

IMPACT OF COLLEGE LIFE ON FITNESS DURING ADOLESCENCE: A PRE- AND POST- EXPERIMENTAL STUDY

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ABSTRACT

Background:

Adolescent physical inactivity is a growing concern in India, with college environments potentially influencing lifestyle habits and physical health. Given the decline in fitness levels during adolescence, targeted interventions are essential to prevent non-communicable diseases and promote long-term well-being.

Objective:

To analyze the impact of a structured college- program for physical fitness based on aerobic capacity, muscle strength, and endurance in adolescent students.

Method:

An experimental pre-post study was conducted over 4 weeks with ten college students meeting specific inclusion criteria. Subjects participated in supervised exercise sessions (three times per week), involving aerobic and muscle-strengthening activities. Physical fitness parameters—VO₂ max, curl-ups, and trunk lift scores—were assessed before and after the intervention using validated field tests. Paired t-tests were performed to contrast before and after-exercise values.

Result:

Following the intervention, all measured fitness parameters significantly improved. Mean VO₂ max went up from 35.56 to 46.52 mL/kg/min, curl-up scores from 11.60 to 67.60, and trunk lift scores from 8.15 to 9.20 (all p-values < 0.001). The results indicate substantial gains in aerobic capacity, core muscle strength, and trunk endurance among participants.

Conclusion:

A short-term structured physical activity program during college life leads to marked improvements in key fitness domains in adolescent students. Routine exercise interventions within educational settings can effectively enhance physical fitness and help prevent future health complications.

Key Words: Physical Fitness, Physical Inactivity, Aerobic Exercise, Muscle Strength, Endurance

How to cite this article: Bhat A, Phukan P, Simon NH, Pavithra YV, Amrutha M, Gaur A, Shreya KN. Impact of college life on fitness during adolescence: a pre- and post-experimental study. Int J Drug Deliv Technol. 2026;16(74s): 1079-1092. DOI: 10.25258/ijddt.16.74s.128

CHAPTER I

INTRODUCTION

Physical Fitness

Physical well-being is a dynamic state encompassing both inherent traits and acquired abilities that allow people to engage in physical activities effectively.¹ It reflects one's overall capacity to execute specific

tasks, exercises, and functional movements, and it is closely associated with both current and future health outcomes. For instance, the ability to sustain prolonged endurance activities—often assessed through maximal aerobic power or cardiorespiratory endurance—demonstrates the integrated functioning

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of the cardiovascular and muscular systems. This capacity can be enhanced through consistent training and positive lifestyle choices.¹

Physical fitness includes five key Components include muscular strength, flexibility, cardiorespiratory endurance, and body composition. These constituents collectively form the basis of fitness in relation to health, which further includes morphological (body structure), muscular (strength and endurance), motor (coordination and agility), cardiorespiratory ((heart and lungs), as well as metabolic (energy system efficiency) dimensions.⁶

Body composition: Relative proportions of body weight, body fat, muscle mass, height, bone density.⁶

Cardiorespiratory endurance: The aptitude to sustain prolonged, moderate- to high-intensity large muscle group exercises for the entire body.

Muscle strength: The muscle's capacity or group of muscles to produce their maximum force in a single effort, influenced by movement patterns, contraction types (concentric, eccentric, isometric), and contraction velocity.⁶

Muscle endurance: The capacity of a muscle to withstand prolonged, repeated contractions without experiencing fatigue is known as endurance.⁶

Muscle power: Being able to produce force rapidly, representing the result of applying force and contraction velocity in one or more joints actions.⁸

Flexibility: The capacity Joints are moved through an optimal range of motion (ROM), governed by properties of muscles, tendons, and other tissues.^{6,9}

Physical Exercise

It is a subset of repetitive, planned, and structured physical exercise with the express purpose of enhancing or preserving physical fitness. This distinguishes it from general daily movements and highlights its targeted benefits.⁵ It exerts profound positive effects on health, playing an essential function in the avoidance of and management of NCDs, or (non-communicable illness) such as Heart-related disease, hypertension, Diabetes in addition to some types of cancer. Regular physical exercise also enhances mental wellness by lessening anxiety symptoms depression, and stress, and it enhances sleep quality, particularly in individuals experiencing psychological strain or trauma.²

Relevance to Adolescents

Physical activity is a top public health concern during adolescence, driven by increasing concerns such as rising obesity rates and the incidence of lifestyle-related disorders.⁶ Establishing adequate physical activity levels during this developmental period is critical, as habits formed in youth often persist into adulthood and significantly influence long-term health

outcomes.¹ The adolescent years represent a crucial window for adopting healthy behaviours, and insufficient physical activity during this stage can lead to detrimental effects on both present and future well-being.¹⁰

College Lifestyle Impact

College students represent a population particularly vulnerable to declines in physical activity and fitness due to college routine, transition stress, reduced sports participation. These behavioural changes can negatively impact flexibility, muscular fitness, cardiorespiratory endurance, and body composition.

Given the growing evidence of reduced activity levels among college-aged individuals, evaluating pre- and post-fitness parameters in this group is essential. Understanding how the college environment influences physical fitness can help identify areas requiring intervention and direct the creation of tactics to encourage healthier habits.

This study aims to assess changes in key elements of physical fitness, including flexibility, musculoskeletal fitness, cardiorespiratory endurance, and body composition among college students. The findings will contribute to improved health-promotion strategies and support efforts to enhance overall well-being in this population.

BACKGROUND FOR THE STUDY

The rising incidence of sedentary lifestyles and related, particularly among adolescents, underscores the importance of promoting physical fitness. Being active is a crucial factor in avoiding non-communicable illnesses such as cardiovascular diseases, obesity and establishing healthy habits for life. Teenage life is a pivotal time frame for developing lifelong physical activity patterns.

Cardiorespiratory fitness (reflected by VO₂max) is a crucial sign of general health and is strongly linked to reduced morbidity as well as mortality. Additionally, body composition, specifically the balance between the mass of fat and fat-free, plays a vital part in health conclusions. While the advantages of exercise are well known, there's a need for focused interventions that address the particular needs and challenges of adolescent populations.

This project aims to examine the effects of a structured intervention with physical exercise on cardiorespiratory fitness, body composition as in adolescents. By utilizing validated assessment tools, this research will offer insightful information regarding the effectiveness of different strategies.

NEED FOR THE STUDY

India is ranked 12th in the world by the WHO for adolescents who do not get enough exercise serious wellness issues. This inactivity has alarmingly

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increased in India, rising from 22.3% in 2000 to 49.4% in 2022, according to data published in The Lancet Global Health.¹⁸

In 2023, data from 27 states in India showed that 25.2% of teenagers aged 15 to 17 did not Participate in physical activity that is moderate to intense (MVPA). Only 38% of the 10–15-year-old youth in Mumbai, Maharashtra, who participated in another study reported meeting MVPA guidelines, while the majority (62%) did not. MVPA regulations were broken by about 60.2% of boys and 64% of girls. In India overall, a higher percentage of urban participants (49.6%) than rural participants (45.8%) reported meeting MVPA requirements. There were notable gender disparities, with 45.8% of men and 35.6% of women meeting MVPA requirements.³⁰

In Karnataka, data from 2016 showed that 81% of teenagers in the age range of 11 and 17 did not Engage in moderate-to-intense physical activity for the recommended 60 minutes each day. By 2024, WHO wants to see a 10% decline in the occurrence of physical inaction worldwide. Is the fourth most significant risk factor for mortality worldwide has been found to be a lack of PA. Approximately 38.2% of adults (those who are at least eighteen years old) in Kolar City were found to participate in less physical activity than the recommended level (<600 MET-minutes per week).²⁹

A recent study in **India revealed** that over 80% of adolescents fail to meet the WHO recommends engaging in at least 150 minutes of moderate-intensity exercise each week. The frequency of NCDs like Second-type diabetes, obesity, hypertension, and mental diseases like anxiety and depression can be raised by the notably higher rates of inactivity among adolescent girls (85%) compared to boys (78%).^{12,13,18} To address these concerning levels of inactivity and their associated health risks, **WHO guidelines** recommend that individuals aged 18 and above should exercise for at least 150–300 minutes a week at a moderate intensity, 75–150 minutes a week at a vigorous intensity, or both. Thereof^{12,13,18}. Hence this study aims to prevent future NCDs and to make the subjects to be well fit and strong so that it will decrease in further health complications.

OPERATIONAL DEFINITION

PHYSICAL FITNESS: The ability of the systems in your body to function is known as physical fitness (PF). together effectively to enable to perform daily tasks and keep yourself healthy.

- Corbin & Guy Le Masurier

PHYSICAL ACTIVITY: Any movement of the body caused by physical activity (PA) the voluntary muscles (Skeletal muscles) that leads to energy consumption.⁵

- Carl J Caspersen

AEROBIC CAPACITY: The maximum amount of oxygen that can be absorbed, used, and transported during physical activity, since the longer the exercise or physical activity, the more oxygen the body needs to provide aerobic resistance.

- Cesar Nhamitambo

MUSCULAR STRENGTH: The ability to apply force to an external object or resistance.

- C. Sandoval

FLEXIBILITY: Flexibility is muscles' and connective tissues' range of motion, at an one or multiple joints.

- Pate R

OBJECTIVE OF THE STUDY

To evaluate aerobic capacity, abdominal muscle endurance, and trunk extensor strength among college adolescents.

To compare pre and post results after 4-weeks intervention.

To determine gender wise differences.

HYPOTHESIS

NULL HYPOTHESIS: There is no significant difference in the results between pre and post study.

ALTERNATE HYPOTHESIS: There is a significant difference in the results between pre and post study.

CHAPTER II

REVIEW OF LITERATURE

2.1 REVIEW RELATED TO PREVALENCE

Daphne Clarence et al., (26th Jun 2024)

The title is “**Half of India's population not physically active: Study shows worrying trend.**” This study aimed to assess and prevalence of teenagers' inadequate physical activity, it will increase the risk of NCDs. According to WHO guidelines concluded that every adolescent has to participate in at least 150 to 300 minutes of moderate exercise or 75 to 150 minutes of intense exercise activity each week, it prevents further diseases.¹⁸

Tessa Strain et al., (August 2024)

The title is “**National, regional, and global trends in sufficient physical activity among adults from 2000 to 2022: a pooled analysis of 507 population-based surveys with 5.7 million participants**”. This study aims to determine how common insufficient physical activity is in 197 countries and territories from 2000 to 2022. In conclusion, the majority of countries are not on course to fulfill the global goal established for 2030, about a third of adults worldwide do not engage in the suggested amounts of exercise. All nations are urged to significantly expand the implementation of policies and programs to address these disparities in light of the evidence of ongoing gaps in participation between sexes and across age groups. Although

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effective policies are known, implementation has been uneven and sluggish worldwide, according to these data and recent progress reports. Successful experiences from nations on track to meet global targets and those with a positive trend should be widely disseminated. It is recommended that all countries coordinate investments and bolster multisector strategies to encourage physical activity across all age groups and genders at the local and national levels.¹¹

Gaurav Kapoor et al., (31st Jan 2022)

The title is **“Physical activity for health and fitness: Past, present, and future”**. The goal of this study was to determine how physical activity has drastically decreased in modern era as a result of technological improvements, which has resulted in a decline in health and fitness. Studies conducted over the past few decades have shown that sedentary and inactive lifestyles increase the risk of chronic illnesses. Additionally, studies show that students are less active than adults. According to the study's findings, promoting physical activity is essential for people of all ages. These objectives can be met by disseminating information through community-wide and mass media campaigns, social support, increasing physical activity in workplaces and communities, physical education, and classrooms. Physical education, after-school sports, and active transportation for school-age children are a few programs aimed at improving societal health. The advantages of exercise in promoting health and fitness are discussed in this article, along with ways to enhance it and lessen its numerous detrimental effects on individuals' lives and economy of the country in the present and the future.¹

Regina Guthold et al., (Jan 2020)

The title is **“Global trends in sufficient physical activity among adolescents: A pooled analysis of 298 population-based surveys with 1.6 million participants.”** Aim of this study is that young people can benefit from physical activity in many ways. A new global initiative on physical activity, on exercise, "A Healthier World with More Active People" was introduced by WHO 2018. Its goals include 15% relative decrease in occurrence of inadequate adults' physical activity and adolescents worldwide by 2030. We outline the predominance and trends of inadequate teenagers in school engage in physical activity (11–17 years old) by nation, region, and worldwide.¹⁰

Britni R Belcher et al., (18th Aug 2020)

The title is **“The roles of physical activity, exercise, and fitness in promoting resilience during adolescence: Effects on mental well-being and brain development.”** Adolescence: Impacts on brain development and mental health. In this study, the connection between exercise, physical exercise, and

aerobic fitness is briefly reviewed by researchers using mental health, and the goal is to lessen adolescent mental health issues. The findings indicated a connection between brain structure and PA/exercise and fitness during adolescence and function connected to mental health-related emotional and cognitive systems. With numerous unresolved issues pertaining to these traits, behaviors, and resilience during future studies, research is required to ascertain whether this delicate stage of adolescent development and exercise's neuroplastic effects may make mental health issues more resilient. According to preliminary neuroimaging research, fitness and exercise may be essential for both healthy mental and brain development in teenagers across the globe. Through PA/exercise and fitness, across boundaries and cultures, probably play a critical role in the adolescent. The brain develops.²⁵

2.2 REVIEW RELATED TO EFFECTS OF PHYSICAL ACTIVITY ON ADOLESCENCE

Brown CEB et al., (2024)

The title is **“Key influences on university students physical activity: A systematic review using the theoretical domains framework and the COB-B model of human behaviour”**. This study set out to assess university students' levels of physical activity. The results provide a foundation for enhancing the creation of theory and evidence-based interventions to Encourage college students to be physically active Particularly promising for encouraging active student lifestyles are interventions that focus on the TDF domains "social influences," "environmental context and resources," and "goals."³

Esther M F Van Sluijs et al., (26th April 2022)

The title is **“Physical activity behaviour in adolescence: evidence and opportunities for intervention”** This study globally shows 80% of adolescents are insufficiently active, and many engage in ≥ 2 hrs of daily recreational screen time, so that the cardiorespiratory fitness level will be decreased and it may lead to problems. So the conclusion was to focus on improving adolescence physical activity surveillance and to reduce the hazards of NCDs.¹²

Yunqi Zhang et al., (29 July 2022)

The title is **“Effect of Physical Exercise on College Students Life Satisfaction: Mediating Role of Competence and Relatedness Needs.”** Zhang Yunqi et al. (29 July 2022) is significant because it looks at how physical exercise affects the contentment of college students. The mediating functions of relatedness and competence requires fulfillment as well as their variations between college students majoring regarding physical education (PE) and those not, were looked into based on fundamental theory of psychological needs. The conclusion was that college

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students' Engaging in physical activity plays a vital role in preventing other illnesses.²

Vidran Kolajevic et al (2022)

The title is “**Physical activity and physical fitness among university students - A systematic Review**”. This study's objective is to evaluate assessment, Exercise has a beneficial impact on the growth and up keep of physical activity and fitness.⁴

Ryan D et al., (May 2014)

The title is “**Concurrent and criterion - Referenced validity trunk muscular fitness tests in school - aged children**” Low back pain (LBP) is a contributing factor to youths' low levels of physical activity; therefore, appropriate evaluation in physical education regarding low back function To determine which kids are potentially at risk a setting is required. The aim of this study is to assess school-aged children's concurrent, criterion-referenced, and core muscular endurance.¹⁶

Weimo Zhu et al., (Dec 2010)

The title is “**A primer-test centred equating method for setting cut-off scores.**” This study aims to evaluate maximum multistage 20-meter shuttle run test intended to ascertain the maximum aerobic capacity of students at school, Adults in good health who go to fitness classes and athletes who play sports with lots of stops and starts. Conclusion is The coefficients of test-retest reliability were 0.95 for adults (81 men and women, ages 20–45) and 0.89 for kids (139 girls and boys, ages 6–16).¹⁴

Amritashish Bagchi et al., (July 2019)

The title “**Development of norms for cardiovascular endurance test for youth aged 18-25 years**”. The study's goal is to create standards for cardiovascular endurance tests for Indian youth age 18-25 years also examine connection between gender, age, with test performance. The developed norms show Beep test performance is inversely correlated with age. Because of physiological variations, males demonstrated greater cardiovascular endurance than females. These standardized norms are crucial for assessing, comparing, and evaluating cardiovascular fitness, providing guidance for Indian youth and assisting coaches in designing effective training plans. More investigation is required to create standards for norms for India's diverse population, as this study focused solely on the 18-25 age range.²⁴

2.3 REVIEW RELATED TO AEROBIC FITNESS TESTS

Trey R Naylor et al, (2025)

"Comparison of cardiorespiratory fitness testing measures in children" is the title. This study's objectives were to (1) contrast peak oxygen consumption measurements (VO₂ peak), HR peak, and One-minute responses to heart rate recovery (HRRec) acquired using a the PACER test also GXT max. (2)

Compare a PACER prediction equation with the VO₂ peak from the GX max and PACER test. The comparison study proved to be highly beneficial and produced positive outcomes.²⁷

Daniel Mayorga-Vega et al., (August 2015)

"Criterion-Related Validity of the 20-M Shuttle Run Test for Estimating Cardiorespiratory Fitness": A Meta-Analysis is the title. The 20-M shuttle run test's validity criteria for evaluating cardiorespiratory fitness was examined in this study. Overall, the 20 MSR test possesses a criterion-related validity mean correlation coefficient that ranges from moderate to high for VO₂ max estimation, according to study conclusion. Current meta-analysis demonstrates that the validity of the criteria-related 20 MSR test is more difficult for adults than for kids. with respect to the potential moderators examined. However, the validity-related criterion for estimating the VO₂ max will be significantly more when the children's performance rating is combined with additional factors. The relationship between measured VO₂ max and the 20 MSR test score appears to be unaffected by the participants' sex or VO₂ max level.¹⁹

Weimo Zhu et al, (Dec 2010)

The title “**A primer-test centred equating method for setting cut-off scores**” this study is aimed to evaluate The goal of the 20-meter shuttle run test's maximum multistage was to ascertain in the maximum school children's aerobic capacity, athletes playing sports with lots of stops and starts, as well as healthy adults taking fitness classes. Conclusion is Test-retest For adults (81 men and women), reliability coefficients were 0.95, ages 20–45) and 0.89 for kids (6–16 years old, 139 boys and girls).¹⁴

L A Leger et al., (1988)

"The multistage 20-meter shuttle run test for aerobic fitness" is the title. The study's maximum number of stages 20-meter the shuttle run test was created to be ascertain in the maximum exercises capacity of healthy adults and school children enrolled in fitness classes, Also, athletes competing in athletics requiring frequent pauses and resumes like basketball and fencing, and so forth. The test's usefulness in measuring and determining children's or adolescents' aerobic capacity level was concluded.¹⁴

Eddolls et al, (2017)

The title “**High-Intensity Interval Training (HIIT) Interventions in Children and Adolescents: A Systematic Review**”. This study's objective is to ascertain whether HIIT is useful for improving fitness and health in children and adolescents. In conclusion, the review found that HIIT is a time-saving workout technique. that significantly improves cardiorespiratory fitness and can also enhance some cardiovascular health markers. The authors noted that

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the best outcomes were achieved when running-based HIIT was performed at very high intensity, around 2–3 times per week for at least 7 weeks. However, changes in body fat and metabolic outcomes were inconsistent across studies. Overall, the review concluded that HIIT is a promising approach for improving fitness in youth, but more Excellent research is required.³¹

2.4 REVIEW RELATED TO CORE STRENGTH TESTS

John R Gilliam et al., (17th Aug 2023)

The title is “**Test-retest reliability and construct validity of trunk extensor muscle force modulation accuracy**”. The purpose of this study was to determine the construct validity and test-retest reliability for trunk extensor muscle force modulation both within and between days. Under all three tested conditions, test-retest consistency for FM accuracy was found to be consistently excellent, both within and between days. Higher FM speeds resulted in higher ICCs, but they also increased between-subject variability and inaccuracy. According to EMG, this protocol generates the greatest amount of muscle activity from the TES, LES, and LM. NMF shows a consistent control strategy across participants and conditions where the trunk extensors dominated the force modulation.²²

Meredith, M. D. et al., (2010)

The title “**FitnessGram/ActivityGram test administration manual (4th ed). Champaign, IL: Human Kinetics**”. The purpose of this study is to assess and assess physical activity in children and adolescents of the TRUNK LIFT, PACER, and CURL UP tests. The conclusion is that tests are very helpful for the students to assess their level of fitness and it improve the cardiorespiratory fitness level.¹⁵

Norman S et al., (May 2006)

The title is “**Reliability and validity of low back strength/Muscular endurance field tests in adolescents.**” This study determined the reliability and evaluated the validity of selected low back field tests. The conclusion is that Validity coefficients are determined by Pearson product-moment correlation coefficients for males and females. Conclusions B-90° DTE was shown to be a valid field test when compared to PRC-DTE, but only for males. Further research on the PRC-DTE and PRC-STE items for adolescents is recommended.²³

D Knudsen et al., (Feb 2001)

The title “**The Validity of recent curl-up tests in young adults**” describes the purpose of this study, which was the reliability of two abdominal endurance field tests in a sample of twenty-two males and 22 female college students, adjusted using isometric strength of the trunk flexor and A Cybex TEF machine is used to measure endurance. The conclusion is

that Abdominal strength and the field tests did not significantly correlate ($-0.21 < r < 0.36$). The bench trunk curl was the only test that demonstrated a substantial relationship with abdominal muscular endurance (male = 0.50 and female = 0.46, $p < 0.05$). modified curl-up's nonsignificant correlation was probably caused by a ceiling effect brought on by the test's simplicity. The curl-up results and their proposed fitness standards related to health should be interpreted cautiously due to the poor correlations (about 25% common variance) between isometric and field tests of abdominal endurance and a recent longitudinal study.²¹

Marković, M., & Milošević, V, et Al (2023)

The title “**Unstable compared to stable core exercises improve muscular endurance in preadolescents and adolescents: An eight-month randomized trial Kinesiology**”. This study's goal was to ascertain whether instruction on unstable surfaces would lead to greater improvements in core muscular endurance compared to traditional stable-surface exercises in young people. The conclusion of the research showed that unstable core training produced significantly better improvements in muscular endurance than stable core training. The authors suggested that adding instability challenges the core muscles more, promotes better neuromuscular activation, and can be more beneficial for enhancing core strength and endurance in youth. They recommended that unstable core exercises can be included in physical education, sports training programs to improve functional performance in growing children and adolescents.³²

CHAPTER III

METHODOLOGY & MATERIALS

3.1 STUDY DESIGN:

It was a pre-experimental investigation.

3.2 SAMPLING TECHNIQUE:

Convenience sampling technique

3.3 SAMPLE SIZE:

Total of ten (10) students was selected for this study based on the selection criteria

3.4 STUDY SETTING:

The research was carried out in Shantha Group of Institutions, Peresandra, Chikkaballapur.

3.5 STUDY DURATION:

The study was conducted over a six-month period.

3.6 TREATMENT DURATION:

The course of treatment lasted 4 weeks.

3.7 SELECTION CRITERIA:

3.7.1 INCLUSION CRITERIA

College going students,

Both boys and girls

Vitally stable

Subjects who will return the signed consent form

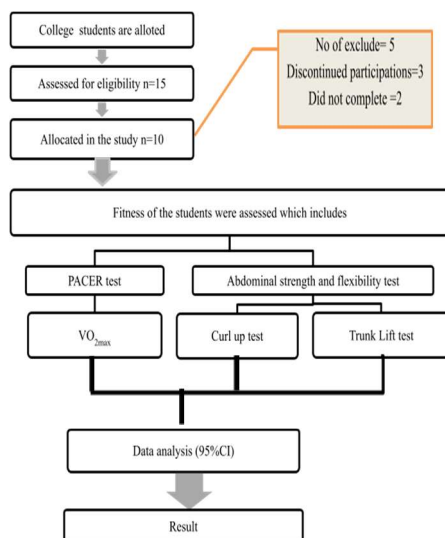
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3.7.2 EXCLUSION CRITERIA

Any injury lasts 1 month.

Health interventions (any kinds of nutritional supplements).

Any kind of cardiovascular problems, neurogenic or orthopedic disease. Any kind of surgery within 1



month.

Sports students “those engaged in structured athletic training programs.”

3.8 VARIABLES:

3.8.1 DEPENDENT VARIABLE

Aerobic Capacity, Strength, and Flexibility of the Subjects

3.8.2 INDEPENDENT VARIABLE

Age and gender of the subjects

3.9 OUTCOME MEASURE:

Aerobic Capacity, Core Muscle Strength, and Flexibility.

3.10 OPERATIONAL TOOL:

Pen or pencil and Paper

Watch

3inch wide strip

12-inch yardstick or ruler



Figure 1: Materials Used
FLOW-CHART

3.11 PROCEDURE

First, the subjects who are willing to participate in the research and fulfil the inclusion and also exclusion standards to be applied.

Permission will be taken from the concerned authority of the location prior to data collection.

Form of consent will be given and the assessment form will be given to be filled up.

Before performing the test, the procedure will be explained to the subjects.

Each physical activity session will have a total duration of 60 minutes and will be conducted 3 days per week. A 5-minute rest period will be incorporated as needed during the session.

There will be a required warm-up and cool-down for each session.

3.12 TECHNIQUES

3.12.1 AEROBIC EXERCISE

To evaluate **Aerobic capacity**, **PACER** or run with increasing aerobic cardiovascular endurance¹³ will be used. PACER is a cardiovascular fitness test.^{14,16} The test will begin with running on the ground between two points 20 meters apart.

The **objective** is to get from one point to the other before the recorded “beep” sounds (**Figure 2**). The recording of beeps also has music in the background. The severity of the PACER is progressive; it begins lightly and progressively becomes more difficult. When the student can no longer complete distance in the time allowed, the test ends.^{14,16}

The test's total number of laps as well as an equating method that translates to estimate VO_{2max} , PACER laps are converted into comparable one-mile run times.¹⁴ Age and the number of laps completed are included in the final formula chosen to calculate aerobic capacity.^{15,16}

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Figure 2: Subjects performing the PACER test

3.12.2 CORE MUSCLE STRENGTH AND ENDURANCE

To check the **abdominal strength, endurance curl-up** procedure was done.

To perform the curl-up examination, the subject lying on their back with their feet level with the floor, little apart, and their knees bent at a 140-degree angle. The head is resting on the mat, and the arms are erect. along the sides, palms down.

Their fingertips should just touch the edge of Measurement strip placed under their legs. The therapist kneels at the head, placing a piece of paper underneath. The subject then slowly curls up, slide their fingertips across the strip of measurement until they reach the far edge, and then goes back to where they were before until their head touches the paper (indicated by a crinkling sound).

This movement should follow a cadence of about 20 curl-ups in a minute. The test goes on up until the subject can no longer maintain the pace, reaches 75 repetitions, or has two form errors. The final score is total number of correctly performed curl-ups, counted each time the head returns to the mat.¹⁶



Figure 3: Shows Subjects performing curl-up test

To check the **trunk strength and endurance**, a **trunk-lift** procedure was done.

The test's goal is to lift the upper body off the ground using the back muscles and stay there long enough to take a measurement. The participant lies on a mat face down. with toes pointed and hands are placed under the thighs.

On the ground, a marker (such as a coin) is positioned in line with their eyes. Throughout the test, they should keep their attention on this marker. The participant raises their upper body off the ground slowly and deliberately. A maximum height of 12 inches should be reached by the lift, avoiding excessive stretching.

The head needs to remain within a neutral position. The lifted position is hold while the tester measures the distance between the floor and the participant's chin using a ruler placed slightly in front of the chin. The subject then slowly lowers their upper body back to beginning posture. The two trials are are conducted, and the best (highest) measurement in inches is documented, with the highest score of 12 inches.¹⁶

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Figure 4: Shows Subjects performing trunk lift

At the end of all tests, to minimize muscle soreness and stiffness, a **cool-down period** will be conducted. This will include slowly decreasing the activity level to a light jog or brisk walking. Static stretching is then performed to promote muscle recovery. and improve flexibility.

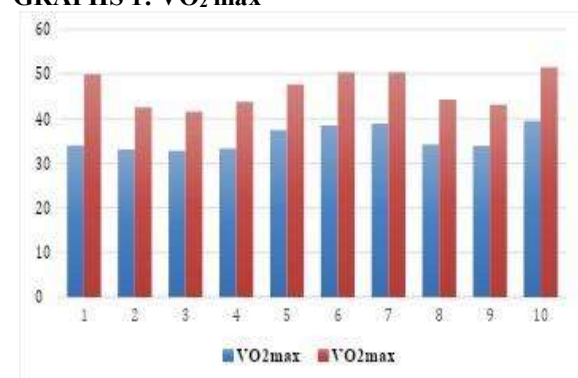
CHAPTER IV DATA ANALYSIS & RESULT

TABLE 1: PRE AND POST DATA OF THE SUBJECT FOR ALL TESTS

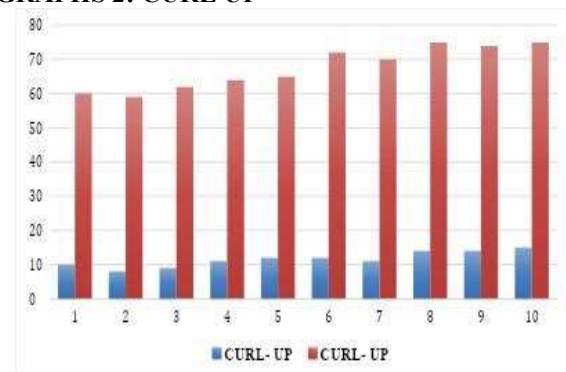
SL NO	AGE	PRE TEST			POST TEST		
		VO2 MAX	CUR L UP	TRUN K LIFT	VO2 MAX	CUR L UP	TRUN K LIFT
1	17	34	10	7	50	60	7.5
2	17	33.1	8	6.5	42.5	59	8
3	17	32.8	9	6	41.6	62	7
4	18	33.3	11	8	43.7	64	8.5

5	18	37.4	12	8.5	47.7	65	10
6	18	38.5	12	8.5	50.4	72	9
7	18	38.9	11	9	50.4	70	10
8	19	34.2	14	8.5	44.3	75	10
9	19	33.9	14	9	43.1	74	10.5
10	19	39.5	15	10.5	51.5	75	11.5

GRAPHS 1: VO₂ max



GRAPHS 2: CURL UP



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GRAPHS 3: TRUNK LIFT

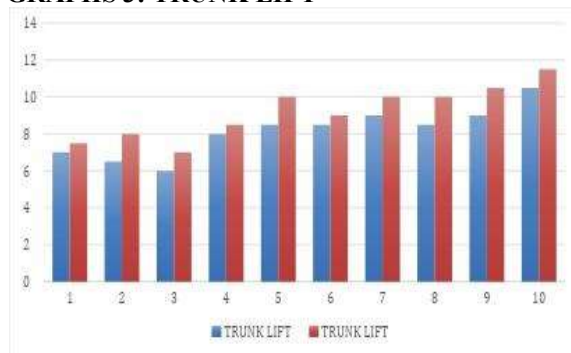
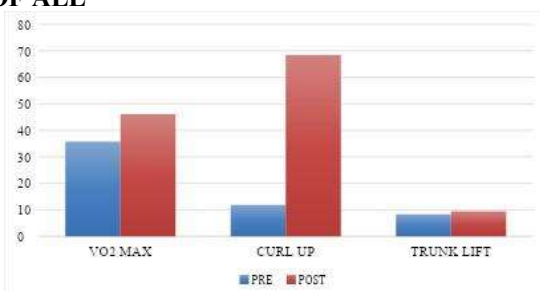


TABLE 2: DESCRIPTIVE ANALYSIS

Descriptive Analysis	VO2 MAX		CURL UP		TRUNK LIFT	
	PRE	POST	PRE	POST	PRE	POST
Mean	35.733	46.133	11.778	68.444	8.2778	9.389
Standard Deviation	2.54	3.82	0.59	0.67	0.84	4.87

GRAPHS 4: PRE AND POST IMPROVEMENT OF ALL



To compare pre and post exercise values, the best next step is to perform a statistical test that analyzes whether the change for each parameter (VO2 Max, Curl Up, Trunk Lift) is significant across the group. The most appropriate test is a **paired t-test** for each variable since the same subjects were measured before and after exercise.

TABLE 3: P VALUE TEST

Parameter	Mean (Pre)	Mean (Post)	p-value	Statistical Significance
VO2 Max	35.56	46.52	.000	***
Curl Up	11.60	67.60	.000	***
Trunk Lift	8.15	9.20	.000	***

VO2 Max	35.56	46.52	.000	***
Curl Up	11.60	67.60	.000	***
Trunk Lift	8.15	9.20	.000	***

***Significant at $p < 0.001$

All three parameters showed extremely low p-values ($p < 0.001$), indicating reject the null hypothesis and accept alternative hypotheses at 95% confidence level. Thus, we can conclude that there is significant improvement between **VO2max**, **curl up** and **trunk lift** values across the groups.

CHAPTER V DISCUSSION

The current study sought to assess modifications in aerobic capacity, abdominal muscle endurance, and trunk extensor strength among college adolescents following a 4-week structured physical activity intervention. The findings demonstrated significant improvements across all measured parameters—VO₂max, curl-up performance, and trunk-lift scores—indicating that even a short-term, well-designed exercise program can yield meaningful enhancements in adolescent physical fitness.

Improvement in Aerobic Capacity (VO₂max)

The results showed a statistically significant increases in VO₂max values between pre- to post-intervention ($p < 0.001$). This improvement suggests enhanced cardiorespiratory efficiency, which may be attributed to the progressive aerobic activities incorporated in the training sessions, including jogging–running intervals and cycling.³¹ These exercises are known to promote peripheral and central cardiovascular adaptations, including improved mitochondrial density, increased stroke volume, and improved oxygen extraction.³¹

Previous literature supports these findings and studies among adolescents consistently report that structured aerobic training significantly enhances VO₂max and overall cardiorespiratory fitness. The PACER test used in this study is a validated field measure for assessing aerobic capacity,^{14,15} and improved scores align with earlier research reflecting increased endurance following regular structured physical activity.^{14,15} Thus, the current study reinforces existing evidence that aerobic training is highly effective for improving cardiovascular health in young populations.

Improvement in Core Muscle Strength and Endurance (Curl-Up Test)

The curl-up scores revealed a marked increase after the 4-week intervention ($p < 0.001$). This improvement

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can be attributed to the inclusion of targeted abdominal exercises such as Dead Bug and Bicycle Crunches, both of which activate the rectus abdominis, obliques, and deep stabilizing musculature. Enhanced neuromuscular coordination and increased muscular endurance are likely contributors to the improved curl-up performance.³²

These findings are comparable to studies showing that core-focused training programs significantly improve abdominal muscle endurance in adolescents. Core strength is essential not only for physical fitness but also for posture, spinal stability, injury prevention, and performance in daily activities.¹⁶ The current study thus further supports the importance of core-specific interventions in adolescent fitness programs.

Improvement in Trunk Extensor Strength (Trunk Lift Test)

Trunk-lift scores also improved significantly ($p < 0.001$). Exercises such as Bird-Dog and Prone Back Extension specifically target the erector spinae, multifidus, and other posterior chain muscles responsible for trunk stability and spinal extension.³² The observed improvements may reflect enhanced muscular endurance, better recruitment of deep stabilizing muscles, and improved postural control.³² Similar studies have demonstrated that trunk-strengthening exercises effectively improve back extensors endurance and reduce the risk of lower-back discomfort in adolescents.¹⁶ Given increasing inactivity behaviours and prolonged sitting among students in college, the improvement in trunk strength is a particularly positive outcome.

Impact of Short-Term Intervention

Although the intervention lasted only 4 weeks, the results indicate substantial improvements across all variables. This suggests that adolescents respond quickly to structured and progressive physical activity, even within a relatively short duration. Such findings emphasize that lack of time—a commonly cited barrier—should not prevent the implementation of fitness programs in educational settings.

Gender Differences

Although gender-wise comparisons were part of the study objectives, the small sample size limits strong conclusions. However, general trends in the data suggest that both male and female participants benefited similarly from the intervention. Previous studies also highlight that while baseline fitness levels may vary between genders, both show significant improvements with consistent training.

Relevance to College Adolescents

The findings align with the growing body of evidence that college routines often reduce physical activity levels due to academic stress, lifestyle changes, and reduced sports participation. This decline emphasizes the need for structured fitness interventions within colleges. The positive changes observed in this study highlight the value and feasibility of incorporating short-duration exercise programs into college timetables to improve overall health and academic performance.

Comparison with Global and National Trends

Global and Indian data indicate increasing physical inactivity among adolescents, with more than 80% failing to meet WHO recommendations.^{18,30} The significant improvements observed in this study support the urgent need for practical interventions to counteract this trend. The results contribute to the literature by demonstrating that even minimal-duration programs can positively influence main fitness components associated with long-term health outcomes.

Overall Interpretation

The significant improvements in VO_{2max} , core strength, and trunk endurance collectively indicate that the intervention was successful in improving the physical fitness of college adolescents. The findings also highlight the adaptability of adolescents to structured physical activity as well as underscore the potential of targeted exercise programs to mitigate the hazards connected to a lack of physical inactivity.

CHAPTER VI

SUMMARY AND CONCLUSION

6.1 SUMMARY

The primary goal of the research is to ascertain the consequences of college life on physical fitness among adolescents. A total of ten adolescent college going students were chosen using the criteria of selection.

The ten students were combined into a single group. The intervention of pre- and post-physical fitness training was given. The treatment duration was 4 weeks. Where the VO_{2max} was assessed by using a pacer, core strength and flexibility was assessed by using curl up, and trunk strength and endurance was assessed by using trunk lift.

6.2 CONCLUSION

The study concluded that 4 weeks of pacer, curl up, trunk lift, training were shown statistically significant pre-test and post-test values. These are beneficial for physical fitness among college going adolescence students.

CHAPTER VII

LIMITATIONS AND RECOMMENDATIONS

7.1 LIMITATIONS

The study, which investigated the effect of college life regarding adolescent physical fitness, had several limitations. A primary constraint was the **tiny sample size**, consisting of only ten subjects participating, which restricts the findings' applicability to a larger population. The study was also short-term, conducted over a period of just **4 weeks**, which might not be enough to notice more significant or long-lasting changes in physical fitness. Furthermore, the research focused exclusively on **adolescent college students**, and the outcomes might not be suitable for different age groups. The research also had a limitation in its scope as it excluded individuals with pre-existing health conditions. Finally, **environmental factors**, such as rain, weather, could have potentially disrupted the scheduled physical activity sessions, posing a challenge to the consistency of the intervention.

7.2 RECOMMENDATIONS

According to the study's limitations, a number of recommendations for upcoming investigation. To improve the validity and applicability of the results, a comparable research should be conducted with a **bigger sample population**. Extending the duration of the study beyond 4 weeks would be advantageous to obtain a deeper comprehension of the long-term consequences of physical exercise on fitness. It is also recommended to replicate this study with different populations, such as **school-going students** or other age groups, to research the impact of physical activity across various developmental stages. Future research could also consider including participants with controlled health conditions to comprehend the role of exercise in disease manage.

CHAPTER VIII

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ANNEXURE-I CONSENT FORM

This is to clarify that I have given my permission to participate in the dissertation work of **SHREYA K N** titled “**A STUDY ON IMPACT OF COLLEGE LIFE ON PHYSICAL FITNESS DURING ADOLESCENCE**”

The above study has been fully explained to me. I have had the opportunity to ask questions about it, and any questions that I have asked have been answered to my satisfaction.

Name of the Participants:

Signature of the Participant:

Date:

ANNEXURE-II SCREENING FORM SI No:

Date:

Name:	Age:
Gender:	Contact Number:
Emergency Contact Name:	Emergency Contact Number:

MEDICAL HISTORY:

1. Are you suffering from chest pain at rest or during exercises? **Yes/No**
If **Yes** please outline the details

2. Did you have any major illness or injury in the last 5 years? **Yes/No**
If **Yes** please outline the details

3. Are you receiving treatment for any diagnosed medical/ hereditary conditions? **Yes/No**
If **Yes** please outline the details

4. Are you taking any prescription medication? **Yes/No**
If **Yes** please outline the details

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Please indicate if you ever experience any of the following symptoms:

☐ Ever get unusually short of breath with very light exertion.

☐ Suffer from asthma.

☐ Ever experience palpitations or irregular heartbeats.

☐ Ever have pain, pressure, heaviness or tightness in the chest area.

☐ Ever have severe dizzy spells or fainting.

☐ Regularly have unexplained pain in the abdomen, shoulders or arms.

☐ Regularly get lower leg pain during walking that is relieved by rest.

☐ Ever been advised by a medical professional not to exercise.

☐ Suffer from increased blood pressure

☐ Received a diagnosis of any form of cancer

☐ Suffer from any chronic illness or condition

☐ Suffer from arthritis/muscle/joint or back pain

☐ Any pre-existing injury

☐ Had any form of recent surgery (within the last 12 months)

☐ Currently take any form of medication, prescribed or otherwise

You have ticked any of the boxes above please provide more detail below including specific symptoms, medical diagnosis and timing along with any current medications that are being taken:
