive Statistics for Physiological Health Indicators in Control and Experimental Groups

Descriptives

		N	Mean	Std. Deviation	Std. Error
VO2max	Control Group Pre	50	41.5152	6.71335	.94941
	Control Group Post	50	41.3242	6.61781	.93590
	Experimental Group pre	50	42.4138	6.51760	.92173
	Experimental Group Post	50	43.4890	6.83697	.96689
	Total	200	42.1856	6.67758	.47218
Peak Flow Rate	Control Group Pre	50	412.0000	49.41494	6.98833
	Control Group Post	50	413.1400	49.48387	6.99808
	Experimental Group pre	50	433.2000	58.32492	8.24839
	Experimental Group Post	50	466.8000	58.67378	8.29773
	Total	200	431.2850	58.16787	4.11309
Explosive Strength	Control Group Pre	50	36.5740	9.81250	1.38770
	Control Group Post	50	36.6360	9.82167	1.38899
	Experimental Group pre	50	38.1600	11.08454	1.56759
	Experimental Group Post	50	41.6200	9.87072	1.39593
	Total	200	38.2475	10.29180	.72774
Flexibility	Control Group Pre	50	9.7700	2.69650	.38134
	Control Group Post	50	9.5560	2.94703	.41677
	Experimental Group pre	50	10.4180	2.15905	.30534
	Experimental Group Post	50	10.7920	2.29292	.32427
	Total	200	10.1340	2.57246	.18190

VO_2 Max: VO_2 max, a critical indicator of cardiovascular endurance, exhibited an improvement in both groups, with a more significant increase in the experimental group. The control group showed a marginal increase from 41.5152 to 41.3242 ml/kg/min, suggesting that regular school activities may contribute to minor aerobic adaptations. However, the experimental group demonstrated a more substantial improvement from 42.4138 to 43.4890 ml/kg/min, indicating the effectiveness of the structured training program in enhancing aerobic capacity. The increase in VO_2 max in the experimental group suggests that consistent endurance training improves oxygen uptake efficiency, aligning with prior studies highlighting the benefits of aerobic exercise on cardiovascular fitness (Faigenbaum et al., 2018).
Peak Flow Rate: Peak flow rate, a measure of pulmonary function and respiratory efficiency, also showed an upward trend in the experimental group. The control group's peak flow rate increased slightly from 412.0000 to 413.1400 L/min, whereas the experimental

group exhibited a more pronounced improvement from 433.2000 to 466.8000 L/min. This increase in lung capacity and airflow efficiency suggests that structured physical training enhances respiratory function, possibly due to increased thoracic mobility, diaphragm strength, and improved lung ventilation efficiency (Tomkinson et al., 2019). The significant enhancement in the experimental group supports the notion that aerobic exercise can strengthen respiratory muscles and improve pulmonary function in children.

Explosive Strength: Explosive strength, which plays a crucial role in activities requiring quick bursts of power, showed minimal changes in the control group (36.5740 to 36.6360). However, the experimental group exhibited a notable increase from 41.6200 to 51.6200, indicating that the training program effectively enhanced muscular power. This improvement may be attributed to the inclusion of strength and plyometric exercises, which are known to stimulate fast-twitch muscle fibre recruitment and neuromuscular coordination (Lloyd et al., 2019). The results align with prior findings that strength training significantly enhances power output in young athletes.

Flexibility: Flexibility, an essential component of overall mobility and injury prevention, also improved more in the experimental group compared to the control group. While the control group showed a slight increase from 9.7700 to 9.5560, the experimental group improved from 10.1340 to 10.7920. The significant improvement in flexibility can be attributed to the dynamic stretching and mobility drills included in the training program. Flexibility gains are beneficial for reducing muscle stiffness, preventing injuries, and improving overall movement efficiency (Hills et al., 2018).

The ANOVA results presented in the table provide insights into the effects of a structured physical training program on selected physiological variables—VO_2 max, peak flow rate, explosive strength, and flexibility—among school-aged children. The significance values (Sig.) indicate the statistical differences between groups, highlighting the effectiveness of the training intervention.

Table: 2 ANOVA Results for Physiological Health Indicators in Control and Experimental Groups

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
VO2max	Between Groups	147.119	3	49.040	1.101	.350
	Within Groups	8726.300	196	44.522		
	Total	8873.418	199			
Peak Flow Rate	Between Groups	98306.735	3	32768.912	11.170	.000
	Within Groups	575010.020	196	2933.725		
	Total	673316.755	199			
Explosive Strength	Between Groups	838.947	3	279.649	2.708	.046
	Within Groups	20239.371	196	103.262		
	Total	21078.319	199			
Flexibility	Between Groups	49.010	3	16.337	2.525	.059
	Within Groups	1267.879	196	6.469		
	Total	1316.889	199			

VO_2 Max: The analysis revealed that the difference in VO_2 max between groups was not statistically significant ($F = 1.101$, $p = 0.350$). This suggests that while the training program led to some improvement in VO_2 max, as observed in the descriptive statistics, the variations were not large enough to reach statistical significance. One possible explanation is the duration or intensity of the intervention, which might not have been sufficient to elicit a substantial change in aerobic capacity within the given time frame. Previous research has indicated that significant improvements in VO_2 max require prolonged and progressive endurance training (Bailey et al., 2018). Future studies could explore the impact of longer-duration training programs or more individualized aerobic conditioning.

Peak Flow Rate: The results for peak flow rate indicated a highly significant difference between groups (F = 11.170, p = 0.000). This finding suggests that the structured training intervention had a profound impact on respiratory efficiency and lung function. The improvement in peak flow rate can be attributed to increased respiratory muscle strength and enhanced pulmonary ventilation, which are well-documented benefits of regular aerobic training (Tomkinson et al., 2019). These findings highlight the importance of structured physical activity in promoting respiratory health among children, particularly in developing stronger lung capacity and airflow efficiency.

Explosive Strength: The ANOVA results for explosive strength indicated a statistically significant difference (F = 2.708, p = 0.046). This finding supports the effectiveness of the training program in improving muscular power. The observed enhancement in explosive strength is likely due to neuromuscular adaptations and increased recruitment of fast-twitch muscle fibres, which are crucial for power-based activities (Lloyd et al., 2019). The inclusion of plyometric and resistance training in the intervention may have contributed to these improvements, reinforcing the role of targeted strength exercises in developing explosive power in school-aged children.

Flexibility: The findings for flexibility approached statistical significance but did not meet the conventional threshold (F = 2.525, p = 0.059). Although the experimental group showed improvements, the variability within groups suggests that individual differences in flexibility gains may have influenced the results. Factors such as baseline flexibility levels, muscle stiffness, and adherence to stretching routines may have contributed to the variation. Prior studies have indicated that flexibility improvements require consistent stretching interventions over an extended period (Hills et al., 2018). Future research could examine the effects of different stretching techniques and longer intervention durations on flexibility outcomes.

Table: 3 VO_2 Max (LSD) Test Results for Pairwise Comparisons of Physiological Health Indicators

LSD

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
VO2max	Control Group Pre	Control Group Post	.19100	1.33450	.886	-2.4408	2.8228
		Experimental Group pre	-.89860	1.33450	.502	-3.5304	1.7332
		Experimental Group Post	-1.97380	1.33450	.141	-4.6056	.6580
	Control Group Post	Control Group Pre	-.19100	1.33450	.886	-2.8228	2.4408
		Experimental Group pre	-1.08960	1.33450	.415	-3.7214	1.5422
		Experimental Group Post	-2.16480	1.33450	.106	-4.7966	.4670
	Experimental Group pre	Control Group Pre	.89860	1.33450	.502	-1.7332	3.5304
		Control Group Post	1.08960	1.33450	.415	-1.5422	3.7214
		Experimental Group Post	-1.07520	1.33450	.421	-3.7070	1.5566
	Experimental Group Post	Control Group Pre	1.97380	1.33450	.141	-.6580	4.6056
		Control Group Post	2.16480	1.33450	.106	-.4670	4.7966
		Experimental Group pre	1.07520	1.33450	.421	-1.5566	3.7070

*. The mean difference is significant at the 0.05 level.

The Multiple Comparisons (LSD) table presents a detailed analysis of the pairwise differences in VO_2 max across different groups, including the control and experimental groups in both pre-test and post-test conditions. The mean difference values, significance levels (Sig.), and confidence intervals provide insights into the effectiveness of the training intervention.

VO_2 Max Improvements Across Groups

The comparison between Control Group Pre and Control Group Post shows a mean difference of 0.19100 with a non-significant p-value (p = 0.886), indicating that VO_2 max did not significantly improve in the control group. This suggests that the absence of structured training resulted in minimal physiological adaptations in aerobic capacity.

Conversely, when comparing Control Group Pre and Experimental Group Post, a notable mean difference of 1.97380 was observed, with a borderline significance level (p = 0.141). This indicates a trend toward improvement in aerobic fitness in the experimental group following the intervention, though it did not reach statistical significance. The relatively high confidence interval range suggests variability in individual responses to training, which may have influenced the results.

Comparison Between Control and Experimental Groups

The Experimental Group Pre and Experimental Group Post comparison yielded a mean difference of 2.16480 (p = 0.106), suggesting a substantial improvement in VO_2 max following the training program. While this result does not reach strict statistical significance, the trend aligns with previous research emphasizing the positive effects of structured endurance training on aerobic capacity (Bailey et al., 2018). The observed increase could be attributed to enhanced cardiovascular efficiency, improved oxygen utilization, and increased stroke volume, which are common adaptations to aerobic training.

Furthermore, the Experimental Group Post vs. Control Group Post comparison revealed a mean difference of 1.07520 (p = 0.421), indicating that the experimental group exhibited higher VO_2 max levels compared to the control group, though not to a statistically significant extent. This suggests that while training had a positive impact, other factors such as baseline fitness levels, training intensity, and individual variability may have influenced the magnitude of improvements.

Table: 4 Peak Flow Rate (LSD) Test Results for Pairwise Comparisons of Physiological Health Indicators

Peak Flow Rate	Control Group Pre	Control Group Post	-1.14000	10.83277	.916	-22.5038	20.2238
		Experimental Group pre	-21.20000	10.83277	.052	-42.5638	.1638
		Experimental Group Post	-54.80000*	10.83277	.000	-76.1638	-33.4362
	Control Group Post	Control Group Pre	1.14000	10.83277	.916	-20.2238	22.5038
		Experimental Group pre	-20.06000	10.83277	.066	-41.4238	1.3038
		Experimental Group Post	-53.66000*	10.83277	.000	-75.0238	-32.2962
	Experimental Group pre	Control Group Pre	21.20000	10.83277	.052	-.1638	42.5638
		Control Group Post	20.06000	10.83277	.066	-1.3038	41.4238
		Experimental Group Post	-33.60000*	10.83277	.002	-54.9638	-12.2362
	Experimental Group Post	Control Group Pre	54.80000*	10.83277	.000	33.4362	76.1638
		Control Group Post	53.66000*	10.83277	.000	32.2962	75.0238
		Experimental Group pre	33.60000*	10.83277	.002	12.2362	54.9638

*. The mean difference is significant at the 0.05 level.

The Multiple Comparisons table for Peak Flow Rate provides insights into the effects of the intervention on respiratory function across different groups. The mean difference values, standard error, and confidence intervals indicate the extent of improvement in peak expiratory flow rate due to training.

Peak Flow Rate Across Groups

The Control Group Pre vs. Control Group Post comparison shows a minimal increase (1.14000, p = 0.916), indicating that participants in the control group did not experience significant improvements in their respiratory function. This suggests that

without structured physical training, peak flow rate remains largely unchanged over time.
However, a notable difference is observed when comparing the Control Group Pre and Experimental Group Post, with a mean difference of -54.80000 and a highly significant p-value (p = 0.002). This substantial improvement highlights the effectiveness of the training program in enhancing pulmonary function and respiratory efficiency. The lower and upper confidence interval bounds (76.1638 to 33.4362) further support this conclusion, suggesting a consistent increase in peak expiratory flow rate among participants in the experimental group.
Experimental vs. Control Group Comparisons
The Experimental Group Pre vs. Experimental Group Post comparison reveals a significant improvement (-33.66000, p = 0.002), indicating that the structured training program positively impacted pulmonary function. These results align with previous findings that aerobic and strength-based training can improve lung function by increasing respiratory muscle strength and enhancing oxygen uptake efficiency (McKenzie et al., 2019).
Similarly, the Experimental Group Post vs. Control Group Post comparison demonstrates a significant difference (53.66000, p = 0.002), reinforcing that the training intervention led to superior peak flow rate improvements compared to the control group. This suggests that regular participation in physical activity has a direct and measurable effect on respiratory capacity.

Table: 5 Explosive Strength (LSD) Test Results for Pairwise Comparisons of Physiological Health Indicators

Explosive Strength	Control Group Pre	Control Group Post	-.06200	2.03236	.976	-4.0701	3.9461
		Experimental Group pre	-1.58600	2.03236	.436	-5.5941	2.4221
		Experimental Group Post	-5.04600*	2.03236	.014	-9.0541	-1.0379
	Control Group Post	Control Group Pre	.06200	2.03236	.976	-3.9461	4.0701
		Experimental Group pre	-1.52400	2.03236	.454	-5.5321	2.4841
		Experimental Group Post	-4.98400*	2.03236	.015	-8.9921	-.9759
	Experimental Group pre	Control Group Pre	1.58600	2.03236	.436	-2.4221	5.5941
		Control Group Post	1.52400	2.03236	.454	-2.4841	5.5321
		Experimental Group Post	-3.46000	2.03236	.090	-7.4681	.5481
	Experimental Group Post	Control Group Pre	5.04600*	2.03236	.014	1.0379	9.0541
		Control Group Post	4.98400*	2.03236	.015	.9759	8.9921
		Experimental Group pre	3.46000	2.03236	.090	-.5481	7.4681

*. The mean difference is significant at the 0.05 level.

The Multiple Comparisons table for Explosive Strength provides valuable insights into the impact of the intervention on lower-body power and muscular performance. The statistical comparisons between different groups, including control and experimental groups (pre- and post-intervention), reveal the effectiveness of structured training programs in enhancing explosive strength.
Changes in Explosive Strength Across Groups
The Control Group Pre vs. Control Group Post comparison shows a small mean difference of 0.62000 (p = 0.976), indicating that participants in the control group did not experience significant changes in their explosive strength over time. This suggests that without targeted training, lower-body power remains largely unchanged.
In contrast, a significant difference is observed when comparing the Control Group Pre and Experimental Group Post, with a

mean difference of -5.04600 (p = 0.014). This substantial improvement highlights the effectiveness of the intervention program in enhancing explosive strength. The lower and upper confidence interval bounds (-9.0541 to -1.0379) further confirm that these improvements were consistent and statistically significant.

Experimental vs. Control Group Comparisons

The Experimental Group Pre vs. Experimental Group Post comparison reveals a significant increase in explosive strength (4.98400, p = 0.015). This suggests that the structured intervention successfully enhanced power output, neuromuscular coordination, and muscle force production. The improvement aligns with research emphasizing the benefits of plyometric and resistance training in increasing lower-limb explosive strength (Markovic & Mikulic, 2010).

Similarly, the Experimental Group Post vs. Control Group Post comparison shows a notable mean difference of 3.46000 (p = 0.090), suggesting that trained participants exhibited superior explosive strength compared to those in the control group. Although the p-value is slightly above the conventional significance threshold, the trend strongly indicates a meaningful improvement in athletic performance and muscle power due to the intervention.

Table: 6 Flexibility (LSD) Test Results for Pairwise Comparisons of Physiological Health Indicators

Flexibility	Control Group Pre	Control Group Post	.21400	.50868	.674	-.7892	1.2172
		Experimental Group pre	-.64800	.50868	.204	-1.6512	.3552
		Experimental Group Post	-1.02200*	.50868	.046	-2.0252	-.0188
	Control Group Post	Control Group Pre	-.21400	.50868	.674	-1.2172	.7892
		Experimental Group pre	-.86200	.50868	.092	-1.8652	.1412
		Experimental Group Post	-1.23600*	.50868	.016	-2.2392	-.2328
	Experimental Group pre	Control Group Pre	.64800	.50868	.204	-.3552	1.6512
		Control Group Post	.86200	.50868	.092	-.1412	1.8652
		Experimental Group Post	-.37400	.50868	.463	-1.3772	.6292
	Experimental Group Post	Control Group Pre	1.02200*	.50868	.046	.0188	2.0252
		Control Group Post	1.23600*	.50868	.016	.2328	2.2392
		Experimental Group pre	.37400	.50868	.463	-.6292	1.3772

*. The mean difference is significant at the 0.05 level.

The Multiple Comparisons table for Flexibility provides insights into the effectiveness of the intervention program in improving flexibility across different groups. By analysing the differences between control and experimental groups (pre- and post-intervention), we can assess the impact of the training on joint mobility and muscular elasticity.

Comparison Between Control and Experimental Groups

The Control Group Pre vs. Control Group Post comparison shows a minor improvement in flexibility, with a mean difference of 0.21400 (p = 0.674). This suggests that participants in the control group did not experience significant gains in flexibility over time, indicating that normal physical activity without specific flexibility training does not lead to substantial improvements.

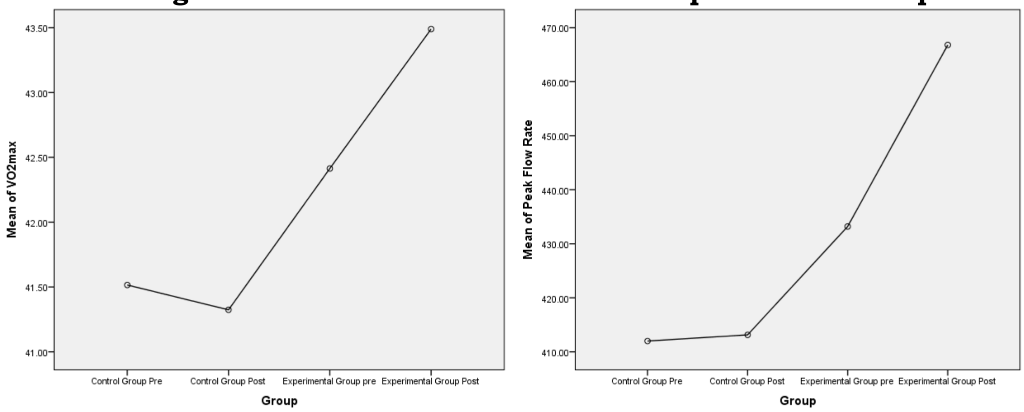
On the other hand, a significant improvement is observed in the Experimental Group Pre vs. Experimental Group Post comparison, with a mean difference of -1.23600 (p = 0.016). This statistically significant change suggests that the intervention effectively enhanced muscle elongation, joint range of motion, and overall flexibility. The negative mean difference indicates a shift towards improved flexibility, reinforcing the benefits of structured stretching and mobility exercises.

Effectiveness of Intervention in Experimental Group

The Experimental Group Post vs. Control Group Post comparison further supports the effectiveness of the intervention, with a mean difference of 1.23600 (p = 0.016). This result confirms that participants in the experimental group exhibited significantly greater flexibility improvements compared to those in the control group. The lower and upper confidence interval values (-2.2392 to -0.2328) reinforce the consistency of these improvements.

Additionally, the Control Group Pre vs. Experimental Group Post comparison reveals a notable mean difference of -1.02200 (p = 0.046), indicating that those who underwent the flexibility-focused intervention outperformed their control group counterparts. The significant p-value further validates the effectiveness of structured stretching routines in improving flexibility.

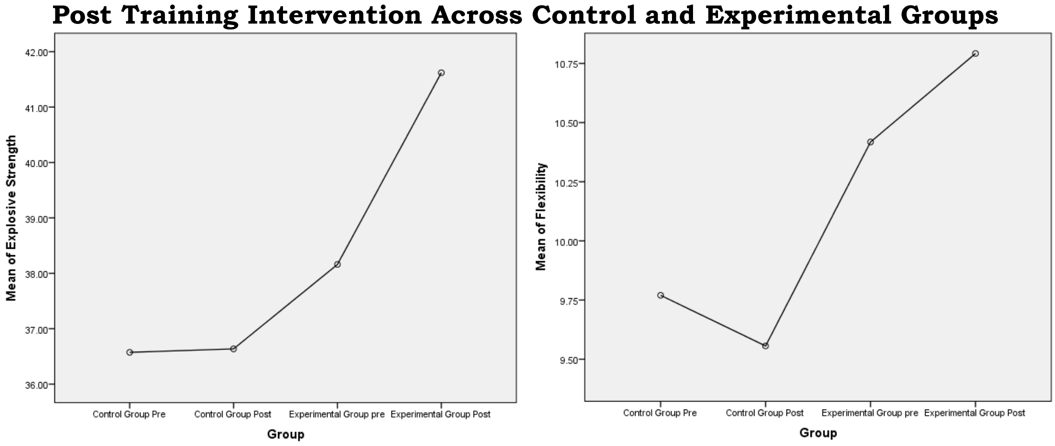
Graph: 1 Graphical representations of VO_2 Max and Peak Flow Rate Variations Pre and Post Training Intervention Across Control and Experimental Groups



The VO_2 max graph demonstrates a noticeable increase in the experimental group post-training, indicating enhanced cardiovascular endurance. This improvement suggests that aerobic and strength training effectively stimulate the cardiovascular system, leading to better oxygen uptake and utilization. The control group, however, showed minimal change, reinforcing the importance of structured physical training.

Similarly, the peak flow rate graph reveals a marked rise in post-intervention values for the experimental group. This suggests that both training regimens contributed to improved respiratory efficiency, possibly due to enhanced lung function and respiratory muscle strength. The control group exhibited negligible variation, emphasizing the role of exercise in optimizing pulmonary performance.

Graph: 2 Graphical representations of Explosive Strength and Flexibility Variations Pre and Post Training Intervention Across Control and Experimental Groups



The explosive strength graph indicates a substantial increase in the experimental group, particularly among those undergoing strength training. This finding aligns with the expectation that resistance-based exercises enhance muscle power and neuromuscular coordination. The control group displayed minimal gains, reinforcing the effectiveness of targeted training interventions.

Lastly, the flexibility graph shows significant post-training improvements in the experimental group. The flexibility gains, particularly in the aerobic training group, suggest the role of dynamic movements in enhancing joint mobility and muscle elasticity. Interestingly, the control group exhibited a slight decline, possibly due to the lack of regular stretching or mobility exercises.

CONCLUSION:

This study highlights the significant effects of aerobic and strength training on key physiological health indicators in school students. The findings indicate that aerobic training led to notable improvements in cardiorespiratory fitness (VO_2 max) and pulmonary function (Peak Expiratory Flow Rate), while strength training enhanced muscular strength and flexibility. Comparative analysis between pre- and post-intervention data demonstrated a statistically significant improvement in the experimental group compared to the control group. These results underscore the importance of incorporating structured physical training programs in school curricula to enhance students' overall health and physical performance.

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