"EFFECTIVENESS OF BICYCLE UTILIZATION ON PHYSICAL FITNESS COMPONENTS AMONG SECONDARY SCHOOL STUDENTS OF SHIVAMOGGA DISTRICT"

A Thesis submitted to Kuvempu University in fulfilment of the requirements for the Award of the Degree of

DOCTOR OF PHILOSOPHY

IN

PHYSICAL EDUCATION

By

Mr. PRAVEENA A.

Guide

Dr. APPANNA M. GASTI

Retired Deputy Director

Department of P.G. Studies and Research in Physical Education

Through

Department of Post Graduate Studies and Research in Physical Education, Kuvempu University, Jnana Sahyadri Shankaraghatta, Shivamogga

2022

Declaration

I, **Mr. Praveena A.,** hereby declare that the thesis entitled **"Effectiveness of Bicycle Utilization on Physical Fitness Components among Secondary School Students of Shivamogga District"** submitted to Kuvempu University for the award of the Degree of **Doctor of Philosophy in Physical Education** is the result of the bonafide research work carried out by me under the guidance of **Dr. Appanna M. Gasti,** Retired Deputy Director, Department of Post Graduate Studies and Research in Physical Education, Kuvempu University.

I further declare that, this or part thereof has not been the basis for the award of any other diploma or degree either in this or any institution or university.

(PRAVEENA A.)

Date: 14-12-2022

Place: Shankaraghatta

Kuvempu University

Dr. APPANNA M. GASTI
Research Guide (Rtd.)
Retired Deputy Director

Dept. of P.G. Studies and Research in
Physical Education, Jnana Sahyadri
Shankaraghatta -577 451, Shivamogga District
Karnataka, INDIA
Mobile : +91 94497 57038

Certificate

This is to certify that the thesis entitled **"Effectiveness of Bicycle Utilization on Physical Fitness Components among Secondary School Students of Shivamogga District"** submitted to Kuvempu University for the award of the degree of **Doctor of Philosophy in Physical Education** is the original research work done by **Mr. Praveena A.,** under my supervision and guidance. Further, it is certified that the content of this thesis, in full or in part, have not been submitted by the candidate to any other Institution or University for the award of any degree or diploma.

Date: 15/12/22
Place: Shankaraghatta

(Dr. APPANNA M. GASTI)
Dr. Appanna.M.Gasti
Retired Deputy Director
Department of Physical Education
Kuvempu University
Shankaraghatta-577 451

Dedicated To Beloved

Parents, Teachers, Family Members & Friends

For their encouragement, love and support throughout my career

Acknowledgements

It is a pleasure to thank many people who made this thesis possible.

*I express my heartfelt and sincere gratitude to my esteemed Guide and Mentor **Dr. Appanna M Gasti.,** Retired Deputy Director and Research Guide, Department of P.G Studies and Research in Physical Education, Kuvempu University for his invaluable scholastic guidance, I am really thankful to him for his sportive support and inspiration extended to me for successful completion of this study.*

I extend my deep sense of gratefulness to Dr. S.M. Prakash., Retired Director, Department of Physical Education, Kuvempu University for his precious advice and expert suggestions provided throughout my study.

My special thanks are due to Dr. Gajanana Prabhu B., Associate Professor and Chairman, Department of P.G Studies and Research in Physical Education, Kuvempu University, Shankaraghatta for his kind help and support in successful completion of this research work.

I extend my sincere gratitude Dr. N.D. Virupaksha., Nagaraja G.S., Dr. Ravindra Gouda S.M., faculty members of the Department of P.G Studies and Research in Physical Education, Kuvempu University, Jnana Sahyadri, Shankaraghatta.

I am thankful to Dr. H.S. Bhojya Naik, Professor, Department of Industrial Chemistry, Dr. Hiremani Naik, R., Professor, Department of P.G. Studies and Research in Commerce, Dr. M.C. Prabhakar, Associate Professor, Sir M.V. Government First Grade Science College, Bommanakatte, Bhadravathi, Dr. Vishwanath R., Guest Lecturer, Department of Industrial Chemistry, Dr, Indrajith Naik E., Forensic Scientific Officer, Bengaluru, Mr. Kala Naik, Physical Education Teacher, Thammadihalli and President of Teachers Union, Shivamogga and Ms. Sumana R. teacher, National Public School, Shivamogga for their help throughout my career.

I am ever thankful to Dr. Geetha C., Professor and Chairman, Dr. Jagannath K. Dange, Professor, Department of Studies and Research in Education, Kuvempu University, Dr. Madhu, G., Principal, KSSM College, Shivamogga, Mr. Robit Mathew, Principal, Mother Teresa School, *Machenahalli,. Shivamogga and Ms. Pooja K., Teacher, Universal Group of Institutions, Bengaluru for their help and support in correction and analysis of this thesis.*

My sincere thanks to SC/ST Cell, Kuvempu University for providing financial support in carrying out the present research work.

I am thankful to Mr. Mahalingappa and all the Non Teaching Staff of the Department of P.G. Studies and Research in Physical Education, Kuvempu University for their timely help.

My thanks are due to Mr. B.C. Ramesh, Former Indian Kabaddi Player and Arjuna awardee, Mr. B.C. Suresh, Former Indian Kabaddi Player, Ekalavya and Dhyanchand awardee, Mr. Ravindra K.R. and Mr. Prashanth G. Kunte, National Kabaddi Players, Karnataka State Amateur Kabaddi Association and Shivamogga District Amateur Kabaddi Association and all the committee member of the Kabaddi Association.

I am thankful to Mr. Vinod F., Mr. Santhosh F., and the friends of Mega Mobiles, Shivamogga, Mr. Kumar C., Mrs. Shantha, lovely Chinmay and Rishika.

I am extremely grateful to my family members Sri. Anantha Naik P., Smt. Putti Bai B., brother Mr. Hemanth, sister Mrs. Yashoda, Mr. Jayaram, Jahnavi and Chinnu, Sri. Eshwar Naik., Smt. Devi Bai, Smt. Uma Bai, Teacher, Government Primary School, Mandya, Smt. Mukunda Bai.

I express my sincere thanks to Sri. B. Vasantha Naik, Retired Director, DGICM, Nagpur/NCCT, New Delhi, Smt. Geetha K., Mr. Abhishek V., KAS, Project Director, DVDC, Dakshina Kannada District, Mangaluru, Sri. Krishna Naik, SDCC Bank, Shivamogga, Smt. Hemavathi, Sri. Ashok, Smt. Neela Bai.

My wholehearted thanks are due to my brothers and sisters Mr. E. Harisha, Mr. Hemanth, Dr, Indrajith Naik E., Forensic Scientific Officer, Bengaluru, Mr. E. Pradeepa, Mr. Jeevan R., Mr. Prajwal A. Naik, Mr. Ganesha K., Ms. Varsha, Ms. Pratheeksha, Ms. Manya, Ms. Moulya, Ms. Veditha K. for their valuable help and cooperation in all the ways throughout my career.

I express my special feelings and thoughts to all my well-wishers and friends Mr. Gopal Nayak, Mr. Sunil D., Mr. Vidyadhara M., Mr. Siddaraju, Mr. Yathisha S.K., Mr. Mahendra S. Pujari, Dr. Nagaraj Y., Mr. Santhosha Naik, Mr. Sanjeev Kumar K., Mr. Shankara Murthy K.M., Dr. Chethan, Mr. Dhanush V., Mr. Veekshith, Mrs. Bhavya R., Mr. Vasantha Naik P., for their help and cooperation in completing this research.

I am grateful to the students of M.P.Ed. and B.P.Ed., Kuvempu University, Mr. Manjanna and family, Jayamma Xerox, Mr. Manjuntha, Rohan Computers, Shankaraghatta for their encouragement.

My thanks are due to Mr. Dinesh and Ms. Sudha, S.G.S. Computers, Shankaraghatta for their printing of this thesis.

I am grateful to Kuvempu University, for providing an opportunity to do my research work.

Last but not the least, I would like to thank all of whom rendered their valuable, precious, constructive and appropriate advice from their rich experience for the successful completion of the research.

- Praveena A.

LIST OF TABLES

LIST OF PHOTOGRAPHS

LIST OF FIGURES

TABLE OF CONTENTS

Chapter-I

Introduction

Chapter - I

INTRODUCTION

Healthy human life at any corner of the world is a gift and responsibility. To certain age of every person, life can be considered as the responsibility of others in the family, school and society. But after a particular age everyone has the freedom and responsibility to define one's life and no matter how hard one tries to blame others for the events of his/her life, each event is the result of one's own choices one made and pattern life he/she lives. Ultimate of aim of every person is to attain healthy and happy life and there are a number of factors that are capable of defining so called happy and healthy life. One of the most important elements in determining an active, long, and fulfilling life is physical fitness. The level of fitness of an individual indicates their state of health and physical fitness is the key to a fulfilling life.

Finding physical inactivity as one of the leading risk factors in human life, World Health Organization (WHO) in 2018 has launched a new Global Action Plan on Physical Activity 2018-2030 which outlines four policy actions areas and 20 specific policy recommendations and actions for Member States, international partners and WHO, to increase physical activity worldwide. The global action plan asks every countries, cities and communities to adopt a 'whole-of-system' response involving all sectors and stakeholders taking action at global, regional and local levels to provide the safe and supportive environments and more opportunities to help people increase their levels of physical activity. In 2018, the World Health Assembly cooperated with WHO a global target of to reduce physical inactivity by 15% by 2030 and align with the sustainable development goals.

Physical activities are found capable enough to provide physical fitness assuring health benefits and skill development. Fitness for a normal individual refers to a state of being physically fit and healthy and it is considered as sporting talent when it comes to athletes. Only by creating a generation that is physically fit, psychologically sound, intellectually educated, socially acceptable and mentally upright a healthy society can be formed. The most important prerequisites for the formation of a socially acceptable personality are physical health and wellbeing. Every individual in the society may live one's life to the utmost extent possible if that person is in good bodily and mental health and is physically and intellectually fit.

Every bodily disruption has the potential to worsen physical wellness. The two greatest ways to maintain one's wellness and the ability to contribute to society's welfare are having good food and exercise. People who take their health and wellbeing seriously will take care to maintain their level of survival fitness and engage in health-promoting or marinating activities as needed. Everyone can remain active and healthy in society, their families, their workplaces, etc. if they are healthy and fit. Even confidence and attention levels can be improved by physical health and wellness.

Living healthy life-style results in prosperity, pleasure, and accomplishments. Without a nutritious diet and regular exercise, no one can remain healthy. Morning strolls and physical activity are particularly beneficial for maintaining our physical and mental wellbeing. Maintaining sound health entails both a good physical and mental state. The quality of one's diet, environmental pollution, regular sleeping patterns, access to clean water, sunshine and fresh air are just a few of the variables that affect one's health.

Physical Fitness

Physical fitness is critical to human well-being in the same way that engine condition is critical to the health of any car, because it allows everyone to work at the top of their abilities. Fitness might be appropriately described as a state that allows one to look nice, feel comfortable and perform at their best. Even greater health for the heart, lungs and body muscles is guaranteed by physical exercise. Physical fitness may be thought of as a state of human wellbeing, more particularly as a higher level of human performance in everyday activities, sports and jobs. In order to be physically healthy, a person must consume the right foods, engage in moderate to strenuous physical activity and get enough rest.

Physical exercise and physical fitness and health are correlated. Walking and other forms of exercise are highly important for maintaining everyone's physical and mental health. Lack of any physical activity results in unhealthy and inadequate living circumstances. As a result, maintaining physical fitness is crucial to living a healthy and active lifestyle. Focusing on choosing the healthiest option that suits one's individual needs and interests is the best strategy to maintain a healthy and active state of wellbeing. Health benefits and skill advantages are the two key components of physical fitness. The importance of physical activity in maintaining physical fitness cannot be overstated, regardless of one's age, gender, position, authority, location, language, caste, education, or assets.

Elements of Physical Fitness

Physical fitness may be divided into two categories: fitness for health and fitness for skills. While the stability of each person's health state is defined by their level of health fitness, the stamina of athletes is defined by their level of skill-related fitness in their chosen activity.

- **Fitness related to health**

Health-related fitness includes certain physical activities that support health fitness and physical fitness. The five factors that make up health fitness are as follows: cardiovascular fitness, muscular strength, muscular endurance, body composition, and flexibility.

- **Skill related fitness components**

Agility, balance, coordination, neuromuscular adaptations, speed, strength and reaction time are all crucial elements of skill-related fitness.

Physical Exercise, Fitness and Wellness

Numerous studies have supported the idea that regular physical exercise, regardless of age, gender, or level of physical ability, has both short and long-term positive effects on health and may enhance overall quality of life. People who engage in physical exercise benefit from improved functional ability, lowered disease risk, improved body composition, weight reduction, and decreased sadness and anxiety, among other physical health advantages. Zhang and W.A. Chen (2019) demonstrated a favorable correlation between physical exercise and happiness as well as life satisfaction.

According to Frank Penedo and Jason R. Dahn's (2015) study titled "Exercise and Well-Being: A Review of Mental and Physical Health Benefits Associated with Physical Activity" exercise and physical activity are strongly linked for improving quality of life and health-related outcomes. As a result, it was suggested on light of the findings of study that encouraging physical activity and exercise would help different groups achieve their intended health outcomes. The human wellbeing that everyone seeks may be obtained without physical soundness. Scientific research has shown the following advantages of physical activity for one's health and well-being:

A stage of decreased risk of illnesses: Maintaining physical fitness through regular exercise guarantees a healthy body by lowering the risk or severity of diseases. It could be feasible to prevent conditions like high blood pressure, diabetes, unbalanced cholesterol levels, cardiovascular disorders, obesity-related problems, etc. for everyone.

Improved mental health: Engaging in regular physical activity helps to combat sadness, anxiety, and circumstances where mood swings might occur. It could make it easier for any person who benefits from it to have a good night's sleep, which is the most crucial rest and refreshment for a pleasant and calm existence.

Mental well-being: It encourages optimism for the future, self-assurance in one's own skills and welfare, order in one's life, inspiration and self-esteem.

Intellectual uprightness: It revitalizes the capacity for focusing, the pattern of thinking, the capacity for resoluteness and decision-making, etc.

Muscle and bone strength: Exercise (activities) is essential for the development and maintenance of strong muscles and bones. Systematic and consistent physical exercise may improve muscles' ability to absorb vital nutrients for young children's development and may even prevent muscular injury, which can cause pain and suffering throughout life, especially on the eve of death. Even better, it may increase bone density, reducing the risk of osteoporosis and arthritis.

Increased energy levels: Exercise helps people feel less weary by increasing their energy levels and keeping them going all day. The individuals would even be able to engage in social contact, which encourages everyone to feel good about them-selves and have a positive outlook on life.

Reduced body weight: Obesity is a stage that may develop from a lack of physical activity. Obesity is a serious issue that puts people at risk for serious health problems, including internal organ and joint damage, loss of motivation and depression, difficulty doing daily tasks, etc.

Physical Activities and Adolescents

Only with a healthy physique one can anticipate a healthy and productive personality. The finest period of everyone's life is while they are in school, or more specifically, when they are in their teens. Regardless of one's body type, physical exercise promotes excellent health and allows one to remain active throughout all phases of life. Everyone may choose a physical activity by thinking about its advantages and understanding how it can enhance overall quality of life and help one retain excellent health. Due to hormonal imbalance, the teenage period is a crucial one for everyone since it may lead to a variety of medical and psychological issues that might lead to the development of unbalanced personalities.

Teenagers need to engage in physical activity in order to maintain their health. In the schools, we want to shape society and future generations of healthy people. Teenagers' healthy habits may be encouraged, which may result in the development of a culture that values living a healthy lifestyle. Every lifestyle has relevance, but those that are taught to children throughout their school years are more likely to stick with them as they get older. If the current generation is convinced of the positive impacts of a healthy culture, it may be passed on from parent to child and generation to generation.

Exercise and physical activity are crucial for everyone. All the people of any ages including kids, teenagers and adults require frequent physical exercise. According to the American Heart Association and the President's Council on Fitness, Sports and Nutrition, teenagers can benefit from the following advantages of physical activity and workouts:

- It facilitates better blood flow throughout the body.
- It helps people to maintain control over their weight.
- It guarantees that they have stable blood cholesterol levels.
- It helps with their high blood pressure.
- It stops bone thinning.
- It guarantees an increase in energy levels.
- It gives them a stress-free educational experience.
- It guarantees restful sleep.
- It boosts self-esteem and assurance.
- It helps people control their tension.
- It aids them for the recovery from depression and anxiety.
- It heightens their optimism and fervor.
- It increases their muscular strength and stamina.

Different Exercises for Physical Fitness

There is no way to guarantee this without physical fitness, since health and physical fitness are crucial components in determining the healthiness of everyone's life. To assure this alleged health and fitness, it is more crucial to choose physical activities that are appropriate and affordable throughout the educational years. Numerous physical activities may be done to maintain physical health and fitness throughout life. But among them, vigorous walking, jogging, swimming, cycling, roller skating, jumping rope, playing on the playground, dancing, gymnastics, hiking, soccer, tag games, etc. are some that are suitable for teens.

Cycling as an Exercise Activity

Cycling is mostly an aerobic exercise; thus, it will have a positive impact on how well one's heart, blood vessels, and lungs perform. By allowing one to breathe more deeply, sweat appropriately and feel a rise in body temperature, it will enhance one's overall level of fitness. Regular riding may lead to an improvement in cardiovascular fitness.

Aside from its many physical advantages, regular riding has health advantages that have caught the attention of the health industry, enabling it to encourage greater investment in cycling rather than other health-improving devices in order to boost levels of physical activity. Numerous studies have been carried out to provide epidemiological evidence for the health effects and explicit effects required to quantify the health effects in well-planned environments.

Cycling's positive effects on personal health when used as a regular form of exercise have been shown to outweigh its negative effects on public health. In comparison to other machine-based transportation systems, the risks of generating air pollution would be assumed to be minimal. All cyclists and would-be cyclists may rest assured that the advantages of cycling-related physical exercise are worthwhile pursuing based on a variety of scientific findings (Physical Activity Guidelines Advisory Committee, 2008).

One of the finest physical activities with a wide range of health advantages is cycling. It is a low-impact activity that strengthens or improves the heart muscles and guards against serious cardiac issues that pose a life-threatening danger. Additionally, it aids in lowering the danger of sadness, the issue of obesity, etc. There is now even an additional benefit to riding that has not before been mentioned. Cycling may significantly minimize the risk of early mortality and lessen the symptoms of diabetes, according to a recent study that was published in JAMA Internal Medicine. According to Harvard University, cycling at a moderate pace may help someone lose weight by burning 298 calories in 30 minutes.

According to Mathias Ried's study, Larsen's cycling may help people live longer, but he did not specify how far or for how long one must bike in order to reap this advantage. The study's goal was to comprehend cycling's long-term advantages. It has been shown that cycling will assist all of its beneficiaries in increasing their daily physical activity levels, maintaining their health, and protecting them from a variety of communicable illnesses. People say that cycling is the best way to stay healthy and fit for the least amount of money.

Benefits of Cycling

Cycling is considered low-impact exercise because it causes far less stress and injury than other forms of exercise.

- Cycling is a terrific exercise for coordination and building muscle.
- Since cycling does not involve a lot of physical expertise, it is a simple and uncomplicated physical activity.
- It encourages bodily equilibrium, which is beneficial for the future development of driving skills.
- Strength, endurance and aerobic fitness will be improved.
- It is a pollution-free, environmentally beneficial activity.
- It is very affordable and user-friendly.

Cycling has several health advantages including (a) improving cardiovascular fitness (b) boosting muscle strength and flexibility (c) improving joint mobility (d) lowering stress levels (e) enhancing posture and coordination (f) strengthening bones; (g) achieving low body fat levels (h) disease prevention or management and (i) reducing anxiety and depression.

Suitability of Bicycling for Teenagers

Cycling is one of the primaries ‘active transportation facilities’ that can be very easily incorporated into a person's daily life as physical activity. This is especially true for adolescents, for whom cycling is the ideal form of exercise to improve their health, academic performance, mental health etc. (Heinberg & Thompson, 2009). Teenagers benefit particularly from cycling since it provides physical exercise at a time when their weight issues are becoming worse.

Adolescence is the ideal time of life development for cultivating a culture of healthy behaviors that are to be anticipated to be maintained throughout life, according to

Garcia *et al.* (1998) who supported their claim with research. Young people who grow up in bicycle-friendly societies where they have access to advantages for their health and development may be more likely to become bicycle-friendly adults (Pucher & Buehler, 2008). Once a person transitions from childhood to adulthood, everyone's level of physical activity tends to diminish. This is especially true if teenagers are not convinced of the advantages of cycling but are confident in its functionality. Adolescence therefore seems to have a key role in the development of attitudes toward cycling that persist throughout adulthood.

According to recent studies on physical activity and health, there is growing, consistent and more detailed evidence to support the value of physical exercise for public health. The Physical Activity Guidelines Advisory Committee (2008) analysis of the scientific literature provides the most thorough explanation of the advantages of cycling for both health and competence. Strong data points to increased cardio-respiratory endurance, muscular fitness, favorable body composition, enhanced bone health, and improved cardiovascular and metabolic health biomarkers in children and adolescents. After analyzing much research, Andersen and Cooper (2010) concluded that, it was reasonable to attempt to quantify the health advantages of cycling, particularly for kids and teenagers. All of the research came to the same conclusion: Compared to passive travelers and walkers, kids who biked to school had improved cardiovascular risk factor profiles and fitness levels.

Cycling is a potentially effective means of achieving the physical activity for many groups, particularly teenagers with hormonal imbalances. Prior to recently, most of the research on the health benefits of commuting physical activity focused on walking and academic exercise rather than riding alone, making it impossible to isolate the specific health benefits of cycling (Oja *et al.*, 2011b). A condition of total physical, mental, social and spiritual wellness is referred to as ‘being in good health’, which entails taking as many everyday precautions as you can to keep your body as healthy as possible.

History of the Study

Due to hormone imbalance, physical development, scholastic stress, the peak of curiosity, aspirations for independence, identity crises, etc., the adolescent period is a vital time in everyone's life. But it is the optimum moment to develop a person who is mentally well, socially dedicated, intellectually honest and philosophically ideal. Only those who are physically healthy will be mentally and intellectually intelligent. Bicycling, among other forms of physical activity, is a better choice to help teenagers during this time of identity crisis since it is highly cost-effective and clever enough to be fitted into a regular schedule without significantly interfering with academic responsibilities. All secondary public-school pupils in Karnataka are given bicycles by the state government. Teenagers' access to the kind of leisure and exercise they require is restricted by an excessive academic load.

In the United States of America, cycling is one of the most popular leisure physical activities. In the National Sporting Goods Association (1992) assessment, bicycling came in third place among popular leisure pursuits in the United States, after swimming and walking. According to the Bicycle Institute of America's 1993 census, 4.3 million Americans who regularly went to work in 1992 utilized bicycles for both enjoyment and transportation. The overreaching effects of technology and its advancements have led to a decline in bicycle use. Numerous health advantages come with cycling. According to the World Health Organization (WHO), cycling may lower the incidence of malignancies, heart disease, and diabetes, which are common in sedentary lifestyles.

The Centers for Disease Control and Prevention's Research (CDC, 2015) states that compared to only three decades ago, the issue of teenage obesity has more than quadrupled and increased. According to CDC data from 2017, overweight young people are more likely to have cardiovascular illnesses, such as high cholesterol and blood pressure, as well as other conditions, including arthritis, diabetes, asthma, sleep apnea, bone thinning and joint pain, psychological issues, and others. When children who used to cycle enter into adolescence, bicycle use begins to decline. The CDC (2015) estimates that 25% of secondary school pupils meet the daily criteria for health and physical fitness, according to a study from 2015.

The benefits of physical activity interventions would probably generalize to school and classroom settings, as research has shown a number of outcomes of physical activities, such as selective attention, information processing, executive functioning and memory performance, among others, in maintaining a healthy society (Donnelly *et al.*, 2016). Children spend 30 hours a week at school, making it the most logical venue to address the issue of children's lack of physical exercise (Dobbins *et al.*, 2013). Academic achievement and physical activity have a beneficial relationship (Centre for Disease Control and Prevention, 2010). There are several health advantages when kids and teenagers can play for at least 60 minutes each day. Youth today do not participate in enough physical activities due to an over-reliance on technology.

Even though they can provide over 56 million children with a unique setting for the development of a healthy generation, schools confront a common issue in juggling physical exercise and academic learning (Centre for Disease Control and Prevention, 2010). The state government is running a free bicycle distribution scheme to provide bicycles with the aim of reducing dropout rates and since there is a problem finding quality time for physical activity during school hours at the secondary school level, this is the best and most logical way to utilize this free bicycle distribution scheme.

Statement of the Problem

The purpose of the study was to find out the *"Effectiveness of Bicycle Utilization on Physical fitness Components among Secondary School Students of Shivamogga District"*. In short three skills related components and three health related components were being studied under physical fitness.

Objectives of the Study

The objectives of the study are :

1. To study the effectiveness of bicycle utilization on explosiveness of secondary school male students. The degree of improvement on explosiveness of 100 bicycle users and 100 bicycle non-users among secondary school male students are being compared over the time span of 6 months to identify the effectiveness of bicycle utilisation.

2. To study the effectiveness of bicycle utilization on balance of secondary school male students. The balance of 100 bicycle users and 100 bicycle non-users among secondary school male students are being compared over the time span of 6 months of bicycle utilisation.

3. To study the effectiveness of bicycle utilization on agility of secondary school male students. The improvement on agility of 100 bicycle users and 100 bicycle non-users among secondary school male students are being compared over the time span of 6 months of bicycle utilisation.

4. To study the effectiveness of bicycle utilization on cardiovascular endurance of secondary school male students. The advancement on cardiovascular endurance of 100 bicycle users and 100 bicycle non-users among secondary school male students are being compared over the time span of 6 months to know the effectiveness of bicycle utilisation.

5. To study the effectiveness of bicycle utilization on muscular strength of secondary school male students. The development on muscular strength of 100 bicycle users and 100 bicycle non-users among secondary school male students are being compared over the time span of 6 months to know the effectiveness of bicycle utilisation.

6. To study the effectiveness of bicycle utilization on body composition of secondary school male students. The difference on the body composition of 100 bicycle users and 100 bicycle non-users among secondary school male students are being compared over the time span of 6 months to know the effectiveness of bicycle utilisation.

Delimitations of the Study

The study is being delimited to :

1. The study had taken into consideration only the male adolescents in the age group between 13-15 years.
2. The study was inclined to adolescents of government secondary school students in rural areas of Shivamogga district.
3. The study was most precisely concentrated to 8th standard students from five taluks of Shivamogga district viz., Bhadravathi, Thirthahalli, Shikaripura, Hosanagara and Shivamogga only.
4. The study was limited to the male secondary school students who used to come to the schools regularly at least from five to seven kilometres distance by bicycles.
5. The study was being conducted only on six components of physical fitness (three from health-related components and three from skill related components)

Limitations of the Study

The researcher faced following limitations at different phases of the study:

1. There were a number of students using bicycle to reach schools, but students regularly with a distance of at least five kilometres were less in number in almost every school.
2. Convincing the individual parents of bicycle users about the study and getting their permission for the children's participation in the study took lot of time in some schools prior to the start of the study.

3. Without disturbing the regular academic time table, the researcher had to take extra care and time for the study.

4. Studying all components of skill and health related fitness was impossible due to heavy study syllabus of secondary school students; hence researcher selected three health and three skill related components.

Hypotheses of the Study

There were 54 hypotheses in the study which means 9 each hypothesis under six variables. Among those 54 hypotheses 27 hypotheses belonged to health-related physical fitness and other 27 hypothesis belonged to skill related physical fitness. They are given below accordingly:

1. There is no significant difference in explosiveness between bicycle users' group and bicycle non-users' group during initial testing prior to bicycle utilization.

2. There is no significant difference in explosiveness between bicycle users' group and bicycle non-users' group after bicycle utilization for the first three months.

3. There is no significant difference in explosiveness between bicycle users' group and bicycle non-users' group after bicycle utilization for six months.

4. There is no significant difference in explosiveness of bicycle users between the initial testing prior to bicycle utilization and at the end of three months of bicycle utilization.

5. There is no significant difference in explosiveness of bicycle users between the initial testing prior to bicycle utilization and at the end of six months of bicycle utilization.

6. There is no significant difference in the explosiveness of bicycle non-users between initial testing and at the end of three months.

7. There is no significant difference in the explosiveness of bicycle non-users between the initial testing and at the end of six months.

8. There is no significant difference in explosiveness of bicycle users at the end of three and six-months of bicycle utilization.

9. There is no significant difference in explosiveness of bicycle non users at the end of three and six months after initial testing.

10. There is no significant difference in balance between bicycle users' group and bicycle non-users' group during initial testing prior to bicycle utilization.

11. There is no significant difference in balance between bicycle users' group and bicycle non-users' group after bicycle utilization for the first three months.

12. There is no significant difference in balance between bicycle users' group and bicycle non-users' group after bicycle utilization for six months.

13. There is no significant difference in balance of bicycle users between the initial testing prior to bicycle utilization and at the end of three months of bicycle utilization.

14. There is no significant difference in balance of bicycle users between the initial testing prior to bicycle utilization and at the end of six months of bicycle utilization.

15. There is no significant difference in the balance of bicycle non-users between initial testing and at the end of three months.

16. There is no significant difference in the balance of bicycle non-users between the initial testing and at the end of six months.

17. There is no significant difference in balance of bicycle users at the end of three and six-months of bicycle utilization.

18. There is no significant difference in balance of bicycle non users at the end of three and six months after initial testing.

19. There is no significant difference in agility between bicycle users' group and bicycle non-users' group during initial testing prior to bicycle utilization.

20. There is no significant difference in agility between bicycle users' group and bicycle non-users' group after bicycle utilization for the first three months.

21. There is no significant difference in agility between bicycle users' group and bicycle non-users' group after bicycle utilization for six months.

22. There is no significant difference in agility of bicycle users between the initial testing prior to bicycle utilization and at the end of three months of bicycle utilization.

23. There is no significant difference in agility of bicycle users between the initial testing prior to bicycle utilization and at the end of six months of bicycle utilization.

24. There is no significant difference in agility of bicycle non-users between initial testing and at the end of three months.

25. There is no significant difference in agility of bicycle non-users between the initial testing and at the end of six months.

26. There is no significant difference in agility of bicycle users at the end of three and six-months of bicycle utilization.

27. There is no significant difference in agility of bicycle non users at the end of three and six months after initial testing.

28. There is no significant difference in cardiovascular endurance between bicycle users' group and bicycle non-users' group during initial testing prior to bicycle utilization.

29. There is no significant difference in cardiovascular endurance between bicycle users' group and bicycle non-users' group after bicycle utilization for the first three months.

30. There is no significant difference in cardiovascular endurance between bicycle users' group and bicycle non-users' group after bicycle utilization for six months.

31. There is no significant difference in cardiovascular endurance of bicycle users between the initial testing prior to bicycle utilization and at the end of three months of bicycle utilization.

32. There is no significant difference in cardiovascular endurance of bicycle users between the initial testing prior to bicycle utilization and at the end of six months of bicycle utilization.

33. There is no significant difference in cardiovascular endurance of bicycle non-users between initial testing and at the end of three months.

34. There is no significant difference in cardiovascular endurance of bicycle non-users between the initial testing and at the end of six months.

35. There is no significant difference in cardiovascular endurance of bicycle users at the end of three and six-months of bicycle utilization.

36. There is no significant difference in cardiovascular endurance of bicycle non users at the end of three and six months after initial testing.

37. There is no significant difference in muscular strength between bicycle users' group and bicycle non-users' group during initial testing prior to bicycle utilization.

38. There is no significant difference in muscular strength between bicycle users' group and bicycle non-users' group after bicycle utilization for the first three months.

39. There is no significant difference in muscular strength between bicycle users' group and bicycle non-users' group after bicycle utilization for six months.

40. There is no significant difference in muscular strength of bicycle users between the initial testing prior to bicycle utilization and at the end of three months of bicycle utilization.

41. There is no significant difference in muscular strength of bicycle users between the initial testing prior to bicycle utilization and at the end of six months of bicycle utilization.

42. There is no significant difference in muscular strength of bicycle non-users between initial testing and at the end of three months.

43. There is no significant difference in muscular strength of bicycle non-users between the initial testing and at the end of six months.

44. There is no significant difference in muscular strength of bicycle users at the end of three and six-months of bicycle utilization.

45. There is no significant difference in muscular strength of bicycle non users at the end of three and six months after initial testing.

46. There is no significant difference in body composition between bicycle users' group and bicycle non-users' group during initial testing prior to bicycle utilization.

47. There is no significant difference in body composition between bicycle users' group and bicycle non-users' group after bicycle utilization for the first three months.

48. There is no significant difference in body composition between bicycle users' group and bicycle non-users' group after bicycle utilization for six months.

49. There is no significant difference in body composition of bicycle users between the initial testing prior to bicycle utilization and at the end of three months of bicycle utilization.

50. There is no significant difference in body composition of bicycle users between the initial testing prior to bicycle utilization and at the end of six months of bicycle utilization.

51. There is no significant difference in body composition of bicycle non-users between initial testing and at the end of three months.

52. There is no significant difference in body composition of bicycle non-users between the initial testing and at the end of six months.

53. There is no significant difference in body composition of bicycle users at the end of three and six-months of bicycle utilization.

54. There is no significant difference in body composition of bicycle non users at the end of three and six months after initial testing.

Significance of the Study

Utilisation of bicycles for physical fitness by attaining health related physical fitness and skill-based physical fitness is the most appropriate way of fostering a culture of self-directed physical activities among adolescents. Free bicycle distribution scheme in Karnataka for secondary school students would help the adolescents to have a better skill and health related physical fitness without causing much disturbance in academics. The present study would be significant for the entire education system due to following reasons:

1. The study would help in assessing the skill-based and health related physical fitness level of the secondary school students through various tests. So that the school authority can have perfect knowledge of tests in understating every student's skill and health related physical fitness.

2. Students, parents, teachers, and administrators will be acquainted with an insight of the present level of skill and health related physical fitness components of secondary school students.

3. The study would promote a taste of bicycling among secondary school students in attaining skill and health related physical fitness during adolescents' problems.

4. The results of the study would help the government authorities to understand the effectiveness of bicycle utilization and promote with more enthusiasm for the next generation by foreseeing the health of future generation.

5. It would assist policy makers and curriculum executors to promote skill related physical fitness and health related physical fitness of secondary school students by utilising the advantages of the free bicycle distribution scheme in Karnataka to its fullest potential.

Operational Definitions of Technical Terms Used in the Study

The key terms used in the study were operationally defined as under.

1. **Effectiveness:** Effectiveness is the competence of producing a desired result or impact from an activity or person. Effectiveness is measured in terms of physical fitness. In the present study, effectiveness is assessed based on scores obtained in fitness tests constructed for the purpose.

2. **Bicycle:** A bicycle is a human-powered or motor-powered, pedal-driven, single-track vehicle having two wheels attached to a frame, one behind the other. A bicycle rider is called a cyclist or bicyclist.

3. **Bicycle Usage:** In this study, ‘bicycle usage’ refers to the practice of riding a bicycle for physical fitness on a regular basis.

4. **Physical Fitness:** Physical fitness is a state of health and well-being and more specifically, the ability to perform aspects of sports, occupations and daily activities. In the present study, physical fitness components like explosive power, balance and agility were tested.

5. **Health-Related Physical Fitness:** Health-related physical fitness refers to a state of being that is free from illness or injury. At various stages of the study, components of health fitness such as cardiovascular endurance, muscular strength and body composition were tested.

6. **Explosive Power:** This is an abstract quality of the human body to manage physical tasks. Explosive power in this study refers to the human ability to use a maximum amount of force in a very short span of time.

7. **Balance:** Balance is the ability to control or stabilize the entire body while standing or moving. For example, handstand in gymnastics body balance intends to strengthen the fundamentals of the body, promote flexibility in joints and sharpen concentration in the mind.

8. **Agility:** Agility is the capability to manage by either changing or controlling the body and its direction and position against a relentless, quick motion. In other words, it is the acquired or inborn quickness of the body to react to any kind of reaction that may be either continuous or rapid.

9. **Cardio-respiratory Endurance:** Cardio-respiratory endurance is the capacity of the heart and lungs to supply oxygen to better functioning muscles while doing unceasing corporeal activity, which can be identified as a noteworthy sign of physical fitness and health. It indicates the power of the circulatory and respiratory systems in one’s physical body to supply fuel, proving one’s stamina. Regular walking, running, jogging, swimming, bicycling and other physical activities are important in improving one's cardio-respiratory endurance capacity. These activities help one to keep one’s heart rate at a safe level with long-term

stamina while doing even hard physical activities. The activity one chooses may not be smart enough to advance his or her cardio-respiratory endurance at once with a high spike and visibility, but it may show the progress slowly as one enjoys working out regularly.

10. **Muscular strength:** Muscular strength is defined as the amount of force applied to a human muscle in order to exert maximum effort. Activities like weightlifting, resistance training, gardening, mountain walking, bicycling, dancing, doing push-ups, etc. can strengthen the muscles. It is the ability to strengthen one's muscles over time by contracting them against any type of resistance and lifting a specific amount of force. Increasing the performance of these muscles will provide (a) increased metabolism (b) reduced fatigue when exercising (c) good posture (d) fewer injuries (e) less chance of backbone problems due to the formation of trunk muscles (f) better sporting performance and (g) refined training techniques for many exercises.

11. **Body Composition:** Body composition refers to a healthy formation of human body composition including size of muscle, fat level, bone strength and other vibrant parts of the body. It is important for managing and maintaining health and body fat.

Chapter-II

Review of Related Literature

Chapter – II

REVIEW OF RELATED LITERATURE

Apoorva Uday Munagekar and Apoorva Likhite (2021) conducted a research study on *"Comparison of Physical Fitness Index (PFI) between Spinning (Indoor Cycling) Female Practitioners and Zumba Female Practitioners using Modified Harvard's Step Test"*. With increase in awareness about the importance of physical fitness, there has been considerable increase in proportion of population indulging in various new emerging forms of exercises such as Zumba and Spinning. To assess and compare physical fitness index (PFI) between females practicing two newer forms of aerobic exercises Zumba (group-1) and spinning (group-2) and to understand whether one aerobic activity has better PFI values over other and whether they can be used interchangeably. It will also create awareness regarding both the newer forms of aerobic exercise forms Zumba and spinning and its effect. Healthy females practicing either Zumba and spinning for one year regularly were chosen, step board of height 33 cm, metronome, stopwatch used. Modified Harvard Step test was explained and then subjects were asked to do it. Results were calculated and scoring was done. The study showed that in Zumba practitioners (group-1) 92.86% population had excellent PFI, 7.14% population had fair PFI. In spinning practitioners (group-2), 100% subjects showed excellent PFI, group-2 had evidently greater mean PFI than group-1 but not statistically significant. There was no statistically significant difference in PFI values between the subjects of two groups spinning and Zumba. Majority of the population of both the groups showed excellent PFI. Both the newer types of aerobic exercise forms can be used interchangeably depending on the age of population.

Daniel Piatkowski and Melissa Bopp (2021) studied on *"Bicycling for Transportation Improves Health, Reduces Pollution and Congestion and Produces Economic Rewards for Communities"*. The present study targeted update and appraisal of the current literature on the factors that influence bicycling for transportation. This is a systematic literature review. Inclusion criteria included peer-reviewed research published in English that reported on qualitative or quantitative findings. Studies were included if they reported on: (1) adults, (2) presented findings that were specific to bicycling for transportation (separate from walking, or overall active transport, or commuting), (3) were cross-sectional or observational (not experimental) and (4) examined the influences on bicycling behaviour. Following a final manual review by the authors, 102 (out of an original 773) studies met the search criteria. The findings are organized using the ecological model as a framework. At the individual level, the research identified demographic characteristics, health and physical activity and psychological factors as significant influences on transportation bicycling, but these factors might be closely related to the context. At the social and cultural level, limited available studies found that community norms and social support were significant, although these constructs lacked consistent definitions. At the environmental level, numerous aspects of the built and natural environment (in a range of scales) were identified as significant, but raised questions of scale and potential interactions with other levels of the ecological model. There is extensive literature on factors that influence transportation bicycling; however, future research is required that simultaneously considers multiple influences at multiple levels, via multiple potential pathways. For communities that want to increase transportation bicycling with specific interventions, maximizing their impact will depend on understanding the individual, social, and physical contexts to determine the most appropriate approach.

Amador García *et al.* (2020) studied on *"Knowledge of Results during Vertical Jump Testing: An Effective Method to Increase the Performance but not the Consistency of Vertical Jumps"*. This study aimed to determine whether the provision of jump height feedback (knowledge of result; KR) can increase the performance and the consistency of output variables. In a randomized order, sixteen participants performed six Squat or counter-movement jumps (three from a 90º knee angle and three from a self-preferred knee angle) with or without KR over four sessions. The provision of KR significantly increased peak force (p=0.046, 1.83%), mean force (p = 0.037, 1.45%), peak velocity (p < 0.001, 3.71%), mean velocity (p=0.004, 3.44%), peak power (p<0.001, 4.22%) and mean power (p=0.001, 4.69%). A high within session reliability was observed for all variables (coefficient of variation [CV] ≤ 5.62%, intra-class correlation co-efficient [ICC] ≥ 0.95). No systematic differences in reliability were detected between the jumps performed without KR (CV=3.00±1.38%, ICC=0.97±0.03) and with KR (CV=3.04± 1.49%, ICC=0.97±0.04). These results suggest that the provision of jump height feedback during vertical jump testing is effective to enhance vertical jump performance but it does not reduce the variability between jumps.

Amuthamozhi Sivachandiran (2020) carried out a study on *"Evaluation of Physical Fitness among Student Population Using Modified Harvard Step Test"*. To assess the physical fitness of students of Chengalpattu medical college, by comparing their pulse rates on performing a modified Harvard step test and to compare the fitness level in relation with the gender. This study was conducted on 40 students of both genders in the age group of 18 to 24 yrs. Fitness was conducted using modified Harvard step test protocol which comprises stepping up and down a 30 cm high step at a rate of 30 times/min at a duration of not < 5 min. The total duration of the stepping exercise and post exercise pulse rate after 1 min, 2 min recovery was noted and used for calculating physical fitness index. The higher the fitness of an individual, lesser is the increase in the pulse rate and faster is the recovery. Statistical analysis showed there is significant relationship between pulse rate recoveries with fitness level. This study enables us to determine how life style factors affect cardio metabolic health in early adulthood and insist upon the need for early intervention.

Kaja Pogacaret (2020) reviewed on *"Determinants of Bicycle Use among Student Population: Exploratory Research of Social and Infrastructure Factors"*. The study enunciated that was exposed more benefits than shortcomings regarding cycling, this study focused on university students as a significant target group that could promote cycling as the main transport mode in cities. The study addressed a variety of determinants, barriers and motivation for cycling among the university students within the international context. Furthermore, it exposed the importance of smaller university cities, where students could present a substantial share of the total population. Contextually, researcher presents the research upon the use of bicycles among the students in the university city of Maribor, Slovenia. Researcher examined whether social or infrastructural determinants play a decisive role, a questionnaire was conducted among 382 students. The findings of the study revealed that, although the topography of the city and the distances between crucial institutions were in general, favourable only 10.7% of students cycle daily, whereby 63.3% do not cycle at all. There were no statistical differences noticed between the impact of infrastructural and social factors; convenience was exposed as a statistically significant determinant, whereas the sustainability aspect proved to be an insignificant factor for students cycling. To concluded, cycling among the student population in smaller cities can represent a common case of potentially high impact of student population regarding sustainable mobility.

Paul Merkes *et al.* (2020) have studied on *"Sprinting in Road Cycling – literature Review"*. This study made on cyclists can produce higher power outputs while adopting a standing position when compared with a seated position, with professional male and female sprinters producing approximately 14.2 and 10.0 $W \cdot kg^{-1}$ during road sprints which last 14 and 22 s, respectively. Additionally, lowering the torso and head during the standing sprint position results in an aerodynamic improvement of around 25%. It is found that, during the sprint, male and female cyclists can reach high velocities, upto 70 $km \cdot h^{-1}$. Performance outcomes in these sprints are affected by several variables including the cyclists' physiological capabilities, the interaction between the cyclist and their bicycle, and the interaction between cyclists. Professional male and female road cyclists produce a power output of approximately 14.2 and 10.0 $W \cdot kg^{-1}$ over an average sprint duration of approximately 14 and 22 s, respectively.

Pranjal Grover *et al.* (2020) conducted a study on *"Correlation of Timed Forearm Plank Test with Basal Metabolic Rate in Sedentary Urban Females of Age Group 25 to 55 Years"*. In the present study, the basal metabolic rate (BMR), defined as the energy required for performing vital body functions at rest is the largest contributor to energy expenditure and is a major contributor to energy balance. Therefore, accurately estimating BMR is critical for developing rigorous obesity prevention and control strategies. The timed forearm plank test also known as the prone bridge test, is a simple and cost-effective fitness test of core muscle strength which can be easily selfadministered. It is also an excellent technique for strengthening the core muscles. Very few studies have studied the relationship of basal metabolic rate and isometric muscle endurance which is known to be less in the female population. Therefore, the need to establish whether there is a significant relationship between the BMR and isometric core muscle endurance in adult females. It is found that, there is a weak positive co-relation between the basal metabolic rate and the timed forearm plank test in sedentary urban females aged 25-55 years.

Rafał Szafraniec *et al.* (2020) worked on *"Effects of Short-Term Core Stability Training on Dynamic Balance and Trunk Muscle Endurance in Novice Olympic Weightlifters"*. Our primary objective was to investigate the effects of short-term core stability training on dynamic balance and trunk muscle endurance in novice weightlifters learning the technique of the Olympic lifts. Our secondary objective was to compare dynamic balance and trunk muscle endurance between novice and experienced weightlifters. Thirty novice (NOV) and five experienced (EXP) weightlifters participated in the study. Medico-lateral (ML) and antero-posterior (AP) dynamic balance and trunk muscle endurance testing were performed a week before (pre) and after (post) a 4-week core stability training program. In the NOV group, there was an improvement of both dynamic balance (ML and AP, $p = 0.0002$) and trunk muscle endurance ($p = 0.0002$). In the EXP group, there was no significant difference between pre and post testing conditions, except an increase in muscle endurance in the right-side plank ($p=0.0486$). Analysis of the results showed that experienced lifters were characterized by more effective dynamic balance and greater core muscle endurance than their novice peers, not only before the training program but after its completion as well. In conclusion, the applied short-term core stability training improved dynamic balance and trunk muscle endurance in novice weightlifters learning the Olympic lifts. Such an exercise program can be incorporated into a training regime of novice weightlifters to prepare them for technically difficult tasks of the Olympic snatch and clean and jerk.

Shraddha Patil and Aashirwad Mahajan (2020) studied on *"Effect of Graded Plank Protocol on Core Stability in Sedentary Dentists"*. Plank training can be an effective exercise to improve the core stability. The aim of the current study was to study the effect of graded plank protocol on core stability in sedentary dentists. This was an experimental study done on 50 participants; they were given the intervention for 6 weeks, 3 days/week. Simple random sampling was done on sedentary dentists of, rural dental collage PIMS. 50 sedentary dentists as measured from IPAQ with mean age (in years) 22.7 ±0.8, who scored <3 on dynamic abdominal endurance test, participated were given graded plank exercise protocol for the period of 6 week 4 days per week on non-consecutive days and the participants were assessed at the start of 1^{st} week and reassessed at the end of 6th week using the outcome measure. The mean values pre unilateral hip bridging endurance test in sec was 20.6±11.50. The mean values of post unilateral hip bridging endurance test in sec were 30.44±13.53. There was significant difference between pre and post values of unilateral hip bridging endurance test. This study concluded that 6-week graded plank protocol was effective for improving the core stability in sedentary dentists.

Vedrana Sember *et al.* (2020) depicted a study on *"Balance Tests in Pre-Adolescent Children: Retest Reliability, Construct Validity, and Relative Ability"*. Balance is an essential prerequisite for the normal physical development of a child. It consists of the ability to maintain the body's centre of mass over its base of support, which is enabled by automatic postural adjustments, and maintain posture and stability in various conditions and activities. The present study aimed to determine the measurement characteristics (reliability and concurrent validity) and the relative ability of balance tests and different motor tests in healthy 11-year-olds. We also evaluated the impact of vision on balance ability. Our results showed high inter-rater reliability (from 0.810 to 0.910) and confirmed the construct validity of the included balance tests. Girls performed significantly better than boys in laboratory tandem stance in following balance components: total sway path with eyes open (BSEO) (t=2.68, p=0.01, effect size (ES) = 0.81), total body sway with eyes closed of centre of pressure (CoP) displacement in the a-p direction (BSEC) (t=1.86, p=0.07, ES=0.57), mean velocity of CoP displacements (VEO) (t=2.67, p=0.01, ES=0.83), mean amplitude of CoP displacements in the a-p direction (AapEO) (t=3.38. p=0.00, ES=1.01) and in mean amplitude of CoP displacements in the m-l direction (AmlEO) (t=3.68, p=0.00, ES=1.19). With eyes closed, girls performed significantly better (t=2.28, p=0.03, ES=0.70) than boys did in the mean amplitude of COP displacements in the a-p direction (AapEO) and significantly better (t=2.37, p=0.03, ES=0.71) in the mean amplitude of COP displacements in the m-l direction (AmlEC). Insignificant correlations between different balance tests, except for a correlation between the flamingo test and one-leg stance on a low beam (r = 0.558, p < 0.01), show that each test assesses different aspects of balance ability; therefore, balance cannot be assessed with a single test.

Emily Frith and Paul D. Loprinzi (2019) conducted a study on *"Association between Motor Skills and Musculoskeletal Physical Fitness among Preschoolers"*. Previous work is conflicted regarding the relationship between motor skill development and physical activity. One potential explanation for this equivocality is the difficulty and lack of precision in physical activity measurement, particularly within preschool populations. Our exploration of plank performance as a proxy measure for fitness addresses a void in the literature, as few studies have investigated the role of motor skill development on fitness. The purpose of this study was to evaluate the potential relationship between motor skill level and musculoskeletal endurance (via the plank test). Methods: Data from the 2012 National youth fitness survey were used, which included 224 preschool-aged children (3–5 years). Motor skill level was assessed from the test of gross motor development second edition (TGMD2). Motor skill parameters included general motor skills, locomotor skills, and object control skills. Results: Within this nationally representative sample of preschoolers, increased motor skills were positively associated with plank performance [general motor skills ($\beta = 0.45$; 95% CI 0.31–0.59), locomotor skills ($\beta = 1.88$; 95% CI 1.15–2.61) and object control skills ($\beta = 2.05$; 95% CI 1.11–2.98)]. Conclusion: Motor skill level in this national preschool sample was associated with musculoskeletal endurance. Thus, future interventions should aim to develop and refine motor skills among preschoolers.

Garden Tabacchi *et al.* (2019) worked on *"Field-Based Tests for the Assessment of Physical Fitness in Children and Adolescents Practicing Sport: A Systematic Review within the ESA Program"*. In the present study, the authors concluded that, high levels of physical fitness (PF) can positively affect both health and cognitive functions, thus monitoring its levels in youth can help increase health and quality of life in adult populations later on. This systematic review aims to identify PF field-based tests used in young European populations practicing sport to find tools that are adequate for the considered target involving a new battery within the enriched sport activities (ESA) project. The preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement were followed. In the 83 identified articles, the main tests used were: vertical/ horizontal jumps (for muscular strength/power); push-ups, running at maximum effort, sit-ups (for muscular strength/endurance); multistage non-intermittent and intermittent tests (for aerobic endurance); sit and reach (for flexibility); sprinting and agility T-tests (for speed and agility, respectively); 10×5 m shuttle run (SR) (for both speed and agility). Few studies assessed coordination, reaction time, power, and balance. Although, the selected tests are widely used and validated they do not determine all PF aspects and do not reflect sport-specific features. A final decision was made for the inclusion of the following tests: standing broad jump, seated medicine ball throw, 20 m SR test, 30 m sprint, Illinois test and a new test i.e., the running test, to assess different skill-related components at once. The use of this combination of tests allows for the assessment of all PF components and can help planning effective training programs and cultivate sporting talent.

Jason Anderson and Amy Lightfoot (2019) reviewed on *"The School Education System in India: An Overview"*. The present research study exhibited the school education system in India is the largest in the world, catering to over 260 million young people each year. Jointly managed at the national and state levels, many initiatives have been undertaken to improve access to quality schooling particularly for those who are economically or socially disadvantaged. With thriving competition from private schools, there have been clear efforts within the government sector to offer parents and children what they most need and want: quality education leading to improved life opportunities. This report, five years after our first overview of the education system in India, is being published at a time when India appears to be at a significant crossroads with its approach to education policy and its implementation. Since the previous report in 2014, significant changes have been made to address issues of quality and equity of provision, for example with the implementation of the Right to Education Act and the widespread adoption of new technologies and approaches to improve teachers' and learners' access to resources and content for learning. The draft National Education Policy released in May 2019 further demonstrates an ongoing commitment to quality provision, revising a policy which was last updated in 1992. The draft includes a strong focus on teachers' continuing professional development and a push towards greater access for mother tongue-based instruction both areas that the British council understands as fundamental to educational success. In our 70 years in India, we have been privileged to work with hundreds of thousands of teachers, teacher educators, school leaders, administrators and policymakers, bringing together expert practitioners from India and the United Kingdom to support multiple programmes and initiatives seeking to improve educational outcomes. We are looking forward to continuing to build these connections to enable mutual learning and development, benefiting millions of young people from across the country. This report will provide a useful overview of this complex system for those who are interested to learn about the structure, mechanisms and policies that ultimately drive both individual and national development.

Kwong Chung Hung *et al.* (2019) in their study on *"Effects of 8-Week Core Training on Core Endurance and Running Economy"* concluded that, the purpose of this study was to examine the effects of 8-week core training on core endurance and running economy in college athletes. Twenty-one male college athletes were randomly divided into 2 groups: a control group (CON) (n=10) and a core training group (CT) (n=11). Both groups maintained their regular training, whereas CT attended 3 extra core training sessions per week for 8 weeks. The participants were assessed before and after the training program using sensory organization test (SOT), sport-specific endurance plank test (SEPT) and 4-stage treadmill incremental running test (TIRT). Compared with the pre-test, significant improvements were observed in post-test SOT (78.8±4.8 vs. 85.3±4.8, p = 0.012) and SEPT (193.5±71.9 s vs. 241.5±98.9 s, p=0.001) performances only in CT. In the TIRT, the post-test heart rate values were lower than the pre-test values in CT in the first 3 stages. In stage 4, the post-test oxygen consumption (VO2) was lower than that in pre-test in CT (VO2: 52.4±3.5 vs. 50.0±2.9 ml/kg/min, p=0.019). These results reveal that 8-week core training may improve static balance, core endurance and running economy in college athletes.

Luca Petrigna *et al.* (2019) conducted a study on *"A Review of Countermovement and Squat Jump Testing Methods in the Context of Public Health Examination in Adolescence: Reliability and Feasibility of Current Testing Procedures"*. In the context of a public health physical fitness (PF) examination in adolescence, a countermovement jump (CMJ) and a squat jump (SJ) are two vertical jump (VJ) tests widely used to evaluate lower limb muscle strength and power respectively. The main criticism of both the CMJ and SJ test is the lack of test standardization. Therefore, the objectives of this review are:(a) to gather information about both jumps; (b) to investigate whether it is possible to identify common procedures referred to in the CMJ and SJ technical execution, and (c) to design standard operating procedures (SOPs) to promote CMJ and SJ standardization in an adolescent population aged 12–18 years. The review partially adopted the preferred reporting items for systematic reviews and meta-analyses statement (PRISMA). Due to growing attention in monitoring physical health through field tests in recent years, articles were collected using the PubMed, Web of Science, and Scopus databases from January 2009 to July 2019. Original articles in which CMJ or SJ were used to assess the muscular strength in adolescents were eligible for further analysis. An article written in English was imposed as a limit. A total of 117 studies met the inclusion criteria. The description of the CMJ and SJ test procedures was different within the literature, with discrepancies in the jump technique, number of jumps, and measurement devices used. A lack of method standardization for both the CMJ and the SJ test was identified. Based on the literature, SOPs for both VJs were proposed. These are useful in the context of public health PF examination in adolescents, as they facilitate an unbiased comparison of jump performance data between published studies.

Manuel Chavarrias *et al.* (2019) studied on *"Health Benefits of Indoor Cycling: A Systematic Review"*. The aim of this manuscript was to conduct a systematic review of published studies about the benefits of indoor cycling training and to establish recommendations for coaches, researchers and practitioners. Materials and Methods: The PRISMA guidelines were followed to conduct the current systematic review. A systematic search was performed to retrieve relevant published articles until January 2019 using the following keywords: 'indoor cycling', 'indoor bicycle' and 'spinning exercise'. Information about participants, intervention, comparisons, outcomes, and study design (PICOS) was extracted. Results: A total of 300 studies were initially identified. After the revision process, 13 of them were included. The total sample size of the studies was 372 (306 women). Results revealed that indoor cycling may improve aerobic capacity, blood pressure, lipid profile and body composition. These enhancements may be achieved as standalone intervention or combined with other physical exercise or diet. The combination of indoor cycling and diet is recommended to improve the lipid profile, lose weight, and reduce blood pressure. Furthermore, indoor cycling alone may also enhance aerobic capacity.

Meryem Gülac (2019) worked on *“Examination of the Correlation between Dynamic Balance and Leg Strength of 11 and 12-Year-Old Children Who Have Fencing Training”*. In this study, it is aimed to examine the relationship between leg strength and dynamic balance of children who have fencing training. 59 epee athletes who are 11 and 12 years old (33 11-year-old, 26 12 year old) participated in research groups. Star excursion balance test was used to determine balance performances and baseline brand leg-dynamometer used to determine the leg strength of athletes who had fencing training. First, the Shapiro-Wilk test was used to determine if the data obtained during the study had a normal distribution. Pearson correlation test was performed for all data displaying a normal distribution. Significance levels were taken as $p<0.05$ according to the research findings it was determined that there is a meaningful relationship between leg strength and balance test of athletes who have fencing training. As a result, it was seen that balance test values increase as the leg strength increases.

Mohan Balaji Vigneshwar *et al.* (2019) studied on *“Design Fabrication and Performance of Push Plank Equipment for Fitness”*. The project aims at design and fabrication of push plank equipment for fitness. The word push plank is used here to refer that this equipment provides the benefit of both push up and plank exercise. Both these workouts combined helps in acquiring a full body workout. This type of equipment is preferred for home fitness because of their characteristics like size, portability, etc. The equipment has many design considerations pertaining to human ergonomics which makes the equipment human friendly, based on anthropometry. Sarrus linkage mechanism incorporated with lever mechanism is effectively used in the designed equipment. The purpose of the project was to design a home fitness equipment to perform a full body workout. The various full body workouts were studied, and push ups and planks were selected to be the workout to be performed using the equipment. The equipment can help the user to perform the workouts push and plank together effectively in order to gain a healthy body. The project also aimed on creating this equipment at a price lower than the other home fitness equipment variants which cost more than 4000 rupees. The aim was achieved by producing the equipment within a cost of 3000 rupees, which can be reduced further with optimizations in fabrication process. The equipment made was able to function effectively and is suitable for people above the age of 10 and is appropriate for use by all gender people.

Muthukumaran Jothilingam *et al.* (2019) worked on *"A Study on Effectiveness of Reaction Ball Training on Agility among Young Adults"*. To determine the effectiveness of reaction ball training to improve agility among young adults, 30 individuals were selected based on inclusion and exclusion criteria. Detailed procedure was explained in participant's words. Procedure was clearly explained to the participants by providing information sheet and informed consent was obtained from all the participants prior to the initiation of procedure. They were divided into two groups by odd and even method. Group-A content of 15 participants, received reaction ball training and group-B content of 15 participants, no specific training. Outcome measures were taken at the baseline and 6 weeks after the reaction ball exercise were given. The post-test mean value of group-A agility T-test is 10.833 (SD 0.982) and post-test mean value of group-B is 12.473 (SD

1.131) this shows that group-A shows greater improvement when compared to group-B in agility with P value of 0.0002(p <.05). This study concludes that reaction ball training is better intervention to improve agility in young adults when compared to non-specific training.

Amir Hossein Haghighi *et al* .(2018) in their study on *"Comparing the Effect of a Jump Rope Training on Physical and Motor Fitness Components among Primary School Boy and Girl Students"*. The aim of this study was to compare the effect of jump rope training on some of the physical and motor fitness factors between male and female primary school students. Forty-three male and female students from primary school volunteered. The students participated in a jump rope training program for 6 weeks (3 sessions per week). Before and after the training periods physical and motor fitness tests including cardiovascular endurance, agility, speed, legs explosive power, hands muscle endurance, hands power, static and dynamic balance were taken from the participants. The data was analyzed by using the ANCOVA and dependent T-tests at the significance level of $P<0.05$. The results showed no significant difference between male and female students in the indices of cardiovascular endurance, speed, hands muscular endurance, hands muscle power, legs explosive power, static and dynamic balance ($P>0.05$), while the agility index was improved in male students. It is suggested that male and female primary school students use jump rope trainings to improve their physical fitness and motor factors.

Bourne *et al.* (2018) conducted a study on *"Health Benefits of Electrically-Assisted Cycling: A Systematic Review"*. A systematic literature review of studies examining physical activity, cardio-respiratory, metabolic and psychological outcomes associated with e-cycling. Where possible these outcomes were compared to those from conventional cycling and walking. Seven electronic databases, clinical trial registers, grey literature and reference lists were searched upto November 2017. Hand searching occurred until June 2018. Experimental or observational studies examining the impact of e-cycling on physical activity and/or health outcomes of interest were included. E-bikes used must have pedals and require pedalling for electric assistance to be provided. Seventeen studies (11 acute experiments, 6 longitudinal interventions) were identified involving a total of 300 participants. There was moderate evidence that e-cycling provided physical activity of atleast moderate intensity, which was lower than the intensity elicited during conventional cycling, but higher than that during walking. There was also moderate evidence that e-cycling can improve cardio-respiratory fitness in physically inactive individuals. Evidence of the impact of e-cycling on metabolic and psychological health outcomes was inconclusive. Longitudinal evidence was compromised by weak study design and quality.

Cemali Çankaya *et al.* (2018) worked on *"Examining the Effects of the Plyometric (Jump Squat) Exercise on Vertical Jump in Female Volleyball Players"*. The aim of present study was to examine the effects of plyometric jump (jump squat) exercises on vertical jump, and to investigate the relation between these exercises and some physical fitness and other defining characteristics in female volleyball players. The sampling of the study consisted of 10 voluntary female players, who were active licensed players at Bursa nova sports club in Turkey volleyball 2nd league, and who had the following defining characteristics; age: 16±0.8 years; sports age: 9.5±0.1 years; height: 176±6.7 cm; body weight: 65.8±5.7 kg; fat %: 26.9±4.3; fat amount: 17.7±4.2 kg; lean weight 47.6±3.1 kg, total body fluid 34.9±2.3. The participants did not face any disabilities or diseases in the past six months; and participated in the training program regularly. They applied a normal diet during the entire study process. A total of 6 trainings a week, 3 sets in each training, 30 jumps in each set, which means a total of a total of 24 trainings, 72 sets and 2160 plyometric jumps (jump squat) were added to the seasonal training programs of the players for 4 weeks. The Bosco test was used. On Sunday, one day before the plyometric studies were started, the other 4 vertical jump measurement tests (T2, T3, T4, T5) including the determining the vertical jump measurements test (T1) were carried out on Sundays every weekend. The body composition was determined by the Tanita body composition analyzer TBF-300. The data that were obtained in this way were analyzed with one-way ANOVA and Pearson correlations coefficient tests in the SPSS for Windows 22 statistical program. As a result, a statistically significant relation was detected between the vertical jump, which is one of the descriptive characteristics of volleyball players, and the amount of fat % and fat ($p=0.05$). The vertical jump arithmetic averages were determined to be T1 33.8±4.8 cm; T2 34.4±4.5 cm; T3 35.2±4.7 cm; T4 36.5±4.9 cm; T5 36.4±4.7 cm ($F=34.353$; $p<0.05$). The effects of the plyometric exercises on vertical jump were found to be $F=34.353$ ($p<0.001$). It can be claimed that the plyometric exercises that were applied on the volleyball players have positive effects and an inversely-proportional relation with body fat %, fat amount, and vertical jump.

Eshita and Lakhvinder Kaur (2018) carried out a study on *"Influence of Height and Weight on Physical Fitness Index of Amateur Gymers of Age 17 Years"*. Physical fitness is a set of attributes a person has or achieve, which is linked to the person's capability to do physical activity. Harvard step test is a good measurement of fitness and a person's ability to recover after a strenuous exercise. Therefore, this study intends to provide accurate information about the influence of height and weight on physical fitness index. The present study was conducted on 30 amateur gymers of 17 years of age and physical fitness index (PFI) was calculated by using modified Harvard step test in which the step height was modified to 33cm. Based on height, the subjects were divided in 2 groups(1) subjects having height >170cm and (2) subjects having height≥170cm. Also based on weight the subjects were divided in 2 groups (1) subjects having wt ≤70 kg and (2) subjects having wt ≥70 kg. The physical fitness index calculated among both groups. Depending upon the score, physical fitness index is graded as excellent (>90), good (80-89), high average (65-79), low average (55-64) and poor (< 55). Statistical analysis: unpaired t' test of Microsoft excel 2007 was used for comparison between height and weight results. P-value less than 0.05 considered as significant. Study shows that there is significant higher physical fitness score in subjects having height >170 cm than those subjects having height ≤170 cm. Also there is statistical high physical fitness score in subjects having weight ≥70kg than those subjects having weight ≤70kg. The height and weight of subjects was found to be positively and significantly correlated to the PFI score. PFI was higher for subjects with ≥170cm height than for subjects with ≤170cm height. The reason lies in the short stature. The subjects with short height of ≤170cm has higher muscle fatigue Similarly, in case of subjects with ≥70kg shows high PFI due to more weight to be lifted up during the stepping process.

James D. George *et al.* (2018) studied on *"New Approach in Assessing Core Muscle Endurance Using Ratings of Perceived Exertion"*. This study sought to develop regression models to estimate maximal endurance time using data from 4 core muscle endurance tests. Eighty healthy university students (age: 22.7 ± 1.9 years) performed the plank, right side-bridge, left side-bridge, and back extension tests in a random order. Participants were instructed to hold each static position for a maximal endurance time, while maintaining proper form and then rest for 5 minutes between tests. A test administrator recorded participants' ratings of perceived exertion (RPE; a modified 10-point scale) every 5 seconds. Based on regression analysis, the elapsed time to reach an RPE of 8 (RPE8) exhibited statistical significance ($p < 0.0001$) and the highest accuracy as compared with lower RPE values. The following univariate regression models were generated to estimate maximal endurance time across the 4 tests: plank ($r = 0.94$; standard error of estimate (SEE)=17.6 seconds; n=77)=23.9+(1.110×RPE8); right side-bridge (r=0.92; SEE=11.4 seconds; n=80)=18.5+(1.022×RPE8); left side-bridge (r=0.93; SEE=10.8 seconds; n=80)=16.8+(1.062×RPE8); and back extension (r=0.93; SEE=14.2 seconds; n=79)=21.5+(1.027×RPE8). These results suggest that submaximal protocols based on elapsed time to reach RPE8 provide strength and conditioning professionals' relatively accurate univariate regression equation estimates of maximal core muscle endurance time and offer a viable submaximal alternative to maximal capacity testing when time efficiency, participant safety or certain educational objectives may be a priority.

Jessica E. Bourne *et al.* (2018) worked on *"A Systematic Literature Review of Studies Examining Physical Activity, Cardio-respiratory, Metabolic and Psychological Outcomes Associated with E-Cycling"*. Where possible these outcomes were compared to those from conventional cycling and walking. Seven electronic databases, clinical trial registers, grey literature and reference lists were searched up to November 2017. Hand searching occurred until June 2018. Experimental or observational studies examining the impact of e-cycling on physical activity and/or health outcomes of interest were included. Ebikes used must have pedals and require pedalling for electric assistance to be provided. Seventeen studies (11 acute experiments, 6 longitudinal interventions) were identified involving a total of 300 participants. There was moderate evidence that e-cycling provided physical activity of at least moderate intensity, which was lower than the intensity elicited during conventional cycling, but higher than that during walking. There was also moderate evidence that e-cycling can improve cardio-respiratory fitness in physically inactive individuals. Evidence of the impact of e-cycling on metabolic and psychological health outcomes was inconclusive. Longitudinal evidence was compromised by weak study design and quality. E-cycling can contribute to meeting physical activity recommendations and increasing physical fitness. As such, e-bikes offer a potential alternative to conventional cycling. Future research should examine the long-term health impacts of e-cycling using rigorous research designs.

Pawiter Singh (2018) studied on *“Assessment of Agility, Strength and Flexibility Parameters between Badminton and Lawn Tennis Players”*. The purpose of the study was to compare the agility, reaction time, strength and flexibility of badminton and lawn tennis player to fulfill the objectives of the study, 30 Badminton and lawn tennis players were selected from Punjab state. Who were participated in inter school tournament of badminton and lawn tennis. The age of selected subjects arranged from 17-19 years. Test used SEMO for agility test, vertical jump for strength test and flexibility (modified sit and reach test) were used to measure the selected physical fitness variables of players in order to analyze the data and significant different between badminton and Lawn tennis players of Punjab. The mean, SD and ‘t’ values were calculated to find out the significant of differences between male badminton and lawn tennis players. Significant level is found out by the application of ‘t’ test at 0.05 level. After comparing of the present data it is concluded that the lawn tennis players have demonstrated better in agility and flexibility tests than badminton players and badminton players demonstrated better in leg strength test.

Pooja Ojha *et al.* (2018) studied on *“Physical Fitness Score and Academic Performance in Medical Students”*. Physical fitness in physiological term is the ability of body to cope the acute exercise stress. As the well-known saying goes that healthy mind lies in a healthy body, a physically fit student will be able to cope academic stress in a better manner. Various studies have shown that both acute and chronic stress can affect physical fitness. The aim is to study physical fitness in MBBS students before professional examination and to correlate the level of physical fitness with their academic performance. A total of 24 male volunteer, age range 18 to 23 yr, MBBS students were recruited for the study. Their weight, height, body mass index (BMI), basal heart rate and physical fitness index using Harvard step test with height adjusted for Indians were taken before university examination. University marks were noted from mark sheet. Physical fitness score (PFS), BMI and university marks were correlated. There was a significant correlation between BMI and PFS. Furthermore, we got a statistically significant correlation between PFS and university marks’ result. Above study will reinforce the concept of healthy body and healthy mind in medical students and will encourage them to maintain their fitness in their busy medical career.

Singgih Hendarto *et al.* (2018) studied on *“Development of Taekwondo Physical Instruments: Test Ages of 14-17 Years Old”*. The purpose of this study was to develop a physical test model of taekwondo athlete category (kyorugie) age 1417 years. This type of research is Research and Development (R and D) research. The research was conducted in several places, namely: Purwokerto, Yogyakarta, Sukoharjo and Surakarta in 2017. A sample of 300 athletes consisting of 150 male athletes and 150 athletes of the castles. Confirmatory factor analysis technique through SPSS program 23.00 with the provision if the measure of sampling adequacy (MSA> 0.5) then the instrument is feasible to use and (MSA <0.5) then the instrument is not feasible to use with significant level α = 0.05, for confirmed the latent variables that determine the physical quality of taekwondo athletes in the category of matches (kyorugie) ages 14-17. In this development study, the steps to be taken include: (1) preliminary study (literature study and field study), (2) planning (conducting analysis), (3) initial draft design, (4) draft validation (5) small group trial and revision, (6) large group trial and revision, (7) result. Validity uses content validity, reliability using Retrone's Alpha test retest and T- skor to equalize units. The result of this research are 10 physical test indicator ata taekwondo athlete category (kyorugie) age 14 - 17 year old son and daughter consist of reliability test obtained result (1) sit and reach test 0,719 and 0,609; (2) The reaction rate test (Ruller drop test) of 0.674 and 0.540; (3) coordination test (eye, hand and foot coordination) of 0.809 and 0.712; (4) The stroke balance test of 0.640 and 0.731; (5) Triple-jump test of 0.801 and 0.749; (6) hex test (hexagon obstacle test) of 0.608 and 0.608; (7) The maximum velocity test (30m hurdles) of 0.817 and 0.740; (8) hand grip strength of 0.771 and 0.737; (9) muscle endurance test (push up) of 0.871 and 0.737; and (10) cardio-respiratory endurance test (multi-stage run) of 0.799 and 0.814. The resulting product is a guidebook, test model and norm of physical test-t taekwondo category of match (kyorugie) age 14-17 years. Based on the results of the research described in the discussion chapter, it can be concluded that: (a) a valid and reliable physical test model to train a taekwondo athlete candidate consists of 10 physical tests. The contents of the test model are: (1) sitting and reaching, (2) Ruller fall test, (3) eye coordination, hands and feet, (4) standing stork balance (5) triple hop leap, (6), (7) runs 30 meters, (8) hand grip strength, (9) push ups, and (10) multi-stage run.

Hanjabambarun Sharma *et al.* (2017) studied on *"Anthropometric Basis of Vertical Jump Performance: A Study in Young Indian National Players"*. Vertical Jump (VJ) is a good measure of athletic performance and occupational activities. Earlier studies reported conflicting results on anthropometric influence. To evaluate the relationship between anthropometric characteristics and VJ in national level hockey and cycling players, fifty four (32 males) national level hockey and cycling players of 11-21 years were the volunteers. Following standard protocols, these variables were measured: VJ, weight (WT), height (HT), trochanterion-height (TH), sum of skinfold thickness (SSF), lengths (acromialestylion (AS) and midstyliondactylion (SD)], breadths [biacromial (AB), biiliocristal (IB), biepicondylarhumerus (HB) and biepicondylar femur (FB)], girths [relaxed arm (AG), mid-thigh (TG) and calf (CG)], lower back and hamstring flexibility (SR), grip [left hand grip (LHG) and right hand grip (RHG)] and back strength (BS). International Society for the Advancement of Kinanthropometry (ISAK) procedures were followed for anthropometric variables measurement. Unpaired-'t'-test was used for comparison between genders. Pearson's correlation and multiple regression analysis were used to evaluate correlates and predictors of VJ respectively. Males had significantly higher VJ, HT, SD, AB and BS; but lower SSF, AS and TG. VJ correlated positively with age, WT, HT, SD, TH, girths, SR and strength among males; but only with WT and LHG among females. After controlling gender, TH and LHG predicted VJ significantly with 69% of total variance. HT, SSF and BS; and LHG were the significant predictors among males and females respectively. Anthropometric and physiological variables like TH, grip, HT, skinfold and BS had major influence on VJ. The result might help in training-monitoring and player's selection.

Karthik Muralidharan and Nishith Prakash (2017) studied on *"Cycling to School: Increasing Secondary School Enrolment for Girls in India"*. The current study articulated that, the impact of an innovative program in the Indian state of Bihar that aimed to reduce the gender gap in secondary school enrolment by providing girls who continued to secondary school with a bicycle that would improve access to school. Using data from a large representative household survey, researcher employed a triple difference approach (using boys and the neighbouring state of Jharkhand as comparison groups) and found that being in a cohort that was exposed to the cycle program increased girls' age-appropriate enrolment in secondary school by 30% and also reduced the gender gap in age-appropriate secondary school enrolment by 40%. Parametric and non-parametric decompositions of the triple-difference estimated as a function of distance to the nearest secondary school showed that the increase in enrolment mostly took place in villages where the nearest secondary school was further away, suggested that the mechanism for program impact was the reduction in the time and safety cost of school attendance made possible by the bicycle. the researcher find that, the cycle program was much more cost effective at increasing girls' enrolment than comparable conditional cash transfer programs in South Asia suggested that the coordinated provision of bicycles to girls may have generated externalities beyond the cash value of the program, including improved safety from girls cycling to school in groups and changes in patriarchal social norms that proscribed female mobility outside the village which inhibited female secondary school participation.

Nan Zeng *et al.* (2017) worked on *"Effects of Physical Activity on Motor Skills and Cognitive Development in Early Childhood: A Systematic Review"*. This study synthesized literature concerning casual evidence of effects of various physical activity programs on motor skills and cognitive development in typically developed preschool children electronic data bases were searched through July 2017. Peer reviewed randomized controlled trials (RCTs) examining the effectiveness of physical activity on motor skills and cognitive development in healthy young children (4-6 years) were screened. A total of 15 RCTs were included. Of the 10 studies assessing the effects of physical activity on motor skills, eight (80%) reported significant improvements in motor performance and one observed mixed finding, but one failed to promote any beneficial outcomes. Of the five studies investigating the influence of physical activity on cognitive development, four (80%) showed significant and positive changes in language learning, academic achievement, attention and working memory. Notably, one indicated no significant improvements were observed after the intervention. Findings support causal evidence of effects of physical activity on both motor skills and cognitive development in preschool children. Given the shortage of available studies, future research with large representative samples is warranted to explore the relationships between physical activity and cognitive domains as well as strengthen and confirm the dose response evidence in early childhood.

Atsushi Imai and Koji Kaneoka (2016) conducted a review on *"The Relationship between Trunk Endurance Plank Tests and Athletic Performance Tests in Adolescent Soccer Players"*. Although it is believed that, trunk function is important for athletic performance, few researchers have demonstrated a significant relationship between the trunk function and athletic performance. Recently, the prone plank and side plank tests have been used to assess trunk function. The purpose of this study was to investigate the relationships between trunk endurance plank tests and athletic performance tests, including whether there is a relationship between long distance running and trunk endurance plank tests in adolescent male soccer players. Cross sectional study design. Fifty-five adolescent male soccer players performed prone and side plank tests and seven performance tests: the Cooper test, the Yo-Yo intermittent recovery test, the step 50 agility test, a 30-m sprint test, a vertical counter movement jump, a standing five-step jump, and a rebound jump. The relationships between each individual plank test, the combined score of both plank tests, and performance tests were analyzed using the Pearson correlation coefficient. The combined score of plank tests was highly correlated with the Yo-Yo intermittent recovery test ($r=0.710$, $p<0.001$), and was moderately correlated with the Cooper test ($r=0.567$, $p<0.001$). Poor correlation was observed between the prone plank test and step 50 agility test ($r=-0.436$, $p=0.001$) and no significant correlations were observed between plank tests and jump performance tests. The results suggest that trunk endurance plank tests are positively correlated with the Yo-Yo intermittent recovery test, the Cooper test, and the step 50 agility test.

Thomas Gotschi *et al.* (2016) conducted a study on *"Cycling as a Part of Daily Life: A Review of Health Perspectives"*. This study articulates a review of health perspectives, health aspects of day-to-day cycling have gained attention from the health sector aiming to increase levels of physical activity and from the transport and planning sector, to justify investments in cycling. The authors review and discuss the main pathways between cycling and health under two perspectives generalizable epidemiological evidence for health effects and specific impact modelling to quantify health impacts in concrete settings. Substantial benefits from physical activity dominate the public health impacts of cycling. Epidemiological evidence is strong and impact modelling is well advanced. Injuries amount to a smaller impact on the population level, but affect crash victims disproportionately and perceived risks deter potential cyclists. Basic data on crash risks are available, but evidence on determinants of risks is limited and impact models are highly dependent on local factors. Risks from air pollution can be assumed to be small with limited evidence for cycling-specific mechanisms. Based on a large body of evidence, planners, health professionals, and decision-makers can rest assured that benefits from cycling-related physical activity are worth pursuing. Safety improvements should be part of the efforts to promote cycling, both to minimize negative impacts and to lower barriers to cycling for potential riders.

Zakiuddin *et al.* (2016) studied on *"A Cross Sectional Study of Physical Fitness Index using Modified Harvard Step Test in Relation with Body Mass Index in Medical Students"*. The physical fitness index measures the physical fitness for muscular work and the ability to recover from the work. The Harvard step test (HST) assesses the physical fitness of individual. The present study was done to assess the physical fitness index using modified Harvard step test in young adult in the age group of 19 to 28 years with varying degree of physical activity. Study was conducted in department of physiology, major S.D. Singh medical college, Farrukhabad. The subjects selected for this study were medical students admitted for first MBBS course and physical fitness index was measured using modified Harvard step test. The height of subjects positively and significantly correlated to the fitness score and also the duration of exercise. In the present study, the mean Harvard index or PFI was 82.0101 in males 46.2542 in females.

Mean value of height and weight were 166.6503cms and 54.2316kgs in males 96.4100cms and 51.9000kgs in females respectively. Low mean value of PFI in female subjects compared to male subjects can thus be attributable to their lower body weight and height; also males are generally more aggressive and accept challenges more than females. This present study is an attempt to modify Harvard step test with classification of score. But for Indians, it is necessary to modify the step test because of short stature.

Dharmesh Parmar and Nikita Modh (2015) worked on *"Study of Physical Fitness Index using Modified Harvard Step Test in Relation with Gender in Physiotherapy Students"*. The physical fitness index measures the physical fitness for muscular work and the ability to recover from the work. The present study was undertaken to assess the physical fitness index using modified Harvard step test in young adult in the age group of 17 to 24 years with varying degree of physical activities. Cross sectional study was done on 105 physiotherapy students and physical fitness index was measured using modified Harvard step test. Statistical analysis was done using descriptive analysis and chi square test. Statistical analysis shows that physical fitness in physiotherapy students is not satisfactory and there is significant difference in physical fitness index between boys and girls. Physical fitness of physiotherapy students in Ahmedabad physiotherapy college is not satisfactory and female are having better physical fitness.

Mohar Kassim and Mat Berahim (2015) depicted a study on *"Football Training Development Programme Under- 15 State Level"*. The main objective of this study is to evaluate the effectiveness of training programmes using dynamic sports performance (DSP) football 'Tiki Taka' skills in playing football amongst male under-15. This study consists of 4 players phase and they are: preparatory phase (sample search), test phase (sample), training phase (conducting training programme) and evaluation phase (assessing the effectiveness of the programme). There are two tests to be carried out on the samples First is the ‘Tiki Taka’ fitness test (PACER test, SEMO test, and 30mZigZag Sprint test) while the second test is the football skills ‘Tiki Taka’ test (SEMO Ball) joint test, zigzag ball joint test, 2.4km test, passing swipe (5-15 m) test and kick juggling balls test (10-30 m)). Pre and post tests will be carried out to evaluate the effectiveness of this study. Changes to the performance of the players and the team are monitored to test the effectiveness of football training programme under review. A total of 58 respondents are identified, but only 20 are selected in this study. Selected samples are evaluated through fitness tests and football skills. This study also has a control sample of 20 players. The sample consists of under-15 football project players from Sekolah Menengah Kebangsaan Mengkebang (SMKM) in Kuala Krai district. Data are analyzed using descriptive statistics, correlation, t-test, and multiple regression analysis. The findings show the effectiveness of the training programme for a period of 6 months on the performance of the players and the team’s fitness level, skills and performance using the ‘Tiki Taka’ football method (Barrow, 2000). Results showed a significant difference in the pre and post test on the sample and also on the performance and achievement of the team formed. Further results showed that the fitness and skill tests established predictor variables that affect talent in football. The study also suggests using the model to identify football rules ‘Tiki Taka’ talent in football, especially for male players under 15 years old.

Pamela E. Jeter *et al*. (2014) in their review article on *“A Systematic Review of Yoga for Balance in a Healthy Population”* concluded that, a systematic review was done of the evidence on yoga for improving balance. Relevant articles and reviews were identified in major databases (PubMed, Medline, IndMed, Web of Knowledge, Embase, EBSCO, Science Direct and Google Scholar) and their reference lists searched. Key search words were yoga, balance, proprioception, falling, fear of falling and falls. Included studies were peer reviewed articles published in English before June 2012, using healthy populations. All yoga styles and study designs were included. Two (2) raters individually rated study quality using the Downs and Black (DB) checklist. Final scores were achieved by consensus. Achievable scores ranged from 0 to 27. Effect size (ES) was calculated where possible. Fifteen (15) of 152 studies (age range 10-93, n=688) met the inclusion criteria: 5 randomized controlled trials (RCTs), 4 quasi-experimental, 2 cross-sectional and 4 single-group designs. DB scores ranged from 10 to 24 (RCTs), 14-19 (quasi-experimental), 6-12 (cross-sectional) and 11-20 (single group). Studies varied by yoga style, frequency of practice and duration. Eleven (11) studies found positive results ($p<0.05$) on at least one balance outcome. Effect size (ES) ranged from -0.765 to 2.71 (for 8 studies) and was not associated with DB score. Yoga may have a beneficial effect on balance, but variable study design and poor reporting quality obscure the results. Balance as an outcome is underutilized and more probing measures are needed.

Youne Hachana *et al.* (2014) studied on *"Validity and Reliability of New Agility Test among Elite and Subelite under 14-Soccer Players"*. Agility is a determinant component in soccer performance. This study aimed to evaluate the reliability and sensitivity of a "Modified Illinois change of direction test" (MICODT) in ninety-five U-14 soccer players. A total of 95 U-14 soccer players (mean 6 SD: age: 13.6161.04 years; body mass: 30.5264.54 kg; height: 1.5760.1 m) from a professional and semi-professional soccer academy, participated to this study. Sixty of them took part in reliability analysis and thirty-two in sensitivity analysis. The intra-class correlation coefficient (ICC) that aims to assess relative reliability of the MICODT was of 0.99, and its standard error of measurement (SEM) for absolute reliability was, 5% (1.24%). The MICODT's capacity to detect change is ''good'', it's SEM (0.10 s) was # SWC (0.33 s). The MICODT is significantly correlated to the Illinois change of direction speed test (ICODT) (r=0.77; p. 0.0001). The ICODT's MDC95 (0.64 s) was twice about the MICODT's MDC95 (0.28 s), indicating that MICODT presents better ability to detect true changes than ICODT. The MICODT provided good sensitivity since elite U-14 soccer players were better than non-elite one on MICODT (p=0.005; d z =1.01 [large]). This was supported by an area under the ROC curve of 0.77 (CI 95%, 0.59 to 0.89, p.0.0008). The difference observed in these two groups in ICODT was not statistically significant (p=0.14; d z =0.51 [small]), showing poor discriminant ability. MICODT can be considered as more suitable protocol for assessing agility performance level than ICODT in U14 soccer players.

Sandip Sankar Ghosh and Chayan Majumder (2013) studied on *"A Study on Agility and Dynamic Balance of Kho-Kho Handball and Basketball Players"*. The purpose of the present study was to compare selected motor fitness components of kho-kho, handball and basketball players of West Bengal. In the present study agility and dynamic balance were chosen as variable for motor fitness components. The study was conducted on seventy five (N=75) players [twenty five kho-kho, twenty five handball and twenty five basketball players]. They were selected randomly from three districts of west Bengal viz., north 24 parganas, Burdwan and Kolkata. The age group of the subjects was ranged from (14-18) years. In this study agility were measured by SEMO agility test and dynamic balance were measured by modified bass test. Mean and standard deviation of each variable were calculated. To determine the significant difference among the means of three games in the selected motor fitness components, one way analysis of variance (ANOVA) was used. The level of significant difference was set at $p<0.05$ level of confidence. For statistical calculations excel spread sheet of windows version 7 was used. The result of the study showed that, there was no significant difference in selected motor fitness components of the three different games.

Oja *et al.* (2011) in their study on *"To Update the Evidence on the Health Benefits of Cycling: A Systematic Review of the Literature Resulted in 16 Cycling-Specific Studies"*. Cross sectional and longitudinal studies showed a clear positive relationship between cycling and cardio-respiratory fitness in youths. Prospective observational studies demonstrated a strong inverse relationship between commuter cycling and all-cause mortality, cancer mortality, and cancer morbidity among middle-aged to elderly subjects. Intervention studies among working-age adults indicated consistent improvements in cardiovascular fitness and some improvements in cardiovascular risk factors due to commuting cycling. Six studies showed a consistent positive dose–response gradient between the amount of cycling and the health benefits. Systematic assessment of the quality of the studies showed most of them to be of moderate to high quality. According to standard criteria used primarily for the assessment of clinical studies, the strength of this evidence was strong for fitness benefits, moderate for benefits in cardiovascular risk factors, and inconclusive for all-cause mortality, coronary heart disease morbidity and mortality, cancer risk, and overweight and obesity. While more intervention research is needed to build a solid knowledge base of the health benefits of cycling, the existing evidence reinforces the current efforts to promote cycling as an important contributor for better population health.

Chapter-III

Methodology

Chapter - III

METHODOLOGY

The selection of participants and criteria measures, research design and statistical techniques utilized for data analysis, administration and process of the tests are all covered in Chapter 4.

Subjects Selected and Criteria

The current research was done on 200 male students from government secondary schools, comprising two groups of 100 cyclists and 100 non-cyclists. The selected 200 male children were from Shivamogga district's periphery 8th grade government schools, and they ranged in age from 13 to 15. Bhadravathi, Thirthahalli, Shikaripura, Hosanagara and Shivamogga were five selected taluks of the Shivamogga district that were included in the research. Based on the distance travelled between home and school around 5 to 7 kilometers per day, 100 male eighth-graders from the five taluks of Shivamogga districts were chosen as bicycle users. The selected 200 eighth-grade pupils for the study were split into two groups of 100 each: 100 bicycle users and the remaining 100 bicycle non-users. Twenty cyclists and twenty non-cyclists were chosen from two schools in each taluk for the current research, which is described in Table 3.1.

Table 3.1. Selection of Samples

Taluks	Name of the schools	No. of bicycle users	No. of bicycle non-users	Total
Shivamogga	G.H.S Ayanuru	10	10	20
	G.H.S Tammadihalli	10	10	20
Thirthahalli	G.H.S Kannangi	10	10	20
	G.H.S Mandagadde	10	10	20
Shikaripura	G.H.S Kalmane	10	10	20
	G.H.S Harogoppa	10	10	20
Bhadravathi	G.H.S Antaragange	10	10	20
	G.H.S Siddapura	10	10	20
Hosanagara	G.H.S Arasalu	10	10	20
	G.H.S Bellur	10	10	20
Total		**100**	**100**	**200**

Choosing the Variables

The research scholar was able to conduct a thorough analysis of selected physical fitness component variables as well as health fitness variables with the help of scientific and methodical review of the literature. The consultation with the various related study area experts in this field also aided in the selection of the study variables.

Three physical fitness components and three health fitness components were chosen as study variables in the research study based on the knowledge gained through the literature review and expert opinion as well as the administrative feasibility in terms of the a) availability of instruments and b) expertise for measuring and recording data. The six variables listed below (Table 3.2) were chosen using the criteria.

Table 3.2. Variables of study and corresponding tests

Subjects	Variables	Test
Secondary School Students	Explosiveness	Vertical Jump
	Balance	Stork Balance Test
	Agility	SEMO Agility Test
	Cardiovascular endurance	Harvard step Test
	Muscular strength	Plank Test
	Body composition	BMI (Body Mass Index)

Criterion Measures

Fitness components variables

1. Explosive power was measured with the help of vertical jump test.
2. Balance was measured by stroke balancing ability timing.
3. Agility test was measured with the help of agility power.
4. The Harvard step test was measured by cardiovascular endurance fitness.
5. Muscular strength was measured by core muscle strength.
6. Height of the subjects was measured with the stadiometer scale in centimetres.
7. Weight of the subjects was measured with digital weighing in kilogram scale
8. The total body weight minus the fat mass.

Data Reliability

By estimating the instrument reliability, tester competency and test reliability, the data reliability was secured.

Device Reliability

The tools used in the study included a stadiometer, an electronic digital manual stop watch and a weighing scale. An electronic digital stop watch that is manually operated was used to measure the time after being calibrated for accuracy. After calibration, the body weight was measured using a digital scale. The standing height was determined using a stadiometer scale.

The Methodology of the Study

Six variable-related tests involving bicycle users and non-users were carried out over three stages: the initial testing stage, the testing stage at the end of three months and the testing stage at the end of six months. The study adopted a quasi-experimental design as shown in table 3.3.

Table 3.3. Quasi-Experimental Design

Type of Groups	Stages of Testing	Test
Bicycle Users (Experimental)	Initial Testing	Physical Fitness components
	Testing after three months of bicycle utilization	
	Testing after six months of bicycle utilization	
Bicycle non users (Controlled)	Initial Testing	
	Testing at the end of three months	
	Testing at the end of six months	

Procedure for Test Administration and Data Collection

Physical fitness assessments were administered in rooms and outside. The individuals were instructed to gather at the testing location before the test was administered and they were informed of its objective. For the test, the investigator enlisted the assistance of schoolchildren and the physical education instructor. The individuals received demonstrations of each exam and every effort was made to assure correctness and consistency in the test delivery.

Physical Fitness Components Variables

1. Vertical jump (Sargent, 1921)

Objective: To measure vertical jump.

Equipment: Floor tapes, marking powder, chalks.

Procedure: Jumping upward into the air is known as a vertical jump or vertical leap. The bicycle rider and non-rider would stand side by side and reach up with the hand that is closest to the wall while maintaining their feet level on the ground. The height of the reach was measured and recorded as the standing reach height/sanding vertical jump at the point of the finger tips. The experiment participant was instructed to jump while holding a chalk on their fingers and make a mark on the wall at the height of their leap. The so-called subject in this running vertical leap method was required to stand a safe distance from the wall, advance towards the wall and jump vertically as high as they could while utilizing their arms and legs to help lift their bodies higher. At the highest point of the leap, the applicant being tested was meant to contact and mark the wall. The score of explosive power was calculated as the gap between the standing reach height and the jump height. Due to its ease of use, speed and ability to measure vertical power directly, this test would seem to be more practical.

Scoring: Every student's attempt at a vertical jump was recorded. For considering the development of explosive power, the best of the three best efforts was recorded.

Photograph 3.1. Researcher collecting data on vertical jump

Table 3.4. Explosive power score index of verticle jump test

Rating	**Men**
Excellent	>28
Very Good	24-28
Above Average	20-23
Average	16-19
Low Average	12-15
Poor	08-11
Very Poor	<8

2. Stork Balance Stand Test (Johnson and Nelson, 1979)

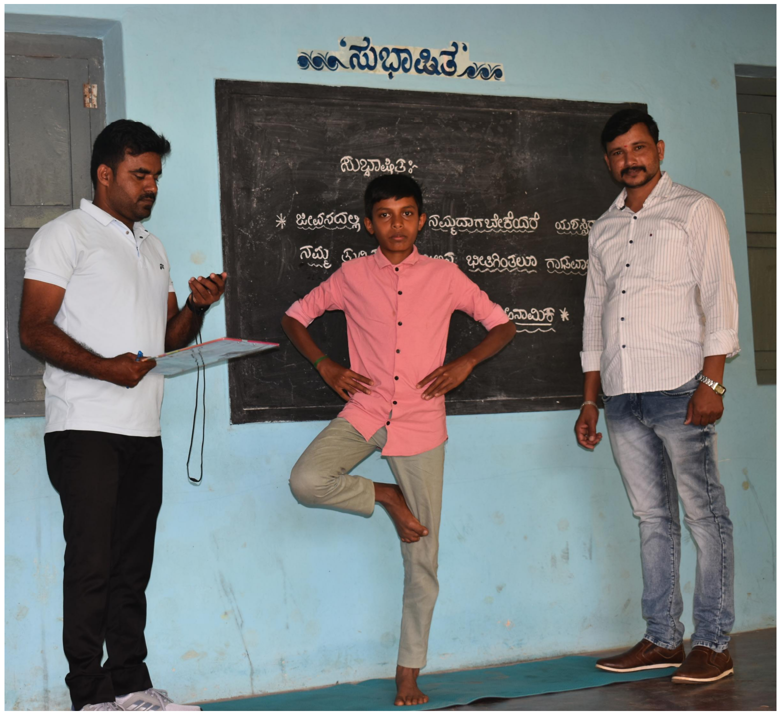
Purpose: To measure whole body balance ability.

Equipment required: flat, non-slip surface, yoga mat, stopwatch, recording sheet and pencil.

Standing balance test procedure: A flat, non-slip surface was chosen for the test to be conducted on. The participants were instructed to take off their shoes and stand erect with their hands on their hips. The right leg was asked be raised, with the toes of the right foot being placed either against the left foot's knee or the inside of the standing leg, depending on which foot was not standing.

Each participating student was asked to lift their heel off the ground in order to balance on the ball of their foot for proper balance. The timer was retained for the purpose of accomplishing the goal after the heel had left the ground. Since the stopwatch's purpose was to time the participant's and pupils' activities, it was stop working as soon as any of the following takes place: Hands were removed from the hips, the supporting foot rotates or moves (hops), the non-supporting foot breaks contact with the knee and the supporting foot's heel strikes the ground.

Scoring: At several tries, the overall amount of participant activity time was being recorded. The best of three tries was then used to determine the score. The table 3.5 gives this test's overall ratings.



Photograph 3.2. Researcher collecting data on stork balance stand test

Table 3.5. Balance score index of single leg balance

Rating	**Score (seconds)**
Excellent	> 50
Good	40 - 50
Average	25- 39
Fair	10 - 24
Poor	< 10

3. SEMO agility test (Kirby, 1971)

Objective: To measure agility.

Equipment required: non-slip surface, marking powder, marker cones, measuring tape, stopwatch and score sheet.

Procedure: Start one foot behind the starting line; rocking motion was not permitted. The candidate begins at cone 1, moves to cone 2 using a side-stepping motion (sideward movement), then circles the cone and runs back pedals to cone 3 as Hand Timing began from the first movement from the set position. As soon as the athlete was near cone 3, they should sprint to cone 1, go around the cone and backward, and then continue running to cone 4. Once you have gone around cone 4, advance quickly to cone 2, then side-step back to cone 1 to begin. Throughout the entire test, the candidate was to maintain a forward-facing position with their back to the baseline.

Scoring: The subject was told to "go" to start the stopwatch and it is told to "stop" when they reach the start/finish line. Every candidate's fastest time over two trials was being recorded to the next decimal place.

Photograph 3.3. Researcher collecting data on SEMO agility test

Table 3.6. Agility score index of SEMO agility

Rating	Male
Excellent	< 10.7
Good	10.47-11.49
Average	11.50-13.02
Fair	13.03-13.79
Poor	>13.8

4. Harvard step test (Brouha *et al.*, 1943)

Objective: To assess the development cardiovascular endurance system.

Equipment: Step or platform 20 inches/50.8 cm high, stopwatch, metronome mobile app and one speaker.

Procedure: The athlete/subject continually steps onto and off of a platform in a cycle in under two seconds, which translates to bicycle riders taking 30 steps per minute and continuing at this pace for five minutes or until fatigue. For males, the platform should be 20 inches tall, or 51 cm, high. The desired speed may be assured in accordance with the test standards by employing a metronome mobile app and speaker. When a pupil is exhausted, they are unable to maintain their stepping pace for another 15 seconds. The individual was instructed to sit down as soon as the test was over, and from that point on, the total number of heartbeats was tallied 1, 2, and 3 minutes after the exam was finished. The phrase "short form test" refers to the heart rate counting that ranges from 1 to 1.5. Under the lengthy variant of the test, further heart beat countings are anticipated to occur between 2 and 2.5 and 3 to 3.5 minutes later.

The fitness index score was calculated using the following equations and the equation most suited for doing so was chosen based on the following standards:

$$\text{Fitness Index (short form)} = \frac{(100 \times \text{Test duration in seconds})}{(5.5 \times \text{Pulse count between 1 and 1.5 minutes})}$$

$$\text{Fitness Index (long form)} = \frac{(100 \times \text{Test duration in seconds})}{(2 \times \text{sum of heart beats in the recovery periods})}$$

Scoring: Using the three pulse rates (BPM) estimation of fitness' level is determined.

Photograph 3.4. Researcher collecting data on Harvard step test

Outcome of the equation is rated as follows

Table 3.7. Cardiovascular endurance score index of Harvard step test

Rating	**Score measurement**
Excellent	>96
Good	83-96
Average	68-82
Low Average	54-67
Poor	<54

5. Plank test (Strand *et al.*, 2014)

Purpose: Measure to back/core stabilizing muscles endurance.

Equipment: flat and clean surface, yoga mat, stopwatch, recording sheets and pen.

Procedure: The goal of this exam was for all students, bicycle users and non-users alike, to maintain an elevated posture for the longest amount of time feasible. Some people may not be able to begin a plank posture in full stretch on the first try without effort and tension. With the legs straight and the weight being supported by the toes, the upper body is raised off the ground by the elbows and forearms. The applicant will next be instructed to elevate their hip off the ground, creating a straight line from head to toe. The stopwatch is to be started as soon as the applicant assumes the anticipated posture. Never keep the head gazing ahead; always keep it towards the ground. When the individual showed struggles to keep their back straight and their hip starts to decelerate down, the test is done.

Scoring: Out of better of three attempts one best timings was be counted for the determination of muscular endurance.

Photograph 3.5. Researcher collecting data on Plank test

Table 3.8. Endurance score index of Plank test

Rating	**Time**
Excellent	> 6 minutes
Very Good	4-6 minutes
Above average	2-4 minutes
Average	1-2 minutes
Below average	30-60 seconds
Poor	15-30 seconds
Very poor	< 15 seconds

6. Body Mass Index (Robert Wood, 2008)

Objective: Measure to body mass index

Equipment required: Weight scales and stadiometer measure for height.

Procedure: BMI was being calculated by considering body mass (M) and height (H) and it was calculated with the equation BMI = M / (H x H), where ‘M’ stands for body mass in kilograms and ‘H’ stands for height in meters. The higher score indicated the higher levels of body fat.

Scoring: considering the score secured by calculating body mass (M) and height (H), BMI rating can be found as shown in the table 3.9 below.

Photograph 3.6. Researcher collecting data on body mass index

Table 3.9. Body mass index score index of BMI

Classification	BMI (kg/m^2)	Sub-Classification		BMI (kg/m^2)
Underweight	< 18.50	Severe thinness		< 16.00
		Moderate thinness		16.00 - 16.99
		Mild thinness		17.00 - 18.49
Normal Range	18.5-24.99	Normal		18.5 - 24.99
Overweight	≥ 25.00	Pre-Obese		25.00 - 29.99
		Obese (≥ 30.00)	obese class I	30.00 - 34.99
			obese class II	35.00 - 39.99
			obese class II	≥ 40.00

Procedure of the Study

Over the course of six months, the Study was carried out. During the allotted period for the study, the researcher used to go to each chosen school once a week to make sure that bicycle riders were frequently coming to the school. Monitoring the anticipated activities of bicycle riders was the task of the physical education instructors in all schools chosen for the study (act of regular cycling for 5 to 7 kilometer). The researcher used to employ the assistance of physical education instructors to organize bicycle races competitions at each school while visiting them on scheduled time as twice a month.

Statistical Techniques Used

In order to determine whether there was a significant difference between the data collected from bicycle users and non-users, the test results of bicycle users and non-users were compared using the appropriate means, standard deviations and ‘t’ test.

Chapter-IV

Analysis of Data and Results of the Study

Chapter - IV

ANALYSIS OF DATA AND RESULTS OF THE STUDY

Introduction

This chapter deals with the data analysis and interpretation of this quasi-experimental study. The study goal was to determine the impact of bicycle use on physical and health fitness in secondary school students. The collected data pertained with six components: The health fitness of students is evaluated using the following criteria:1) explosiveness, 2) balance, 3) agility, 4) cardiovascular endurance, 5) muscular strength and 6) body composition. The findings and results are also discussed considering the acceptance or rejection of each hypothesis.

To establish the effectiveness of bicycle utilization by justifying the difference between bicycle users and bicycle non-users, the statistical technique called the "t" test is mainly used in this study. The effectiveness of bicycles is being rationalized by analysing the output data from bicycle users as well as bicycle non-users through three different tests at three stages of this study, such as the initial stage, the three-month time period, and the six-month time period. All throughout the study, the level of significance was calculated at 0.05 level. The Statistical Package for the Social Sciences (SPSS) was utilized for all the statistical calculations.

Objective 1: To study the effectiveness of Bicycle Utilization on Explosiveness of Secondary school male students

To achieve the duly formulated hypotheses, the paired sample t-test technique has been applied and results are presented in the following tables and graphs.

Table 4.1. Summary of 't'-test on explosiveness between bicycle users and bicycle non-users during initial testing prior to bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
During initial testing prior to bicycle utilization	Bicycle users	31.90	100	5.59	0.47	Not significant at 0.05 Level
	Bicycle non-users	31.57	100	5.34		

Table 4.1 shows that the obtained 't' value of 0.47 is not significant at the 0.05 level. It means that the duly formulated null hypothesis 1 is accepted, i.e., "There is no significant difference between the bicycle users' group and the bicycle non-users' group during initial testing prior to bicycle utilization." It is concluded that the bicycle users' group and the bicycle non-users' group are similar regarding their explosiveness during initial testing before bicycle utilization. The above results are graphically presented in Figure 4.1.

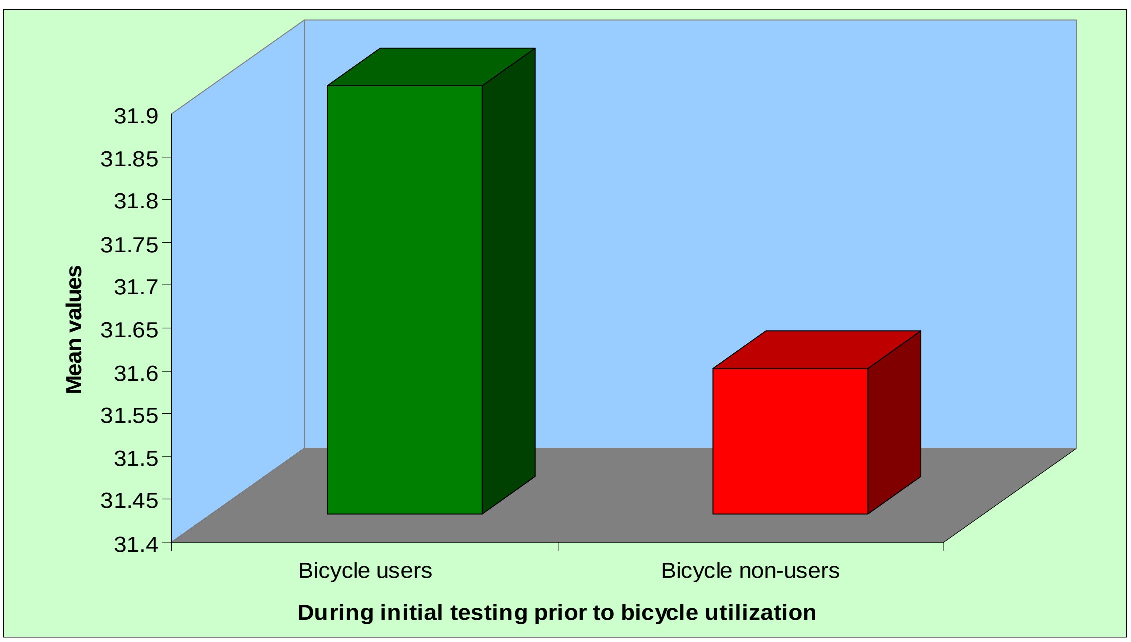


Figure 4.1. Comparison of mean scores of explosiveness between bicycle users' group and bicycle non-users' group prior to bicycle utilization

Figure 4.1 shows that there is no statistically significant difference in mean explosiveness scores of explosiveness between bicycle users and non-users.

Table 4.2. Summary of 't'-test on explosiveness between bicycle users and bicycle non-users at the end of three months of bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Results after three months	Bicycle users	34.03	100	4.8	3.43	Significant at 0.05 level
	Bicycle non-users	31.60	100	5.34		

The above table 4.2 shows that the calculated 't' value is 3.43 and that it is significant at the 0.05 level. It means that the above null hypothesis 2 is rejected and the alternative hypothesis is formulated, i.e., 'There is a significant difference in explosiveness between the bicycle users' group and the bicycle non-users' group after bicycle utilization of the first three months'. After three months of bicycle use, it is concluded that the bicycle user group was significantly more explosive than the non-user group. It is also evident from the table that the explosiveness of non-bicycle users is significantly lower than that of bicycle users. As a result, after three months of bicycle use, it is possible to conclude that bicycle riding increased the explosiveness of bicycle users. The above results are graphically presented in Figure 4.2.

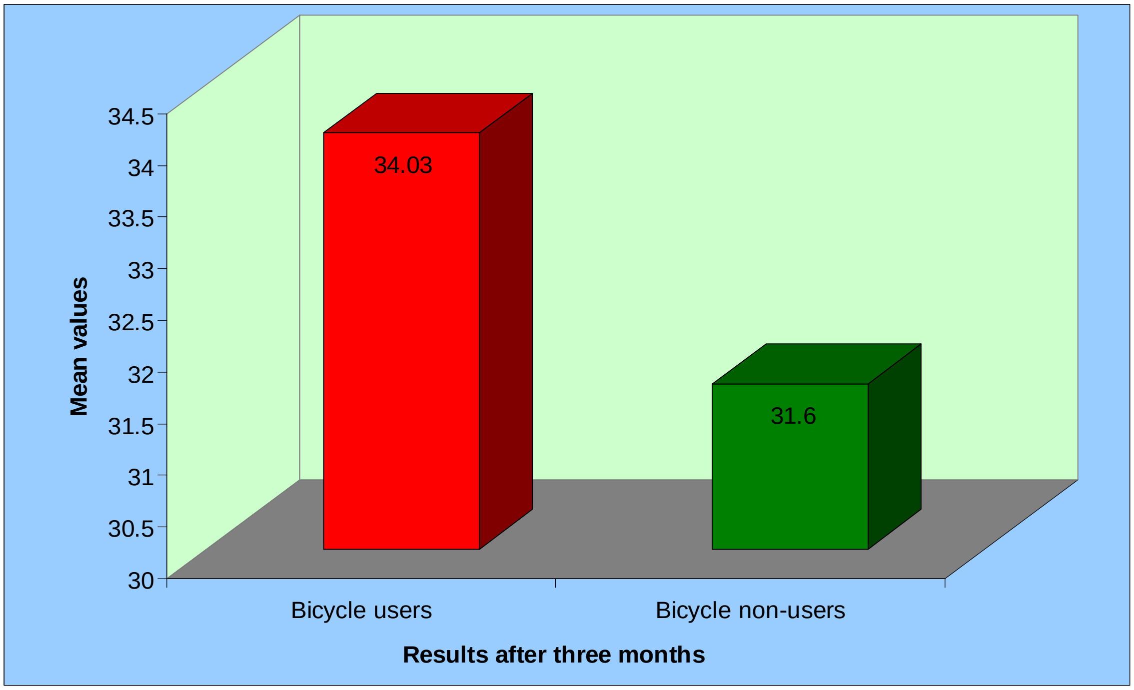


Figure 4.2. Comparison of mean scores of explosiveness after bicycle utilization of three months between bicycle users' group and non-bicycle users' group

Figure 4.2 compares the mean scores of explosiveness after three months of bicycle use between the bicycle users' and non-bicycle users' groups. After three months of bicycle utilization, the mean score of the bicycle users' group is higher than that of the non-bicycle users' group. After three months of bicycle use, it is possible to conclude that bicycle riding increased the exclusive power of the bicycle users' group.

Table 4.3. Summary of 't' test on explosiveness between bicycle users and bicycle non-users at the end of six months

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Results after six months	Bicycle users	43.57	100	9.53	10.79	Significant at 0.05 level
	Bicycle non-users	31.86	100	5.23		

Table 4.3 above shows that the calculated ‘t’ value is 10.79 and that it is significant at the 0.05 level. It means that hypothesis 3 is rejected and the alternative hypothesis is formulated, i.e., ‘There is a significant difference in explosiveness between the bicycle users’ group and the bicycle non-users’ group after bicycle utilization for six months’. It is concluded that the bicycle users’ group is significantly higher than the non-bicycle users’ group in their explosiveness after bicycle utilization for six months. It is also evident from the table that the explosiveness of the non-bicycle users’ group is significantly lower than the bicycle users’ group. As a result, after six months of bicycle use, it is possible to conclude that bicycle riding increased the explosiveness of the bicycle users' group. The above results are graphically presented in Figure 4.3.

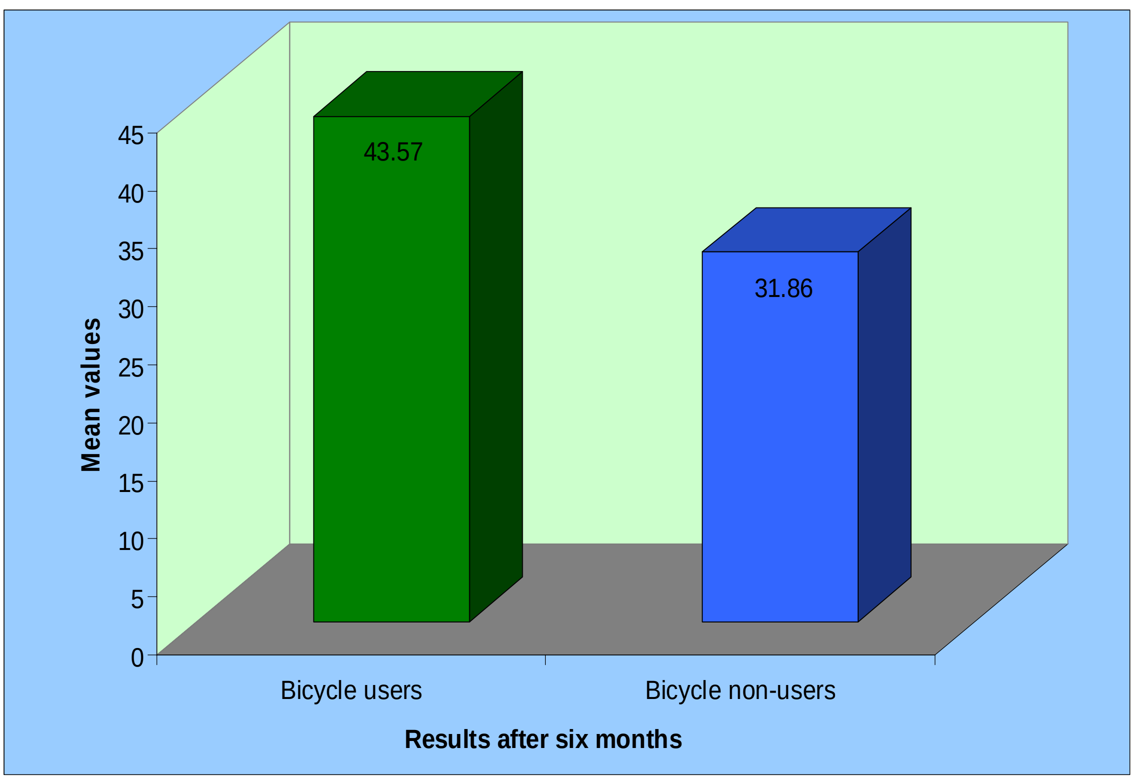


Figure 4.3. Comparison of mean scores of explosiveness after bicycle utilization of six-months between bicycle users’ group and bicycle non-users’ group

Figure 4.3 compares mean scores after six months of bicycle use in explosiveness between the bicycle users group and the non-bicycle users group. After six months of bicycle utilization, the bicycle users' mean score is higher than the non-bicycle users' mean score. After six months of bicycle use, it is possible to conclude that bicycle riding increased explosive power in the bicycle user group.

Table 4.4. Summary of ‘t’ test on explosiveness of bicycle users’ group at the end of three months

Details about testing		**Mean**	**N**	**Std. Deviation**	**‘t’ value**	**Sig.**
Bicycle users Group	Initial test results	31.90	100	5.59	2.75	Significant at 0.05 level
	Result after three months	34.03	100	4.8		

Table 4.4 above shows that calculated ‘t’-value is 2.75and it is significant at 0.05 level. It means that the null hypothesis 4 is rejected and the alternative hypothesis is formulated, i.e., ‘There is a significant difference in the explosiveness of bicycle users between the initial testing prior to bicycle utilization and at the end of three months of bicycle utilization’. It is concluded that mean score of bicycle user groups during the period after bicycle utilization is significantly higher than the means scores of bicycle user groups during the period prior to bicycle utilization regarding their explosiveness. It is also evident from the table that the explosiveness before utilization of bicycle is significantly lower than the after intervention of three months of the bicycle user group. Hence, it can be concluded that, bicycle riding effected in increasing the explosiveness of bicycle user group after bicycle utilization for three months.

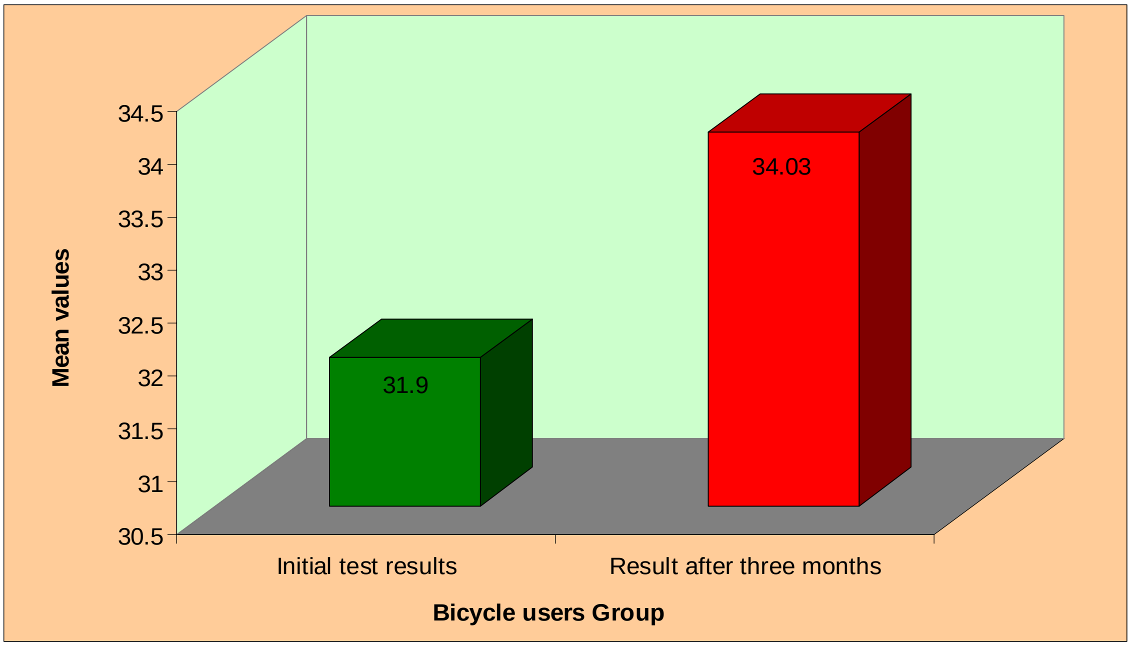


Figure 4.4. Comparison of mean scores in explosiveness of bicycle users' group between initial testing and after three months' utilization of bicycle

Figure 4.4 shows a comparison of mean explosiveness scores of bicycle users between initial testing and after three months of bicycle use. After three months of bicycle use, it is possible to conclude that bicycle riding increased the explosiveness of the group of bicycle users.

Table 4.5. Summary of 't' test on explosiveness of bicycle users' group at the end of six months

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle users group	Initial test results	31.90	100	5.59	11.18	Significant at 0.05 level
	Result after six months	43.57	100	9.53		

Table 4.5 above shows that the calculated 't' value is 11.18 and that it is significant at the 0.05 level. It means that the null hypothesis 5 is rejected and the

alternative hypothesis is formulated, i.e., 'There is a significant difference in the explosiveness of bicycle users between the initial testing prior to bicycle utilization and at the end of six months of bicycle utilization'. It is concluded that the after-bicycle utilization six-month mean score of bicycle user groups is significantly higher than the prior bicycle utilization means scores regarding their explosiveness. It is also evident from the table that the explosiveness of bicycle users before bicycle utilization is significantly lower than the after-bicycle utilization of six months. As a result, after six months of bicycle use, it is possible to conclude that bicycle riding increased the explosiveness of the bicycle users' group.

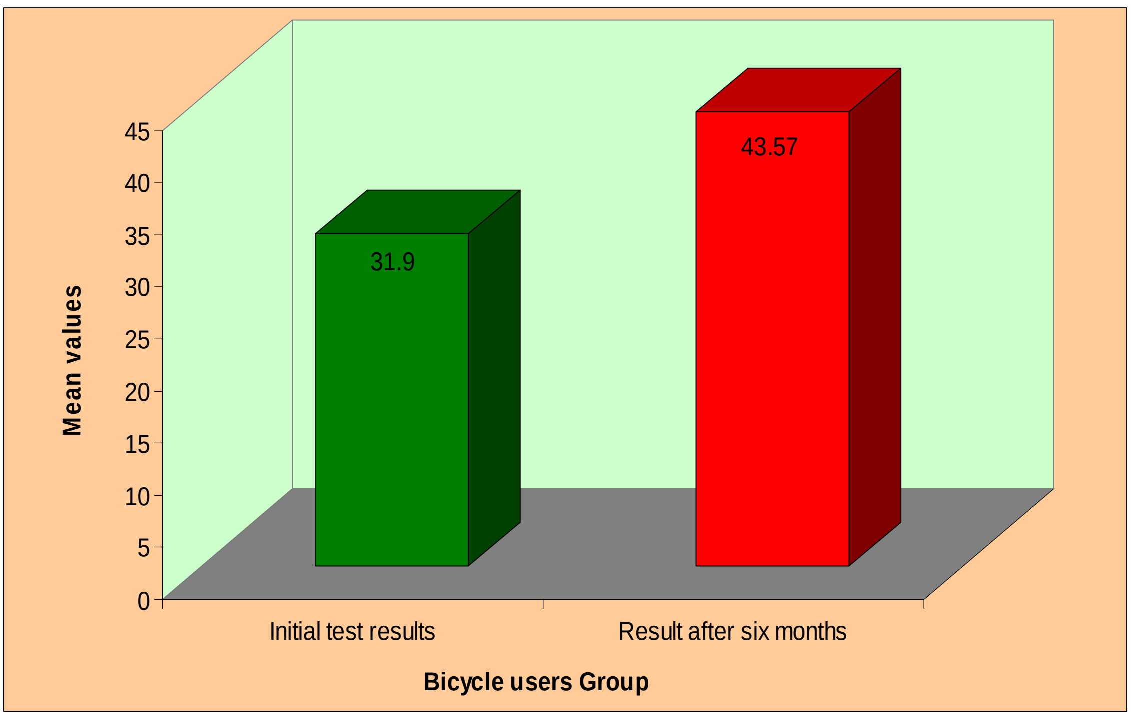


Figure 4.5. Comparison of mean scores in explosiveness of bicycle users' group between initial testing and after six months' utilization of bicycle

Figure 4.5 shows a comparison of mean scores in the explosiveness of bicycle users between initial testing and after six months of bicycle use. After six months of bicycle use, it is possible to conclude that bicycle riding increased the explosiveness of the group of bicycle users.

Table 4.6. Summary of 't' test on explosiveness of bicycle non-users at the end of three months

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Initial test results	31.57	100	5.34	0.04	Not significant at 0.05 level
	Result after three months	31.60	100	5.34		

Table 4.6 shows that obtained 't'-value 0.04 is not significant at 0.05 level. It means that the formulated above hypothesis 6 is accepted, i.e., "There is no significant difference in the explosiveness of bicycle non-users between initial testing and at the end of three months." It is concluded that mean scores of explosiveness among the bicycle non-users' group at initial testing and after three months of the study are similar.

Table 4.7. Summary of 't' test on explosiveness of bicycle non users at the end of six months

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Initial test results	31.57	100	5.34	0.39	Not significant at 0.05 level
	Result after six months	31.86	100	5.23		

Table 4.7 shows that the obtained 't'-value of 0.39 is not significant at the 0.05 level. It means that hypothesis 7 is accepted, i.e., 'There is no significant difference in the

explosiveness of bicycle non-users between the initial testing and at the end of six months'. It is concluded that the mean scores of explosiveness among the bicycle non-user group at initial testing and after the six-month period of the study are the same.

Table 4.8. Summary of 't'-test on explosiveness of bicycle users' group between three and six month intervals

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle users group	Results after three months	34.03	100	4.8	8.88	Significant at 0.05 level
	Results after six months	43.57	100	9.53		

Table 4.8 above shows that calculated 't'-value is 8.88 and it is significant at 0.05 level. It means that the hypothesis 8 is rejected and formulated the alternative hypothesis i.e., "There is a significant difference in Explosiveness of bicycle users at the end of three and six months of bicycle utilization". It is concluded that the after-bicycle utilization score of six months for the bicycle users' group is significantly higher than that of three months of bicycle utilization with regard to their explosiveness. It is also evident from the table that the explosiveness at the end of three months of bicycle utilization is significantly lower than the explosiveness acquired after the utilization of bicycles during the next six months' period. Hence, it can be concluded that bicycle riding increased the explosiveness of bicycle user groups more after six months of its utilization than after three months.

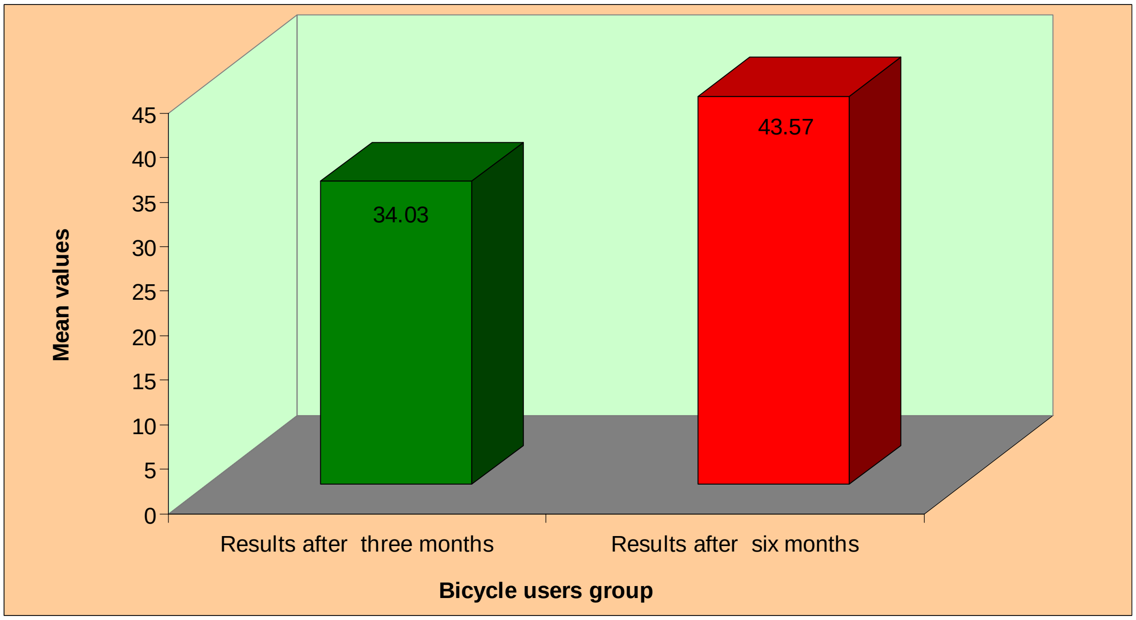


Figure 4.6. Summary of 't' test on Explosiveness of bicycle users between three months and six month intervals

The figure 4.6 above explains the comparison of mean scores in the explosiveness of the bicycle users' group after three months of bicycle use versus six months of bicycle use. The mean score of bicycle users after three months of bicycle use is lower than the mean score of bicycle users after six months of bicycle use. After six months of bicycle use, it is possible to conclude that bicycle riding increased the explosiveness of the group of bicycle users.

Table 4.9. Summary of 't' test on explosiveness of bicycle non-users between three months and six month intervals

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Results after three months	31.60	100	5.34	0.35	Not significant at 0.05 level
	Results after six months	31.86	100	5.23		

Table 4.9 shows that obtained ‘t’-value is 0.35 and it is not significant at 0.05 level. It means that the formulated hypothesis 9 is accepted, i.e. "There is no significant difference in explosiveness of bicycle non-users at the end of three and six months after initial testing." It is concluded that the mean score in their explosiveness of non-bicycle users after three months from the time of initial testing and after six months from initial testing is similar.

Objective 2: To study the effectiveness of bicycle utilization on balance of secondary school male students

To achieve the duly formulated hypotheses, the paired sample ‘t’-test technique has been applied and results are presented in the following tables and graphs.

Table 4.10. Summary of ‘t’-test on balance between bicycle users and bicycle non users during initial testing prior to bicycle utilization

Details about testing		Mean	N	Std. Deviation	‘t’ value	Sig.
Initial testing results	Bicycle users group	24.30	100	6.03	0.22	Not significant at 0.05 level
	Bicycle non-users group	24.10	100	6.55		

Table 4.10 demonstrates that the obtained 't' value of 0.22 is not statistically significant at the 0.05 level. It means that hypothesis 10 is accepted, i.e., "There is no significant difference in balance between the bicycle users’ group and the bicycle non-users’ group during initial testing prior to bicycle utilization." It is concluded that the mean scores of the bicycle users’ group and the bicycle non-users’ group are similar

regarding the balance test during initial testing before bicycle utilization. The above results are graphically presented in Figure 4.7.

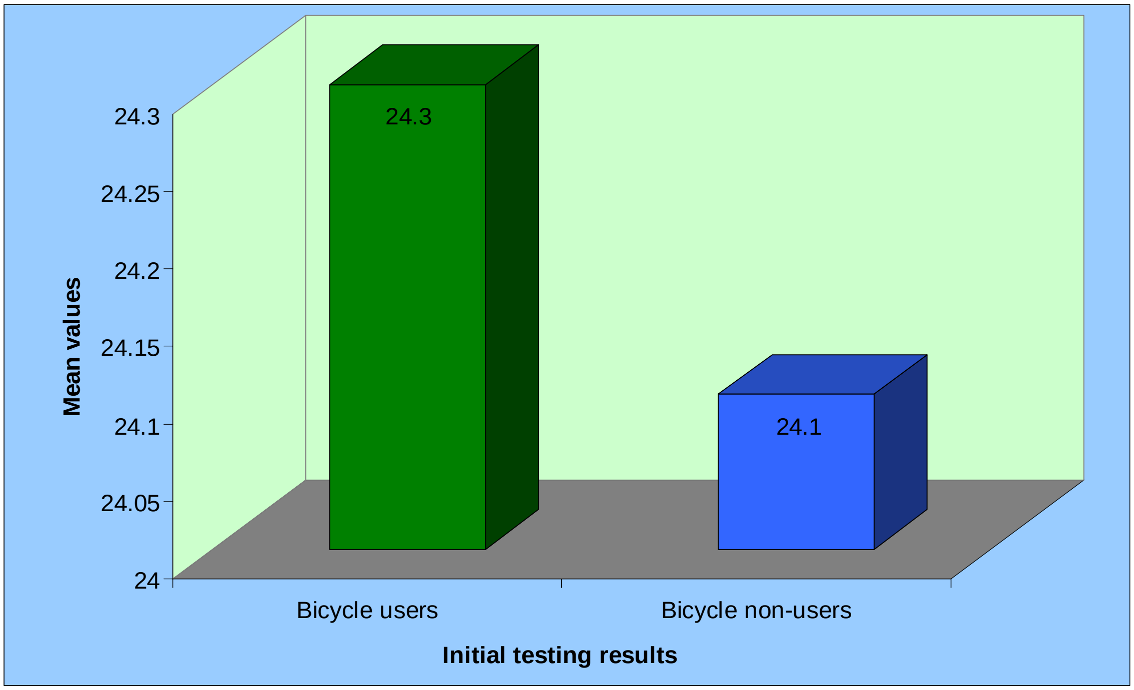


Figure 4.7. Comparison of mean scores of balance test between bicycle users' group and bicycle non-users' group

Above figure 4.7 shows that comparison of mean scores in the Balance test between bicycle users' group and bicycle non-users' group are similar.

Table 4.11. Summary of 't'-test on Balance test between bicycle users and bicycle at the end of three months of bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Results after three months	Bicycle users group	28.03	100	7.08	3.20	Significant at 0.05 level
	Bicycle non-users group	24.82	100	7.11		

Table 4.11 above shows that the calculated 't' value is 3.20 and that it is significant at 0.05 levels. It means that hypothesis 11 is rejected and the alternative hypothesis, "There is no significant difference in balance between the bicycle users' group and the bicycle non-users' group after three months of bicycle utilization," is framed. It is concluded that the bicycle users' group is significantly higher than the non-users' group in their balance after three months of bicycle utilization. It is also evident from the table that the balance of non-bicycle users is significantly lower than the bicycle users' group due to the utilization of bicycles. As a result, after three months of bicycle use, it is possible to conclude that bicycle riding influenced the Balance Test. The above results are graphically presented in figure 4.8.

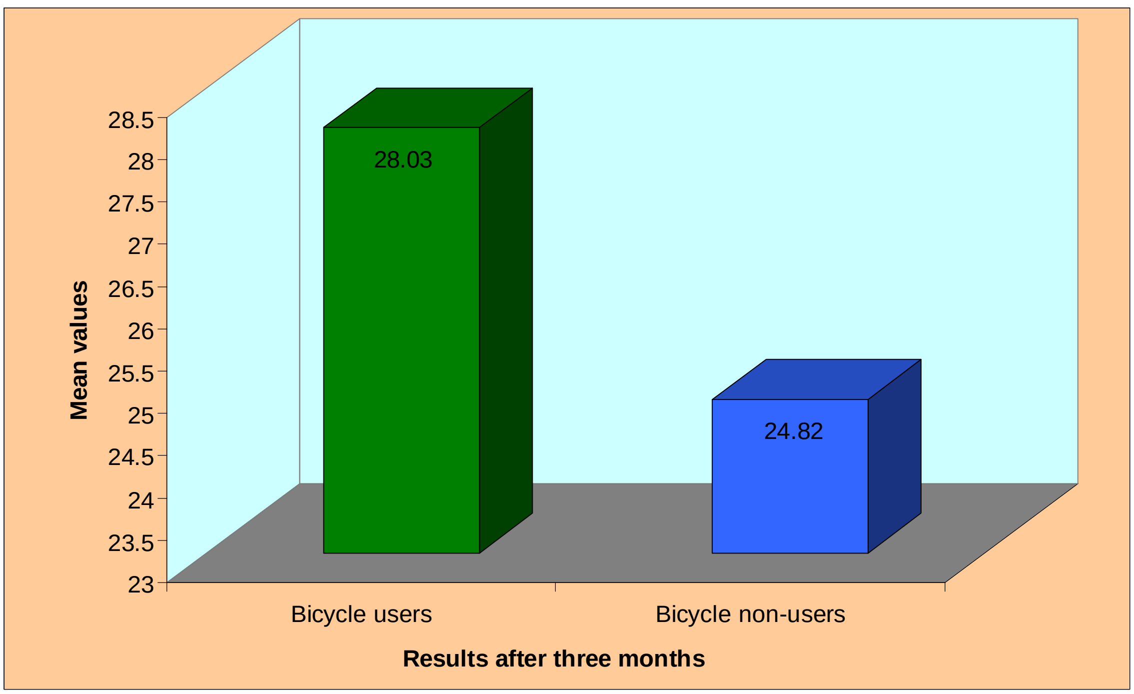


Figure 4.8. Comparison of mean scores of balance test after bicycle utilization of three months between bicycle users' group and bicycle non-users' group

Figure 4.8 compares the mean scores of the Balance test after three months of bicycle use between the bicycle users' group and the non-bicycle users' group. After three months of bicycle utilization, the mean score of the bicycle users’ group is higher than that of the non-bicycle users’ group. It can be concluded that bicycle riding increased the balance of the bicycle users’ group after three months of bicycle utilization.

Table 4.12 Summary of ‘t’ test on balance between bicycle users and bicycle non-users at the end of six months

Details about testing		**Mean**	**N**	**Std. Deviation**	**‘t’ value**	**Sig.**
Results after six months	Bicycle users group	33.41	100	8.32	8.09	Significant at 0.05 level
	Bicycle non-users group	24.88	100	7.08		

Table 4.12 above shows that the calculated ‘t’ value is 8.09 and that it is significant at the 0.05 level. It means that hypothesis 12 is rejected and the alternative hypothesis, "There is a significant difference in balance between the bicycle users' group and the bicycle non-users' group after six months of bicycle use," is framed. It is concluded that the bicycle users’ group is significantly higher than the non-bicycle users’ group in their balance after bicycle utilization for six months. It is also evident from the table that the balance of the non-bicycle users’ group is significantly lower than the bicycle users’ group due to the bicycle users’ group. As a result, after six months of bicycle use, it is possible to conclude that bicycle riding increased the balance of the bicycle users' group. The above results are graphically presented in figure 4.9.

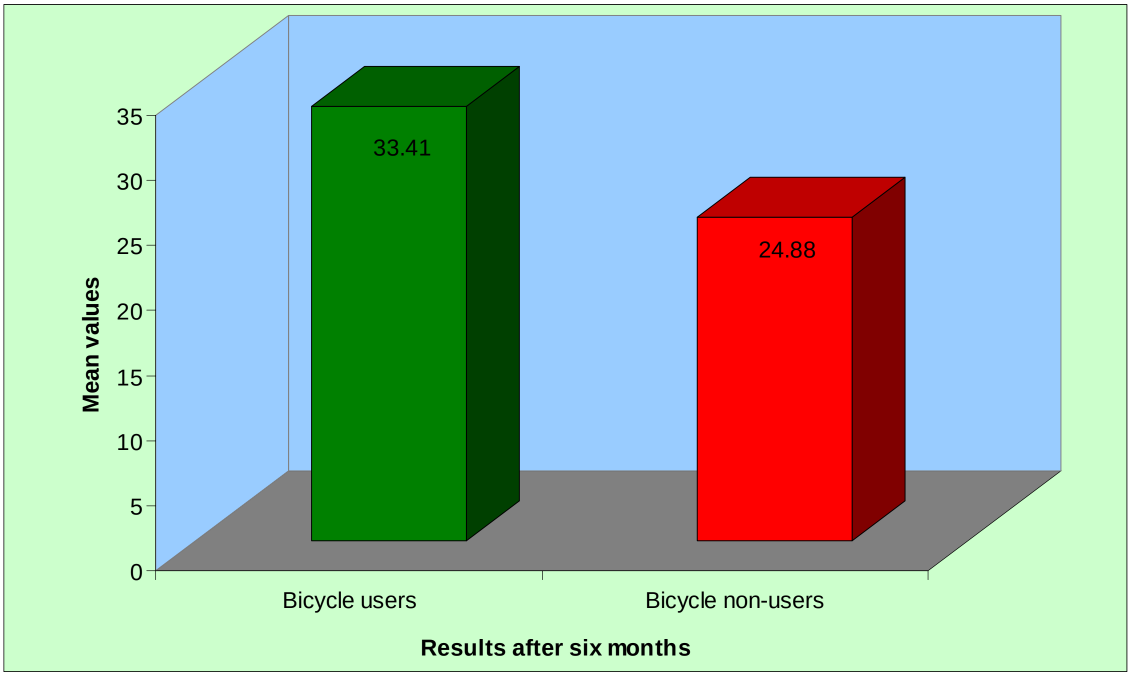


Figure 4.9. Comparison of mean scores of balance test after bicycle utilization of six months between bicycle users' group and bicycle non-users' group

Figure 4.9 shows that comparison of mean scores after bicycle utilization of six months in the Balance between bicycle users' group and non-bicycle users' group. After six months of bicycle utilization, the mean score of the bicycle users' group is higher than the mean scores of the non-bicycle users' group. After six months of bicycle use, it is possible to conclude that bicycle riding influenced the balance test of the bicycle users' group.

Table 4.13. Summary of 't'-test on the balance of bicycle users' group between initial test and at the end of three months

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle users group	Initial test results	24.30	100	6.03	3.78	Significant at 0.05 level
	Results after three months	28.03	100	7.08		

Table 4.13 above shows that the calculated t-value is 3.78 and that it is significant at the 0.05 level. It means that hypothesis 13 is rejected and the alternative hypothesis is formulated, i.e., ‘There is a significant difference in the balance of bicycle users between the initial testing prior to bicycle utilization and at the end of three months of bicycle utilization’. It is concluded that the mean score of the bicycle users’ group at the end of three months of bicycle utilization is significantly higher than their means scores at the initial test prior to bicycle utilization regarding their balance. It is also evident from the table that the balance of the bicycle users’ group before bicycle utilization was significantly lower than it was after the intervention of three months. As a result, after three months of bicycle use, it is possible to conclude that bicycle riding increased the balance of the bicycle users' group.

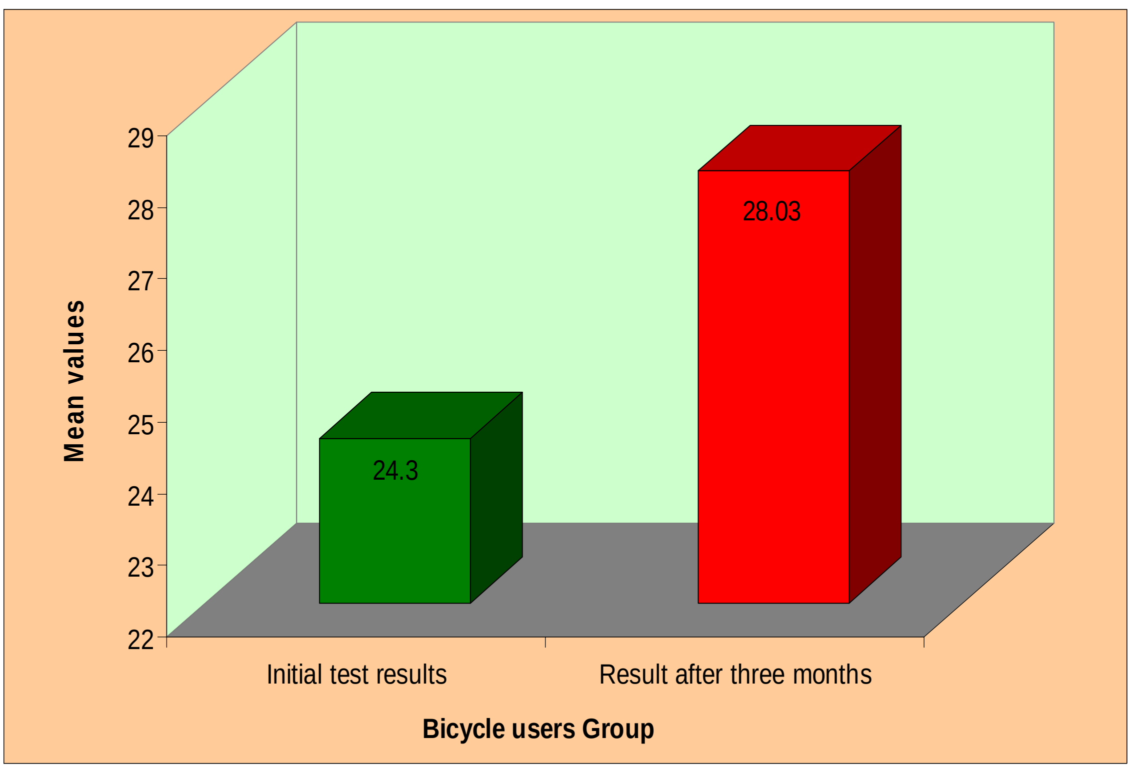


Figure 4.10. Comparison of mean scores in balance of bicycle users between initial testing and at the end of three months’ interval

Figure 4.10 depicts a comparison of mean scores in the balance test of the bicycle users' group between initial testing and after three months of bicycle use. After three months of bicycle utilization, their balance test-related mean score is higher than that of initial testing. After three months of bicycle use, it is possible to conclude that bicycle riding influenced the balance test of the bicycle users' group.

Table 4.14. Summary of 't'-test on the balance test of bicycle users' group at the end of six months

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle users group	Initial test results	24.30	100	6.03	9.19	Significant at 0.05 level
	Results after six months	33.41	100	8.32		

Table 4.14 above shows that the calculated 't' value is 9.19 and that it is significant at the 0.05 level. It means that hypothesis 14 is rejected and the alternative hypothesis is formulated, i.e., "There is a significant difference in the balance of bicycle users between the initial testing of bicycle utilization and at the end of six months of bicycle utilization." It is concluded that the after-bicycle utilization score of six months for bicycle users' groups is significantly higher than their mean score at the initial test with regard to their balance.

Table 4.14 also shows that the Balance before bicycle utilization is significantly lower than the Balance after bicycle utilization of the bicycle users' group for six months. As a result, after six months of bicycle use, it is possible to conclude that bicycle riding affected the balance of the bicycle users' group.

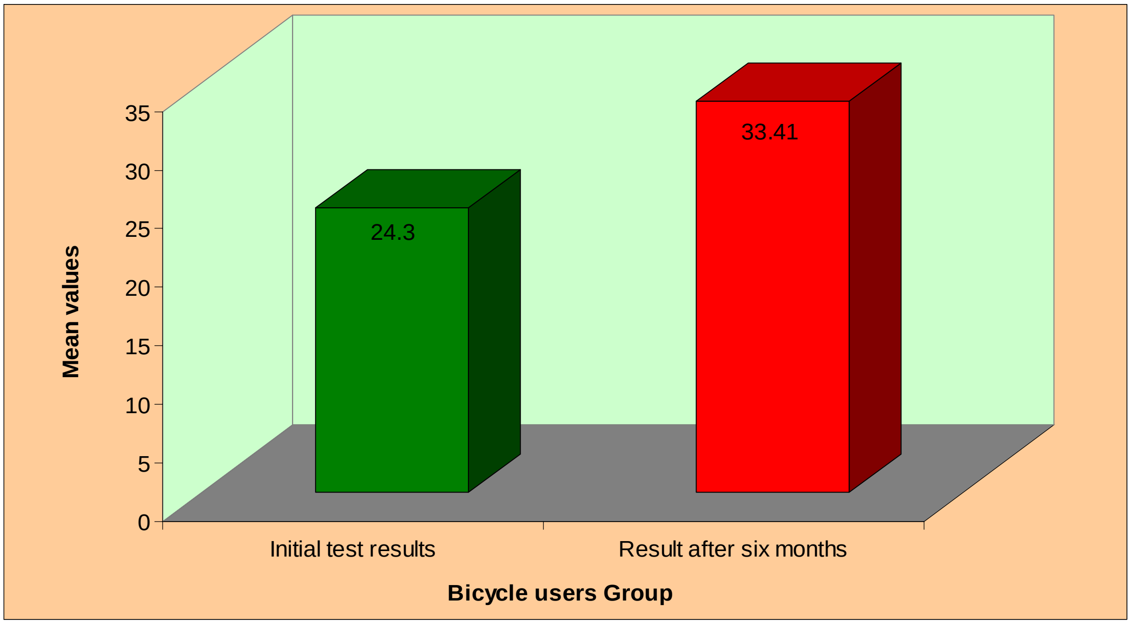


Figure 4.11. Comparison of mean scores in balance of bicycle users between initial testing and at the end of six months' intervals

Figure 4.11 shows the comparison of mean scores in balance of bicycle users' group between initial testing and after bicycle utilization for the six-month. After bicycle utilization for six months, the mean score of bicycle users is higher than the mean score at initial testing. After six months of bicycle use, it is possible to conclude that bicycle riding improved the bicycle user group's balance.

Table 4.15. Summary of 't' test on balance of bicycle non-users between initial testing and at the end of three months

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Initial test results	24.10	100	6.55	0.70	Not significant at 0.05 level
	Results after three months	24.82	100	7.11		

Table 4.15, the obtained ‘t’- value is 0.70 and is not significant at the 0.05 level. It means that hypothesis 15 is accepted, i.e., "There is no significant difference in the balance of bicycle non-users between initial testing and at the end of three months." It can be stated that the bicycle nonuser group's mean scores on the Balance Test at the start of the study and after three months are the same.

Table 4.16. Summary of ‘t’ test on balance test of bicycle non users between initial testing and at the end of six months

Details about testing		Mean	N	Std. Deviation	‘t’ value	Sig.
Bicycle non-users group	Initial test results	24.10	100	6.55	0.80	Not significant at 0.05 level
	Results after six months	24.88	100	7.08		

Table 4.16 shows that obtained ‘t’ value is 0.80 and it is not significant at 0.05 level. It means that the formulated above hypothesis 16 is accepted, i.e., "There is no significant difference in the balance of bicycle non-users between the initial testing and at the end of six months." It is concluded that mean scores of balances among the bicycle non-user group at initial testing and after the six-month study period are similar.

Table 4.17. Summary of ‘t’ test on balance test of bicycle users’ group between three and six month intervals

Details about testing		Mean	N	Std. Deviation	‘t’ value	Sig.
Bicycle users group	Results after three months	28.03	100	7.08	5.15	Significant at 0.05 level
	Results after six months	33.41	100	8.32		

Table 4.17 above shows that the calculated t-value is 5.15 and that it is significant at the 0.05 level. It means that hypothesis 17 is rejected and the alternative hypothesis, "There is a significant difference in the balance of bicycle users after three and six months of bicycle utilization" is framed. It is concluded that, in terms of balance, the bicycle users' group's after-bicycle utilization mean score at three months is higher than the bicycle users' group's mean score at the end of bicycle utilization. Table 17 also shows that the balance at the end of three months of bicycle utilization is significantly lower than the balance acquired after six months of bicycle utilization. Hence, it can be concluded that bicycle riding increased the balance of bicycle users' groups more after six months of its utilization than after three months of its utilisation.

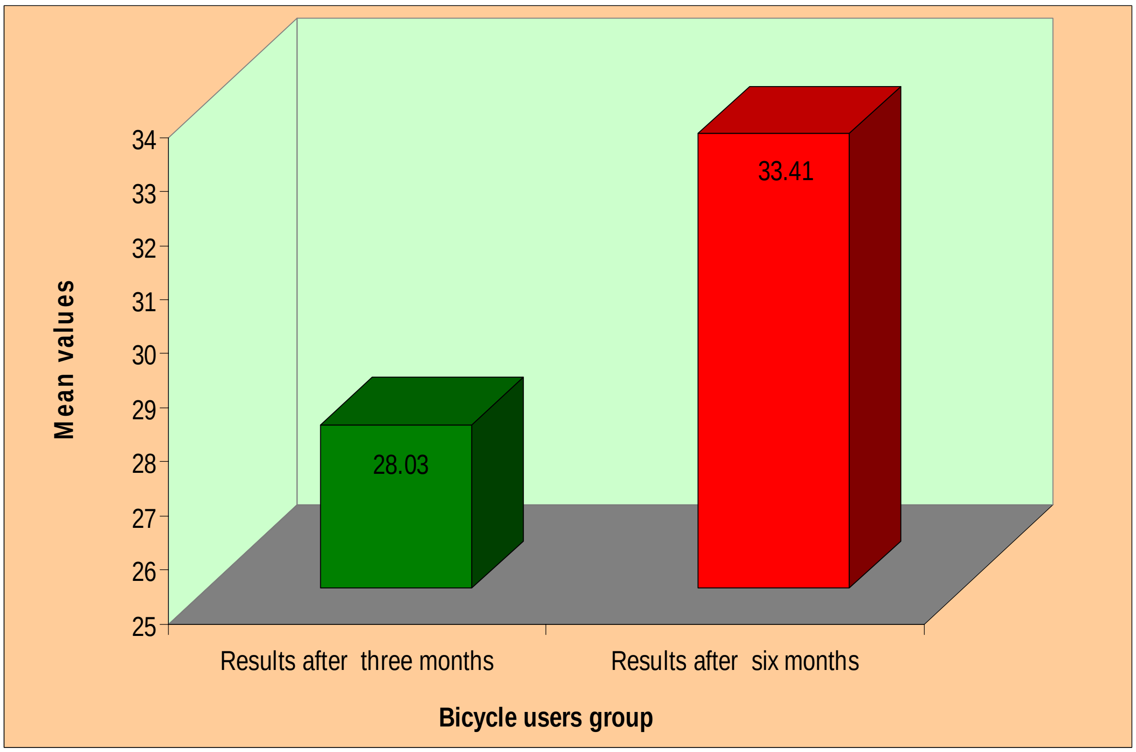


Figure 4.12. Comparison of mean scores in balance of bicycle users between three and six months of intervals

The figure 4.12 above explains the comparison of mean scores in Balance after three months of bicycle use versus six months of bicycle use for the bicycle users' group. The mean score of bicycle users' balance after six months of bicycle use is higher than the mean score of bicycle users' balance after three months of bicycle use. After six months of bicycle use, it is possible to conclude that bicycle riding increased the balance of the bicycle users' group.

Table 4.18. Summary of 't'-test on balance of bicycle non-users between three months and six month intervals

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Results after three months	24.82	100	7.11	0.06	Not significant at 0.05 level
	Results after six months	24.88	100	7.08		

Table 4.18 shows that the obtained 't' value is 0.06, which is not significant at the 0.05 level. It means that hypothesis 18 is accepted, i.e., "There is no significant difference in balance between bicycle users and non-users at the end of three to six months after initial testing." The mean scores in the balance of non-bicycle users at three months after initial testing and six months after initial testing are found to be similar.

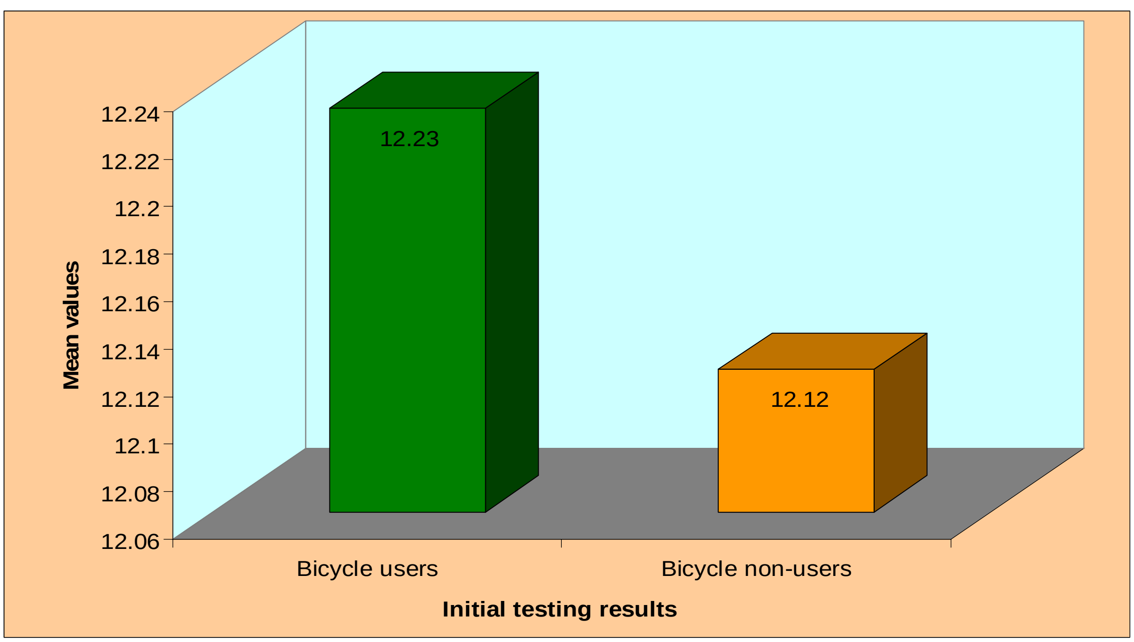
Objective 3: To study the Effectiveness of Bicycle Utilization on Agility of Secondary School male students.

To achieve the duly formulated hypotheses, the paired sample t-test technique has been applied and results are presented in the following tables and figures :

Table 4.19. Summary of 't'-test on Agility between bicycle users and bicycle non users at initial test prior to bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Initial testing results	Bicycle users group	12.23	100	1.25	0.60	Not significant at 0.05 level
	Bicycle non-users group	12.12	100	1.23		

Table 4.19 shows that obtain 't'-value is 0.60and it is not significant at 0.05 level. It means that the formulated above hypothesis 19 is accepted, i.e., "There is no significant difference in agility between the bicycle users' group and the bicycle non-users during initial testing prior to bicycle utilization." It is concluded that the bicycle users' group and the bicycle non-users' group are similar in their agility at the initial test.



Graph 4.13. Comparison of initial test mean scores in agility test between bicycle users' group and bicycle non-users' group

Figure 4.13 shows that comparison of initial test mean scores in Agility between bicycle users' group and bicycle non-users' group is similar.

Table 4.20. Summary of 't' test on agility between bicycle users and bicycle at the end of three months of bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Results after three months	Bicycle users group	12.96	100	0.48	5.86	Significant at 0.05 level
	Bicycle non-users group	12.17	100	1.29		

Table 4.20 above shows that the calculated 't' value is 5.86 and that it is significant at 0.05 levels. It means that the above null hypothesis 20 is rejected and the alternative hypothesis is formulated, i.e., "There is a significant difference in agility between the bicycle users' group and the bicycle non-users' group after bicycle utilization for the first three months." It is concluded that the bicycle users' group is significantly higher than the bicycle non-users' group in their agility after three months of bicycle utilization. It is also evident from the table that the agility of the bicycle non-users' group is significantly lower than the bicycle users' group due to the utilization of bicycles. As a result, after three months of bicycle use, it is possible to conclude that bicycle riding increased the agility of the bicycle users' group.

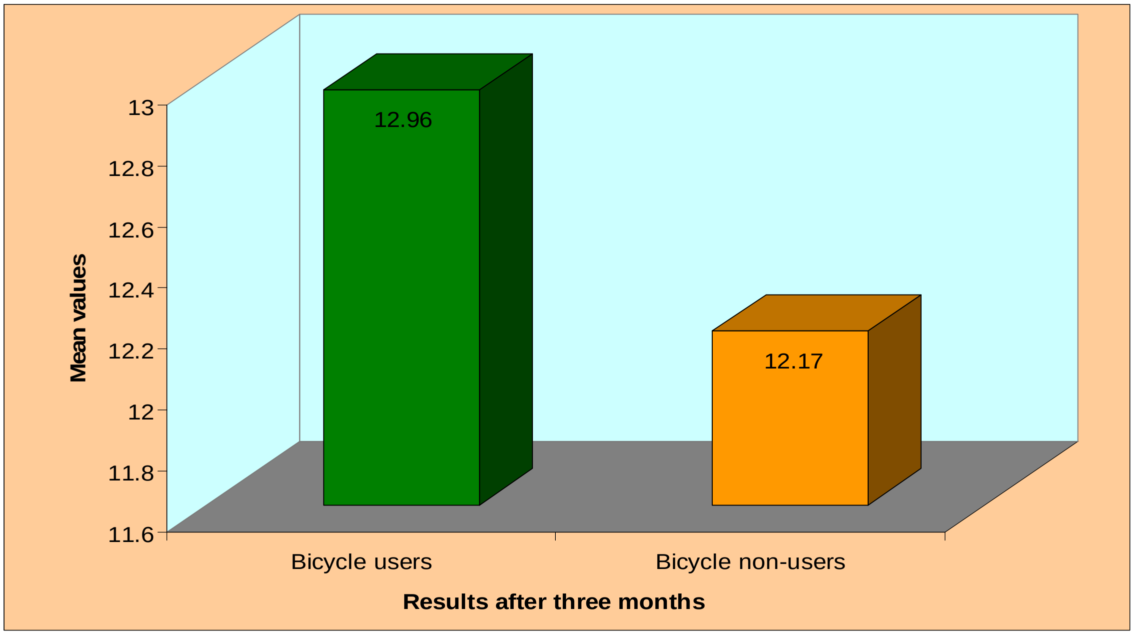


Figure 4.14. Comparison of mean scores of agility after bicycle utilization of three months between bicycle users' group and bicycle non-users' group

Figure 4.14 shows a comparison of mean agility test scores after three months of bicycle use between the bicycle users' and non-bicycle users' groups. After three months of bicycle utilization, the mean score of the bicycle users' group is higher than that of the non-bicycle users' group. It can be concluded that bicycle riding increased the agility of the bicycle users' group after three months of bicycle utilization.

Table 4.21. Summary of 't'-test on agility between bicycle users and bicycle at the end of three months of bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Results after six months	Bicycle users group	13.19	100	0.25	10.50	Significant at 0.05 level
	Bicycle non-users group	12.03	100	1.07		

Table 4.21 above shows that the calculated t-value is 10.50 and that it is significant at the 0.05 level. It means that the above null hypothesis 21 is rejected and the alternative hypothesis is formulated, i.e., ‘There is a significant difference in agility between the bicycle users’ group and the bicycle non-users’ group after bicycle utilization for six months’. It is concluded that the bicycle users’ group is significantly higher than the bicycle non-users’ group in their agility after bicycle utilization for six months. It is also evident from the table that the agility of the bicycle non-users’ group is significantly lower than that of the bicycle users’ group and this is due to the bicycle's utilization for six months. Hence, it can be concluded that bicycle riding increased the agility of the bicycle users’ group after six months of bicycle utilization.

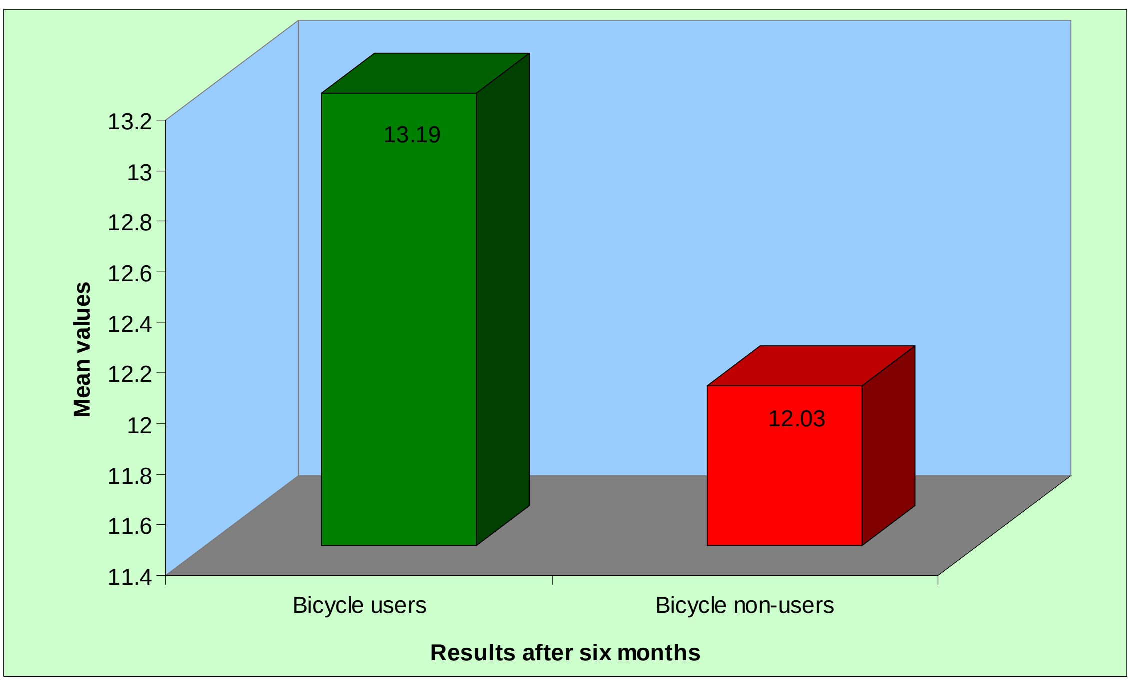


Figure 4.15. Comparison of mean scores of agility after bicycle utilization of six months between bicycle users’ group and non-bicycle users’ group

Figure 4.15 shows a comparison of mean scores after six months of bicycle use in the Agility between the bicycle users' and non-bicycle users' groups. After six months of bicycle utilization, the mean score of the bicycle users' group is higher than the mean scores of the non-bicycle users' group. After six months of bicycle use, it is possible to conclude that bicycle riding increased the agility of the bicycle users' group.

Table 4.22. Summary of 't'-test on the agility of bicycle users' group at the end of three months

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle users group	Initial test results	12.23	100	1.25	5.74	Significant at 0.05 level
	Results after three months	12.96	100	0.48		

Table 4.22 above shows that the calculated t-value is 5.74 and that it is significant at the 0.05 level. It means that the above null hypothesis 22 is rejected and the alternative hypothesis is formulated, i.e., "There is a significant difference in agility of bicycle users between the initial testing prior to bicycle utilization and at the end of three months of bicycle utilization."

It is concluded that the mean score of bicycle user groups at the end of three months of bicycle utilization is significantly higher than the mean scores of bicycle user groups at the initial test prior to bicycle utilization in their Agility. It is also evident from the table that the agility before the intervention was significantly lower than it was after the bicycle was used for three months. Hence, it can be concluded that bicycle riding effected an increase in agility of the bicycle users' group after three months' utilization of bicycle.

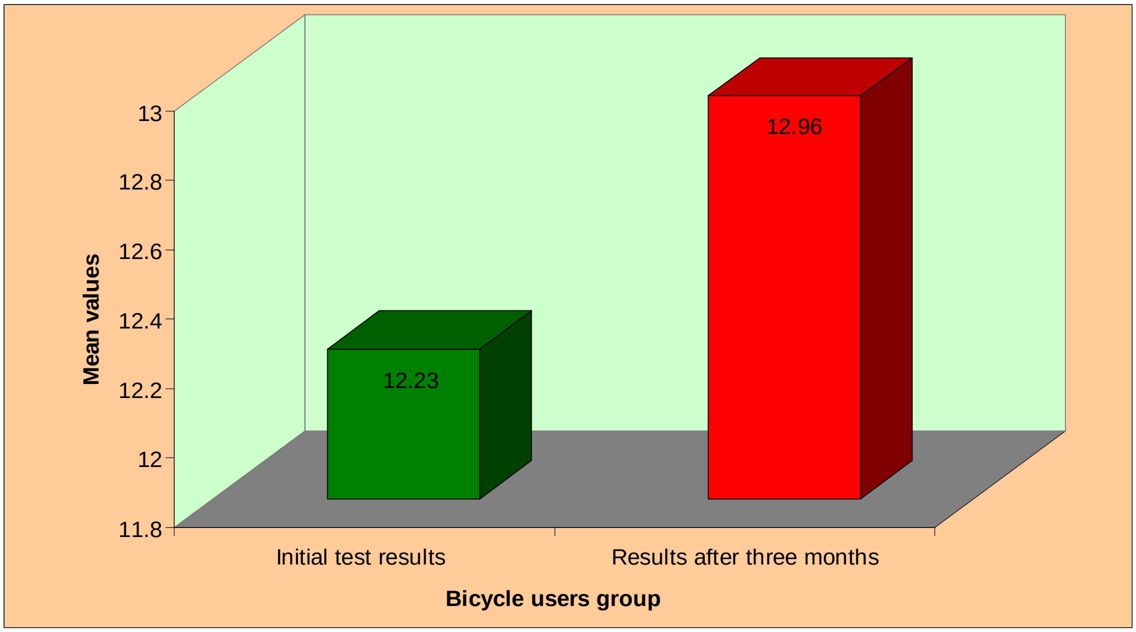


Figure 4.16. Comparison of mean scores in agility of bicycle users' group between before and after three months' utilization of bicycle

Figure 4.16, we see the comparison of mean scores in agility between initial testing and after the period of bicycle utilization for three months for the bicycle users' group. After three months of bicycle utilization, the mean score of the bicycle users' group is higher than the mean scores shown at initial testing. After three months of bicycle use, it is possible to conclude that bicycle riding increased the agility of the bicycle users' group.

Table 4.23. Summary of 't'-test on the agility of bicycle users' group at the end of six months

<table>
<tr><th colspan="2">Details about testing</th><th>Mean</th><th>N</th><th>Std. Deviation</th><th>'t' value</th><th>Sig.</th></tr>
<tr><td rowspan="2">Bicycle users group</td><td>Initial test results</td><td>12.23</td><td>100</td><td>1.25</td><td rowspan="2">7.6</td><td rowspan="2">Significant at 0.05 level</td></tr>
<tr><td>Results after six months</td><td>13.19</td><td>100</td><td>0.25</td></tr>
</table>

Table 4.23 above shows that calculated ‘t’ value is 7.6 and it is significant 0.05 level. It means that the above null hypothesis 23 is rejected and the alternative hypothesis is formulated, i.e., "There is a significant difference in agility of bicycle users between the initial testing prior to bicycle utilization and at the end of six months of bicycle utilization."

It is concluded that after bicycle utilization for six months, the mean score of bicycle users’ groups is significantly higher than the mean score at the initial test regarding their agility. It is also evident from the table that the agility before bicycle utilization is significantly lower than that of the bicycle users’ group after six months of bicycle utilization. As a result, after six months of bicycle use, it is possible to conclude that bicycle riding increased the agility of the bicycle users' group.

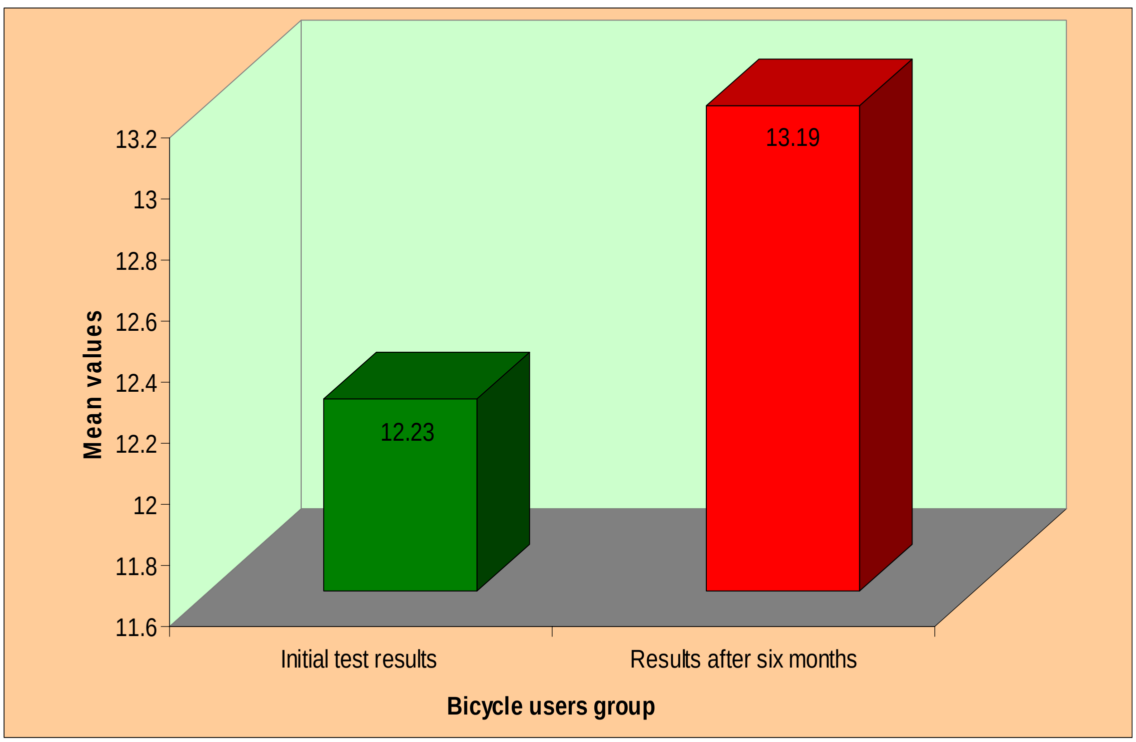


Figure 4.17. Comparison of mean scores in agility of bicycle users between initial testing and at the end of six months’ intervals

Figure 4.17 shows the comparison of mean scores in agility for the bicycle users' group between their initial testing and after bicycle utilization for six months. After bicycle utilization for six months, the mean score of bicycle users' agility is higher than the mean score at initial testing. After six months of bicycle use, it is possible to conclude that bicycle riding increased the agility of the bicycle users' group.

Table 4.24. Summary of 't'-test on agility of bicycle non-users at the end of three months

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Initial test results	12.12	100	1.23	0.26	Not significant at 0.05 level
	Results after three months	12.17	100	1.29		

Table 4.24 shows that the obtained 't' value is 0.26 and is not significant at the 0.05 level. It means that the formulated above hypothesis 24 is accepted, i.e., "There is no significant difference in agility of bicycle non-users between initial testing and at the end of three months." It is concluded that the mean agility scores of the bicycle nonuser group at the start of the study and after three months are similar.

Table 4.25. Summary of 't' test on agility of bicycle non-users at the end of six months

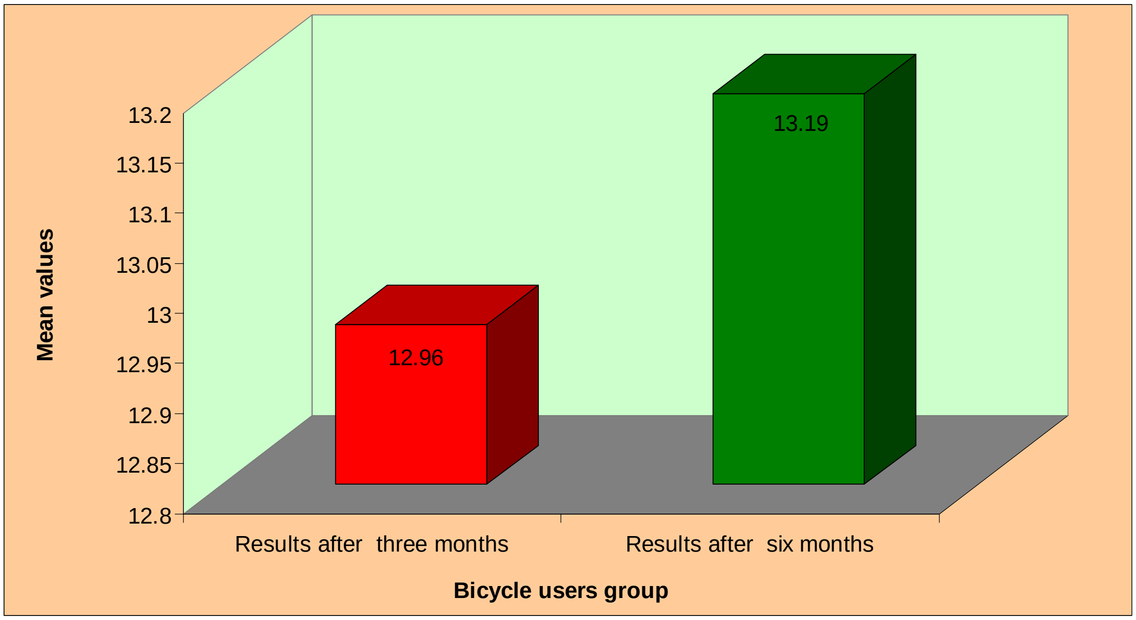
Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Initial test results	12.12	100	1.23	0.56	Not significant at 0.05 level
	Results after six months	12.03	100	1.07		

Table 4.25 demonstrates that the obtained "t" value of 0.56 is not statistically significant at the 0.05 level. It means that the formulated above hypothesis 25 is accepted, i.e., "There is no significant difference in agility of bicycle non-users between the initial testing and at the end of six months." It is concluded that mean scores of agility among the bicycle nonuser group at initial testing and after the six-month period of the study are similar.

Table 4.26. Summary of 't'-test on agility of bicycle users between three months and six month intervals

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle users group	Results after three months	12.96	100	0.48	4.16	Significant at 0.05 level
	Results after six months	13.19	100	0.25		

Table 4.26 above shows that the calculated t-value is 4.16 and that it is significant at the 0.05 level. It means that the above null hypothesis 26 is rejected and the alternative hypothesis is formulated, i.e., "There is a significant difference in agility of bicycle users at the end of three and six months of bicycle utilization." It is concluded that the after-bicycle utilization mean score of bicycle users for 6 months is significantly higher than the mean scores of the bicycle users' group at the end of bicycle utilization by three months with regard to their agility. The table also shows that the agility at the end of three months of bicycle use was significantly lower than the agility acquired after the next three months of bicycle use. As a result, it is possible to conclude that bicycle riding increased the agility of bicycle user groups more after six months of use than after three months.



Graph 4.18. Summary of 't'-test on agility of bicycle users between three months and six month intervals

Figure 4.18 above compares mean scores of agility after three months of bicycle use to mean scores of agility after six months of bicycle use for the bicycle users' group. The mean score of bicycle users after three months of bicycle use is lower than the mean score of bicycle users after six months of bicycle use. After six months of bicycle use, it is possible to conclude that bicycle riding increased the agility of the bicycle users' group.

Table 4.27. Summary of 't' test on agility of bicycle non-users between three months and six month intervals

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Results after three months	12.17	100	1.29	0.88	Not significant at 0.05 level
	Results after six months	12.03	100	1.07		

Table 4.27 shows that the obtained 't' value of 0.88 is not significant at the 0.05 level. It means that the formulated above hypothesis 27 is accepted, i.e., "There is no significant difference in agility between bicycle users and non-users at the end of three and six months after initial testing." It is concluded that the mean scores of agility of bicycle non-users between three months after initial testing and six months after initial testing are similar.

Objective 4: To study the effectiveness of Bicycle Utilization on Cardiovascular Endurance of Secondary School male students.

To achieve the duly formulated hypotheses, the paired sample 't' test technique has been applied and results are presented in the following tables and graphs.

Table 4.28. Summary of 't'- test on cardiovascular endurance between bicycle users and bicycle non-users at initial test prior to bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Initial testing results	Bicycle users group	92.45	100	13.25	0.65	Not significant at 0.05 level
	Bicycle non-users group	93.63	100	13.27		

Table 4.28 shows that the obtained 't' value is 0.65 and is not significant at the 0.05 level. It means that hypothesis 28 is accepted, i.e., "There is no significant difference in cardiovascular endurance between the bicycle users' group and the bicycle non-users' group during initial testing prior to bicycle utilization." It is concluded that the bicycle users' group and the bicycle non-users' group are similar in their cardiovascular endurance at the initial test.

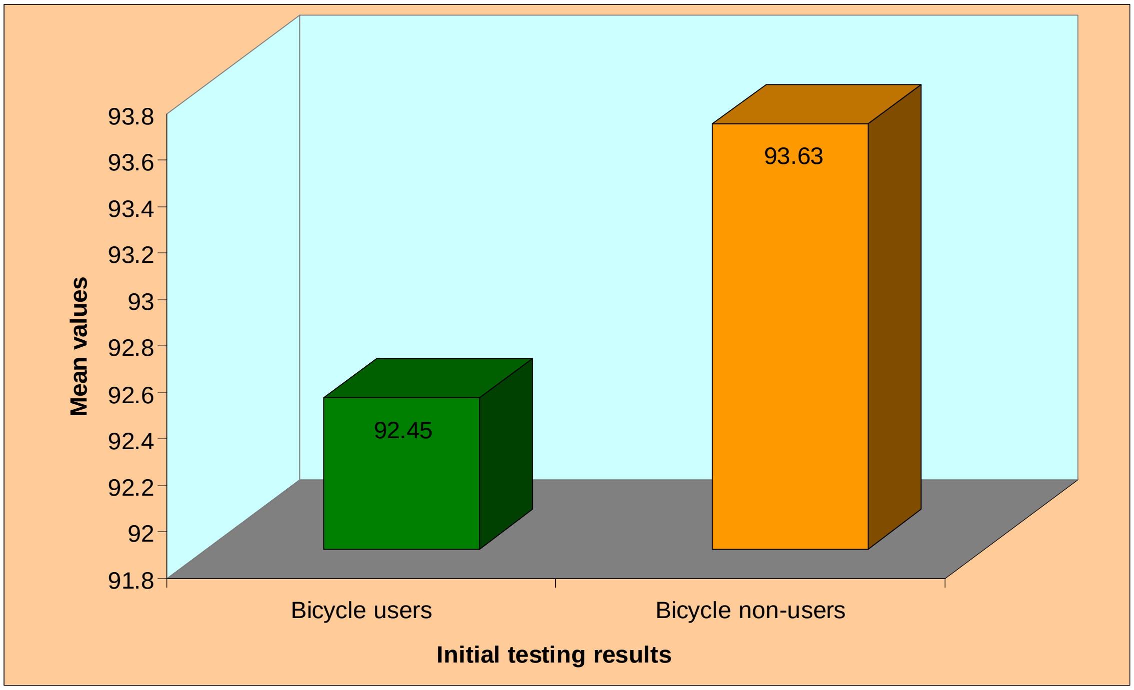


Figure 4.19. Comparison of initial test mean scores in cardiovascular endurance between bicycle users' group and bicycle non-users' group

Above figure 4.19 shows that comparison of mean scores in cardiovascular endurance between bicycle users' group and bicycle non-users' group is similar.

Table 4.29. Summary of 't'-test on cardiovascular endurance between bicycle users and bicycle non-users at the end of three months of bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Results after three months	Bicycle users group	99.52	100	10.92	3.11	Significant at 0.05 level
	Bicycle non-users group	94.06	100	13.81		

Table 4.29 shows that the obtained t value is 3.11 and is not significant at the 0.05 level. It means that the formulated above hypothesis 29 is accepted, i.e., "There is a significant difference in cardiovascular endurance between the bicycle users' group and

the bicycle non-users' group after bicycle utilization for the first three months." It is concluded that the bicycle users' group is significantly higher than the bicycle non-users' group in their cardiovascular endurance after three months of bicycle utilization. It is also evident from Table 4.29 that the cardiovascular endurance of the bicycle non-user group is significantly lower than that of the bicycle user group due to the utilization of bicycles. As a result, after three months of bicycle use, it is possible to conclude that bicycle riding increased cardiovascular endurance in the bicycle users' group.

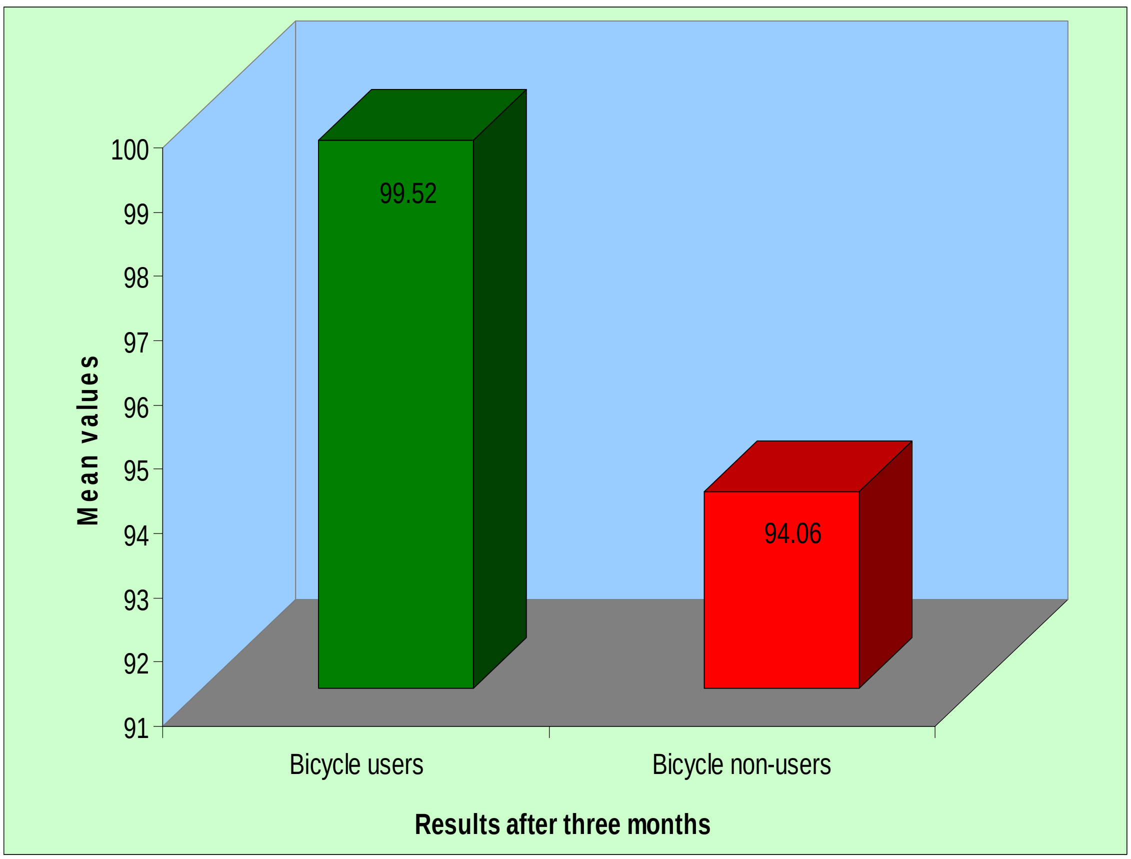


Figure 4.20. Comparison of mean scores of cardiovascular endurance after bicycle utilization of three months between bicycle users' group and bicycle non-users' group

Figure 4.20 compares the mean scores after three months in cardiovascular endurance between the bicycle users' and non-bicycle users' groups. The test mean score regarding cardiovascular endurance of the bicycle users' group is higher than that of the non-bicycle users' group. After three months of use, it is possible to conclude that bicycle riding increased cardiovascular endurance in the bicycle users' group.

Table 4.30. Summary of 't' test on cardiovascular endurance between bicycle users and bicycle non-users at the end of six months of bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Results after six months	Bicycle users group	109.30	100	13.86	2.34	Significant at 0.05 level
	Bicycle non-users group	95.25	100	15.11		

Table 4.30 above shows that the calculated t-value is 7.34 and that it is significant at the 0.05 level. It means that the above null hypothesis 4.30 is rejected and the alternative hypothesis is formulated, i.e., "There is a significant difference in cardio-vascular endurance between the bicycle users' group and the bicycle non-users' group after bicycle utilization for six months."

It is concluded that the bicycle users' group is significantly higher than the bicycle non-users' group in their cardiovascular endurance after bicycle utilization for six months. It is also evident from Table 30 that the cardiovascular endurance of the bicycle non-user group is significantly lower than that of the bicycle user group due to the utilization of bicycles. As a result, after six months of bicycle use, it is possible to conclude that bicycle riding increased cardiovascular endurance in the bicycle users' group.

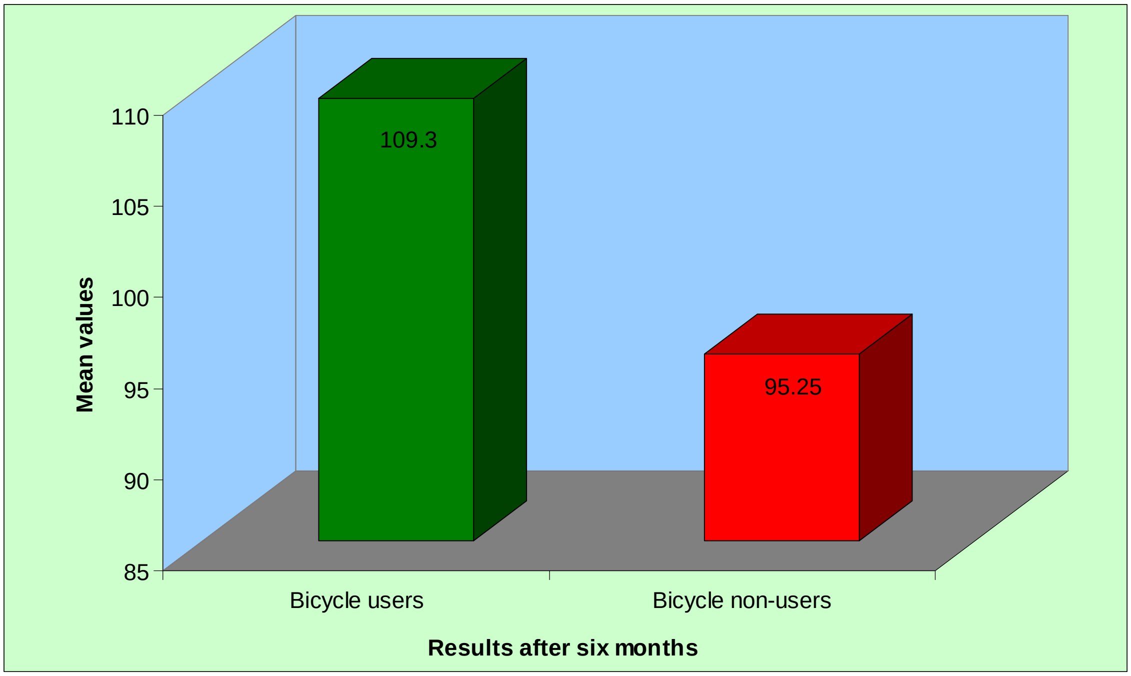


Figure 4.21. Comparison of mean scores of cardiovascular endurance after bicycle utilization of six months between bicycle users' group and bicycle non-users' group

Figure 4.21 compares the mean scores of cardiovascular endurance after six months of bicycle use between the bicycle users' and non-bicycle users' groups. The test mean score of the bicycle users' group is higher than that of the bicycle non-users' group. After six months of bicycle use, it is possible to conclude that bicycle riding increased cardiovascular endurance in the bicycle users' group.

Table 4.31. Summary of 't'-test on the cardiovascular endurance of bicycle users' group between initial and after three months' utilization of bicycle

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle users group	Initial test results	92.45	100	13.25	3.96	Significant at 0.05 level
	Results after three months	99.52	100	10.92		

Table 4.31 above shows that the calculated ‘t’ value is 3.96 and that it is significant at the 0.05 level. It means that hypothesis 31 is rejected and the alternative hypothesis is formulated, i.e., "There is a significant difference in cardiovascular endurance of bicycle users between the initial testing prior to bicycle utilization and at the end of three months of bicycle utilization." It is concluded that the mean score of bicycle user groups in their cardiovascular endurance at the end of three months of bicycle utilization is significantly higher than the mean score of bicycle user groups at the initial test prior to bicycle utilization. It is also evident from the table that the cardiovascular endurance before bicycle utilization is significantly lower than the after-bicycle utilization for the first three months of the bicycle user group. As a result, after three months of bicycle use, it is possible to conclude that bicycle riding increased cardiovascular endurance in the bicycle users' group.

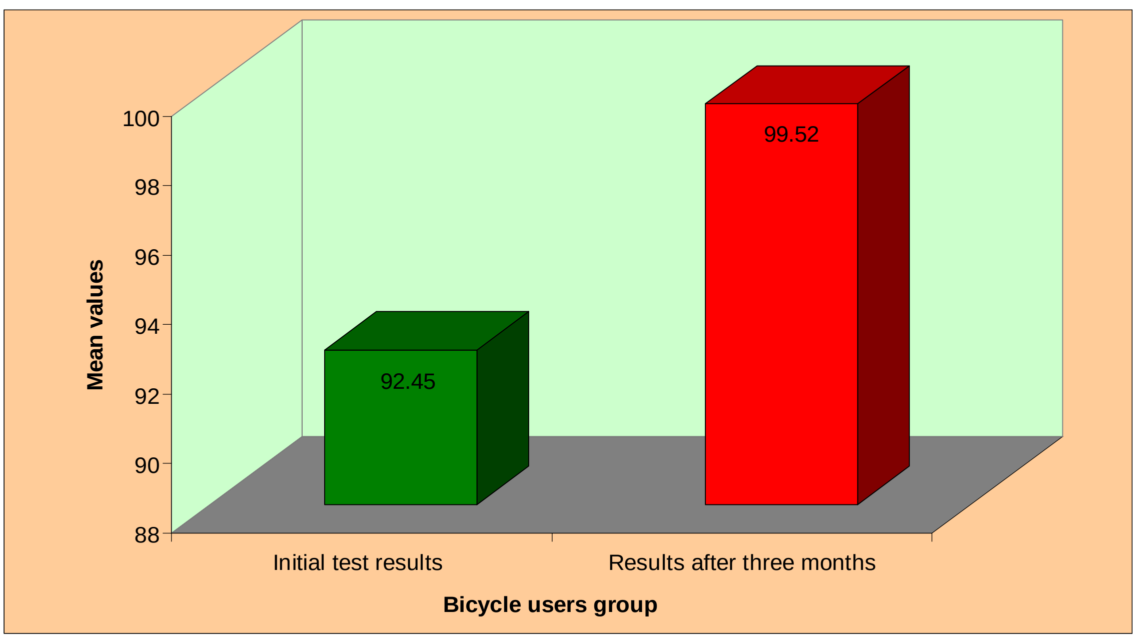


Figure 4.22. Comparison of mean scores in cardiovascular endurance of bicycle users’ group between initial testing and after three months’ utilization of bicycle

Figure 4.22 shows a comparison of mean cardiovascular endurance scores between initial testing and after three months of bicycle use. The mean score of the bicycle users' group in cardiovascular endurance at the end of three months is higher than that of the initial testing. It can be concluded that bicycle riding increased the cardiovascular endurance of the bicycle users' group after three months of bicycle utilization.

Table 4.32. Summary of 't'-test on the cardiovascular endurance of bicycle users' group between initial testing and after six months' utilization of bicycle

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle users group	Initial test results	92.45	100	13.25	8.84	Significant at 0.05 level
	Results after six months	109.30	100	13.86		

Table 4.32 above shows that the calculated 't' value is 8.84 and that it is significant at the 0.05 level. It means that the above null hypothesis 4.32 is rejected and the alternative hypothesis is formulated, i.e., "There is a significant difference in cardiovascular endurance of bicycle users between the initial testing prior to bicycle utilization and at the end of six months of bicycle utilization." It is concluded that the mean score of bicycle user groups in their cardiovascular endurance at the end of six months of bicycle utilization is significantly higher than the mean score of bicycle user groups at the initial test prior to bicycle utilization. It is also evident from Table 32 that the cardiovascular endurance before bicycle utilization is significantly lower than the after-bicycle utilization for the first six months of the bicycle user group. As a result, after six months of bicycle use, it is possible to conclude that bicycle riding increased the cardiovascular endurance of the bicycle users' group.

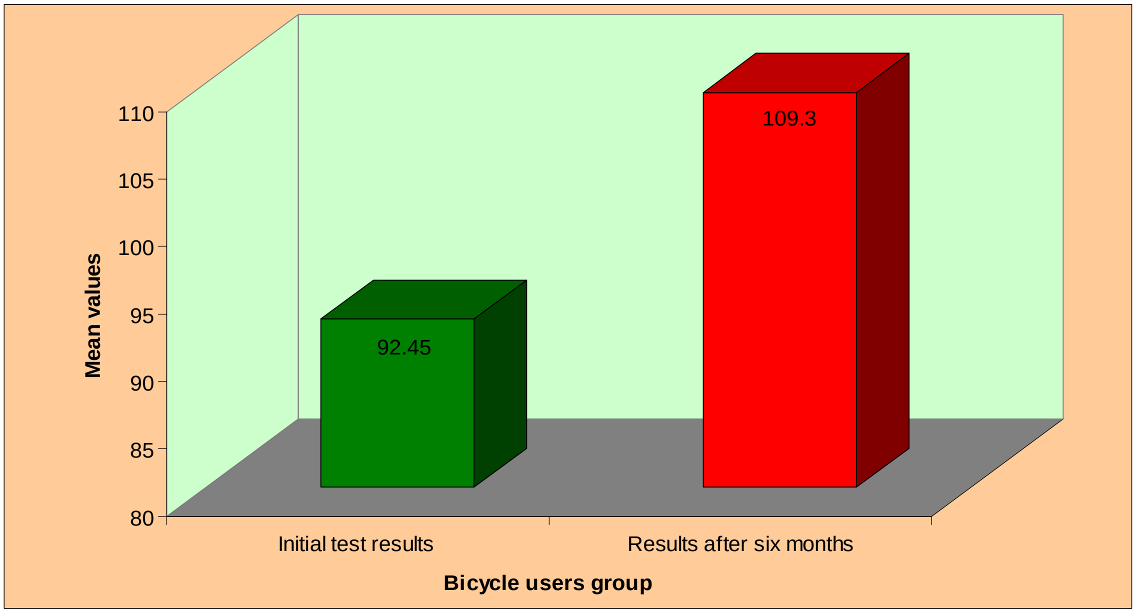


Figure 4.23. Comparison of mean scores in cardiovascular endurance of bicycle users' group between initial and after six months' utilization of bicycle

Figure 4.23, we see a comparison of mean scores of cardiovascular endurance between initial testing and after six months of bicycle use. The bicycle users' group mean score is higher than the initial testing mean score. It can be concluded that bicycle riding increased the cardiovascular endurance of the bicycle users' group after six months of bicycle utilization.

Table 4.33. Summary of 't'-test on cardiovascular endurance of bicycle non users between initial and after three months

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Initial test results	93.63	100	13.27	0.22	Not significant at 0.05 level
	Results after three months	94.06	100	13.81		

Table 4.33 shows that the obtained ‘t’ value of 0.22 is not significant at the 0.05 level. It means that the formulated above hypothesis 33 is accepted, i.e., "There is no significant difference in cardiovascular endurance of bicycle non-users between initial testing and at the end of three months". It is concluded that the mean scores of cardiovascular endurance among the bicycle non-user group at the start of the study and after three months are similar.

Table 4.34. Summary of ‘t’ test on cardiovascular endurance of bicycle non users at the end of six months

Details about testing		Mean	N	Std. Deviation	‘t’ value	Sig.
Bicycle non-users group	Initial test results	93.63	100	13.27	0.79	Not significant at 0.05 level
	Results after six months	95.25	100	15.11		

Table 4.34 shows that the obtained ‘t’-value is 0.79 and is not significant at the 0.05 level. It means that the formulated above hypothesis 34 is accepted, i.e., "There is no significant difference in cardiovascular endurance of bicycle non-users between initial testing and at the end of six months." It is concluded that the mean scores of bicycle non-users in cardiovascular endurance at initial testing and after six months of the study are similar.

Table 4.35. Summary of ‘t’-test on cardiovascular endurance of bicycle users between three months and six-month intervals

Details about testing		Mean	N	Std. Deviation	‘t’ value	Sig.
Bicycle users group	Results after three months	99.52	100	10.92	2.29	Significant at 0.05 level
	Results after six months	109.30	100	13.86		

Table 4.35 above shows that the calculated 't' value is 2.29 and that it is significant at the 0.05 level. It means that the 35 is rejected and the alternative hypothesis is formulated, i.e., "There is a significant difference in cardiovascular endurance of bicycle users at the end of three and six months of bicycle utilization." It is concluded that the after-bicycle utilization score of six months for the bicycle users' group is significantly higher than their mean scores acquired at the end of bicycle utilization of three months with regard to their cardiovascular endurance.

The table also shows that the cardiovascular endurance at the end of the three-month bicycle utilization period is significantly lower than the cardiovascular endurance acquired after the six-month bicycle utilization period. Hence, it can be concluded that bicycle riding has a greater effect on increasing the cardiovascular endurance of bicycle users' groups after six months of its utilization than after three months.

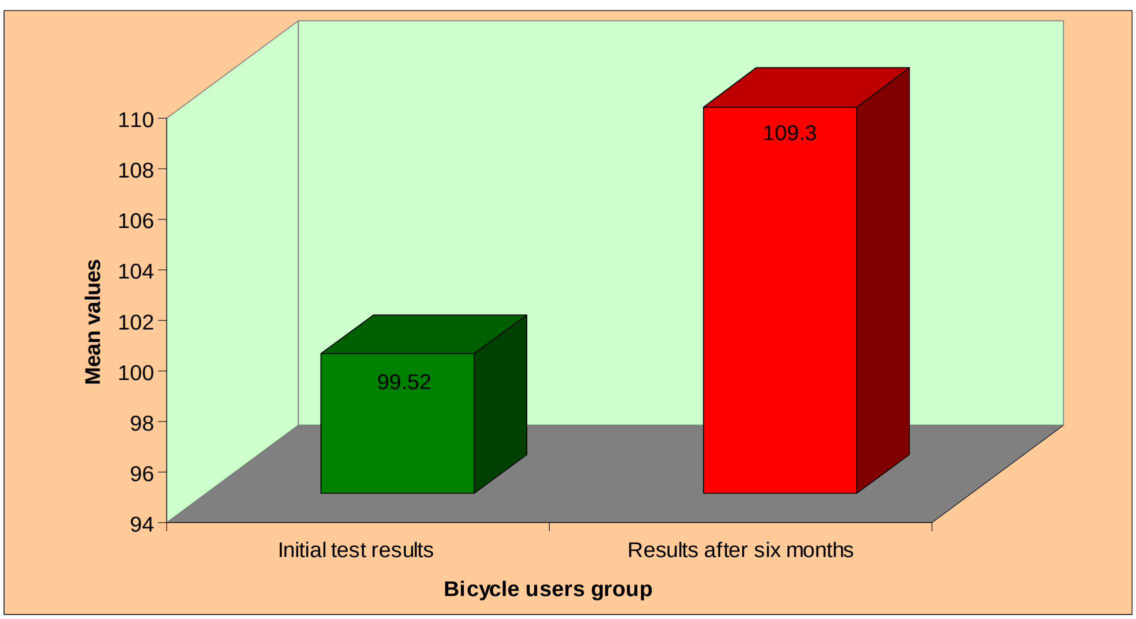


Figure 4.24. Summary of 't'-test on cardiovascular endurance of bicycle users between three months and six month intervals

The figure 4.24 above explains the comparison of mean scores in cardiovascular endurance after three months and six months of bicycle use in the bicycle users' group. The mean score of bicycle users after three months of bicycle use is lower than the mean score of bicycle users after six months of bicycle use. It can be concluded that bicycle riding increased the cardiovascular endurance of the bicycle users' group after six months of bicycle utilization.

Table 4.36. Summary of 't'-test on cardiovascular endurance of bicycle non-users between three months and six-month intervals

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Results after three months	94.06	100	13.81	0.58	Not significant at 0.05 level
	Results after six months	95.25	100	15.11		

Table 4.36 above shows that the calculated 't' value is 0.58, which is not significant at the 0.05 level. It means that the null hypothesis 36 is rejected and the alternative hypothesis is formulated, i.e., "There is no significant difference in cardiovascular endurance of bicycle non-users at the end of three and six months after initial testing." It is concluded that mean score of their Cardiovascular Endurance of bicycle non-users after three months from the time of initial testing and after the six months from initial testing is similar.

Objective 5: To study the effectiveness of Bicycle Utilization on Muscular Strength of Secondary School male students.

To achieve the duly formulated hypotheses, the paired sample t test technique has been applied and results are presented in the following tables and figures.

Table 4.37. Summary of 't'-test on muscular strength between bicycle users and bicycle non-users at initial test prior to bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Initial testing results	Bicycle users group	2.05	100	0.46	0.23	Not significant at 0.05 level
	Bicycle non-users group	2.03	100	0.38		

Table 4.37 shows that the obtained 't' value is 0.23 and is not significant at the 0.05 level. It means that the formulated above hypothesis 37 is accepted, i.e., "There is no significant difference in muscular strength between the bicycle users' group and the bicycle non-users' group during initial testing prior to bicycle utilization." It is concluded that the bicycle users' group and the bicycle non-users' group are similar in their muscular strength at the initial test.

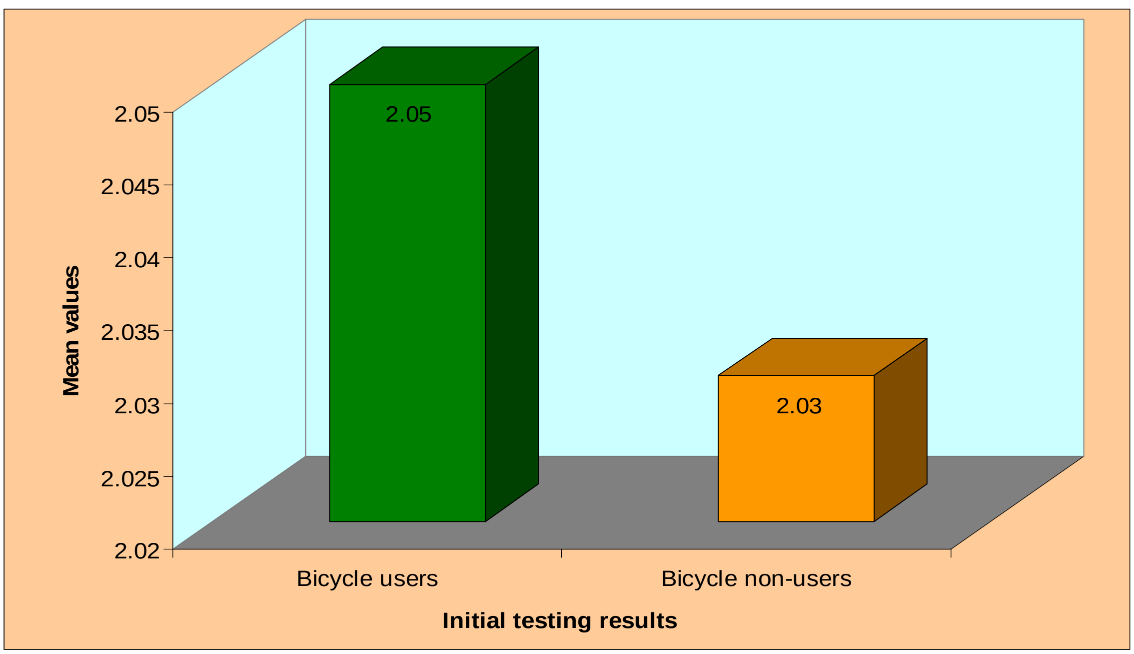


Figure 4.25. Comparison of initial test mean scores in muscular strength of bicycle users' group and bicycle non-users' group

Figure 4.25 shows that comparison of mean scores in Muscular Strength between bicycle users' group and bicycle non-users' group are similar.

Table 4.38. Summary of 't'-test on muscular strength between bicycle users and bicycle non-users at the end of three months of bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Results after three months	Bicycle users group	2.20	100	0.29	3.88	Significant at 0.05 level
	Bicycle non-users group	2.04	100	0.35		

Table 4.38 shows that obtain 't' value is 3.88 and it is not significant at 0.05 level. It means that the formulated above hypothesis 38 is accepted, i.e., "There is a significant difference in muscular strength between the bicycle users' group and the bicycle non-users' group after bicycle utilization for the first three months."

It is concluded that the mean score of the bicycle users' group is significantly higher than that of the bicycle non-users' group in their muscular strength after three months of bicycle utilization. It is also evident from table 4.38 that the muscular strength of the bicycle non-users 'group is significantly lower than that of the bicycle users' group and this is due to the utilization of bicycles.

Hence, it can be concluded that bicycle riding effected the increase in muscular strength of the bicycle users' group after three months of bicycle utilization.

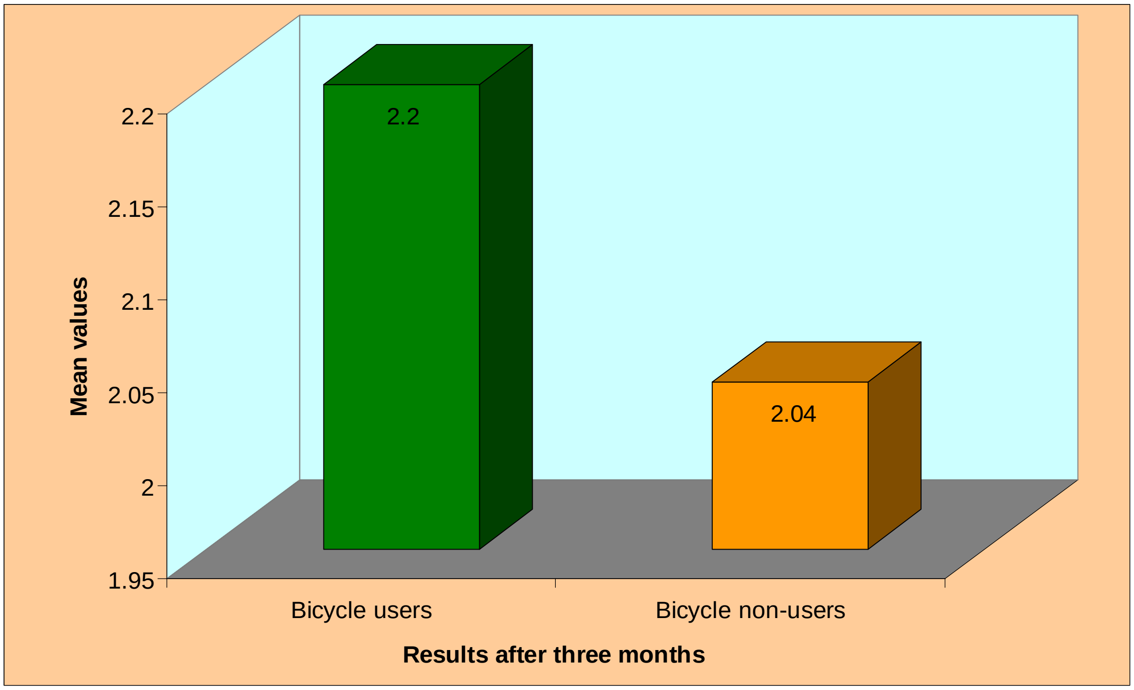


Figure 4.26. Comparison of mean scores of muscular strength after bicycle utilization of three months between bicycle users' group and non-bicycle users' group

Figure 4.26, we see the comparison of mean scores after three months in muscular strength between the bicycle users' group and the non-bicycle users' group. Because the test mean score of the bicycle users' group is higher than that of the non-bicycle users' group, it can be concluded that three months of bicycle use resulted in increased muscular strength of the bicycle users' group.

Table 4.39. Summary of 't' test on muscular strength between bicycle users and bicycle non-users at the end of six months of bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Results after six months	Bicycle users group	3.12	100	0.82	12.12	Significant at 0.05 level
	Bicycle non-users group	2.01	100	0.36		

Table 4.39 above shows that the calculated 't' value is 12.12 and that it is significant at the 0.05 level. It means that the null hypothesis 39 is rejected and the alternative hypothesis is formulated, i.e., "There is a significant difference in the muscular strength between the bicycle users' group and the bicycle non-users' group after bicycle utilization for six months."

It is concluded that the mean score of the bicycle users' group is significantly higher than that of the bicycle non-users' group in their muscular strength after bicycle utilization for six months. It is also evident from Table 39 that the muscular strength of the bicycle non-users' group is significantly lower than that of the bicycle users' group, and this is due to the utilization of bicycles. Hence, it can be concluded that bicycle riding effected the increase in muscular strength of the bicycle users' group after the bicycle was utilized for six months.

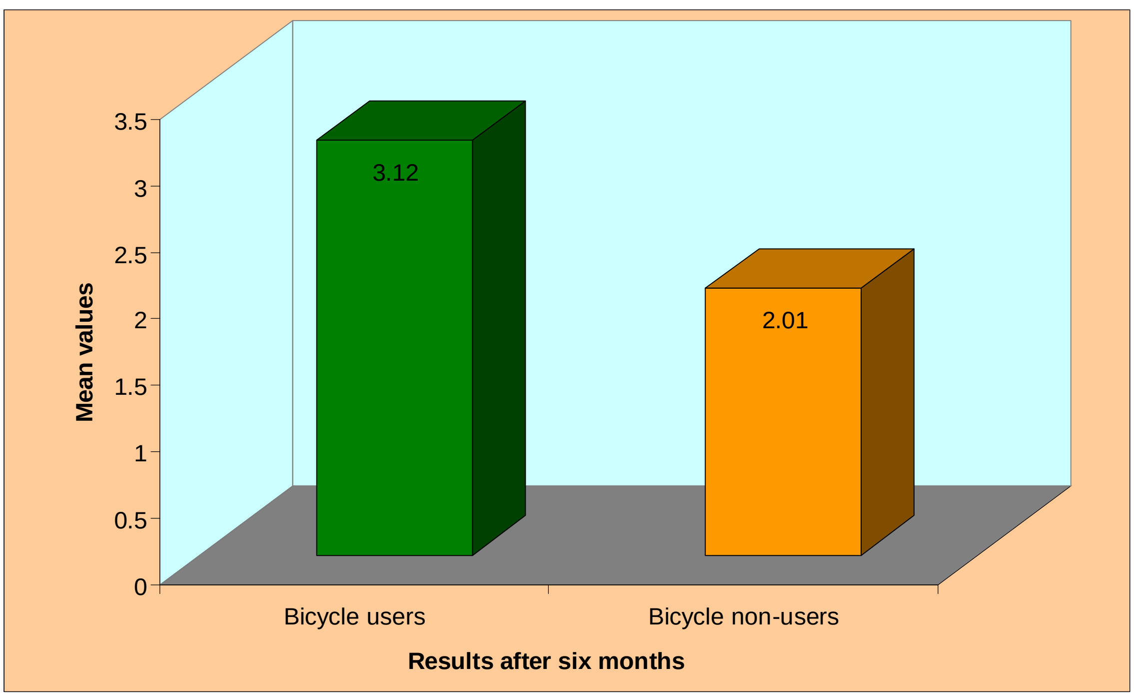


Figure 4.27. Comparison of mean scores of muscular strength after bicycle utilization of six months between bicycle users' group and non-bicycle users' group

Figure 4.27, we see the comparison of mean scores after six months in muscular strength between the bicycle users' group and the non-bicycle users' group. Because the test mean score of the bicycle users' group is higher than that of the non-bicycle users' group, it can be concluded that bicycle riding increased the muscular strength of the bicycle users' group after six months of bicycle use.

Table 4.40. Summary of 't' test on the muscular strength of bicycle users' group between initial and after three months' utilization of bicycle

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle users group	Initial test results	2.05	100	0.46	2.91	Significant at 0.05 level
	Results after three months	2.20	100	0.29		

Table 4.40 above shows that the calculated 't' value is 2.91 and that it is significant at the 0.01 level. It means that the above null hypothesis 40 is rejected and the alternative hypothesis is formulated, i.e., "There is a significant difference in muscular strength in the bicycle utilization group between the initial testing prior to bicycle utilization and at the end of three months of bicycle utilization." It is concluded that the mean score of the bicycle user group at the end of three months of bicycle utilization is significantly higher than the mean score of the bicycle user groups at the initial test prior to bicycle utilization in muscular strength.

It is also evident from Table 4.40 that the muscular strength before bicycle utilization is significantly lower than the after-bicycle utilization for the first three months of the bicycle user group. As a result, after three months of bicycle use, it is possible to conclude that bicycle riding increased the muscular strength of the bicycle users' group.

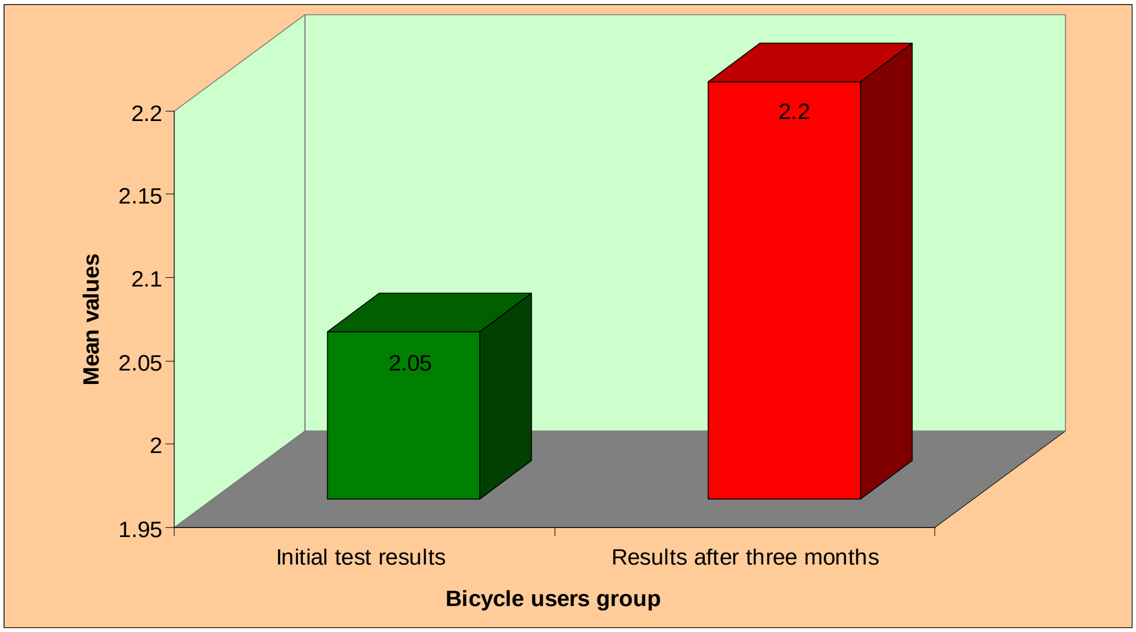


Figure 4.28. Comparison of mean scores in muscular strength of bicycle users' group between initial and after three months' utilization of bicycle

Figure 4.28, we see the comparison of mean scores in muscular strength for the bicycle users' group between initial testing and after a period of bicycle utilization of three months. After three months of bicycle use, it is possible to conclude that bicycle riding increased the muscular strength of the bicycle users' group.

Table 4.41. Summary of 't'- test on the muscular strength of bicycle users' group between initial and after six months' utilization of bicycle

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle users group	Initial test results	2.05	100	0.46	11.80	Significant at 0.05 level
	Results after six months	3.12	100	0.82		

Table 4.41 above shows that the calculated 't' value is 11.80 and that it is significant at the 0.05 level. It means that the null hypothesis 41 is rejected and the alternative hypothesis is formulated, i.e., "There is a significant difference in the

muscular strength of bicycle users between the initial testing prior to bicycle utilization and at the end of six months of bicycle utilization." It is concluded that the mean score of bicycle user groups in their muscular strength at the end of six months of bicycle utilization is significantly higher than the mean score of bicycle user groups at the initial test prior to bicycle utilization. It is also evident from Table 4.41 that the muscular strength of the bicycle user group before bicycle utilization is significantly lower than the after-bicycle utilization for six months. As a result, after six months of bicycle use, it is possible to conclude that bicycle riding increased the muscular strength of the bicycle users' group.

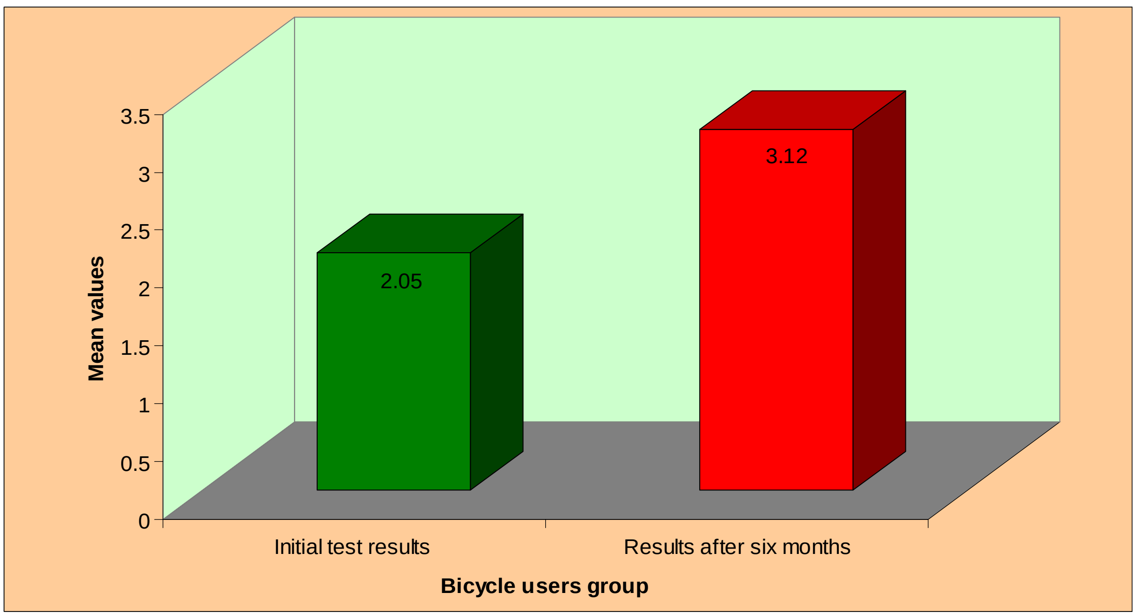


Figure 4.29. Comparison of mean scores in muscular strength of bicycle users' group between initial and after six months' utilization of bicycle

Figure 4.29 shows the comparison of mean scores in the muscular strength of bicycle users' group before and after a six-month period of bicycle use. After six months of bicycle use, it is possible to conclude that bicycle riding increased the muscular strength of the bicycle users' group.

Table 4.42. Summary of ‘t’-test on muscular strength of bicycle non-users between initial and after three months

Details about testing		Mean	N	Std. Deviation	‘t’ value	Sig.
Bicycle non-users group	Initial test results	2.03	100	.38	0.08	Not significant at 0.05 level
	Results after three months	2.04	100	.35		

Table 4.42 shows that the obtained ‘t’-value is 0.08 and is not significant at the 0.05 level. It means that hypothesis 42 is accepted, i.e., "There is no significant difference in muscular strength of bicycle non-users between initial testing and at the end of three months." It is concluded that the mean scores of muscular strength of the bicycle non-user group at the start of the study and after three months are similar.

Table 4.43. Summary of ‘t’ test on muscular strength of bicycle non-users between initial testing and at the end of six months

Details about testing		Mean	N	Std. Deviation	‘t’ value	Sig.
Bicycle non-users group	Initial test results	2.03	100	0.38	0.37	Not significant at 0.05 level
	Results after six months	2.01	100	0.36		

Table 4.43 shows that the obtained ‘t’-value is 0.37 and is not significant at the 0.05 level. It means that hypothesis 43 is accepted, i.e., "There is no significant difference in muscular strength of bicycle non-users between initial testing and at the end of six months." It is concluded that the mean scores of muscular strength of the bicycle nonuser group at the start of the study and after six months are similar.

Table 4.44. Summary of ‘t’ test on muscular strength of bicycle users between three months and six month intervals

Details about testing		Mean	N	Std. Deviation	‘t’ value	Sig.
Bicycle users group	Results after three months	2.20	100	0.29	10.72	Significant at 0.05 level
	Results after six months	3.12	100	0.83		

Table 4.44 above shows that the calculated ‘t’ value is 10.72 and that it is significant at the 0.05 level. It means that the above null hypothesis 44 is rejected and the alternative hypothesis is formulated, i.e., "There is a significant difference in muscular strength of bicycle users at the end of three and six months of bicycle utilization." It is concluded that, with regard to their muscular strength, the after-bicycle utilization mean score of the bicycle users’ group is significantly higher than the mean score of the bicycle users’ group at the end of bicycle utilization by three months.

The table also shows that the muscular strength at the end of three months of bicycle use is significantly lower than the muscular strength acquired after a six-month period of bicycle use. Hence, it can be concluded that bicycle riding increased the muscular strength of bicycle users’ groups more after six months of its utilization than after three months.

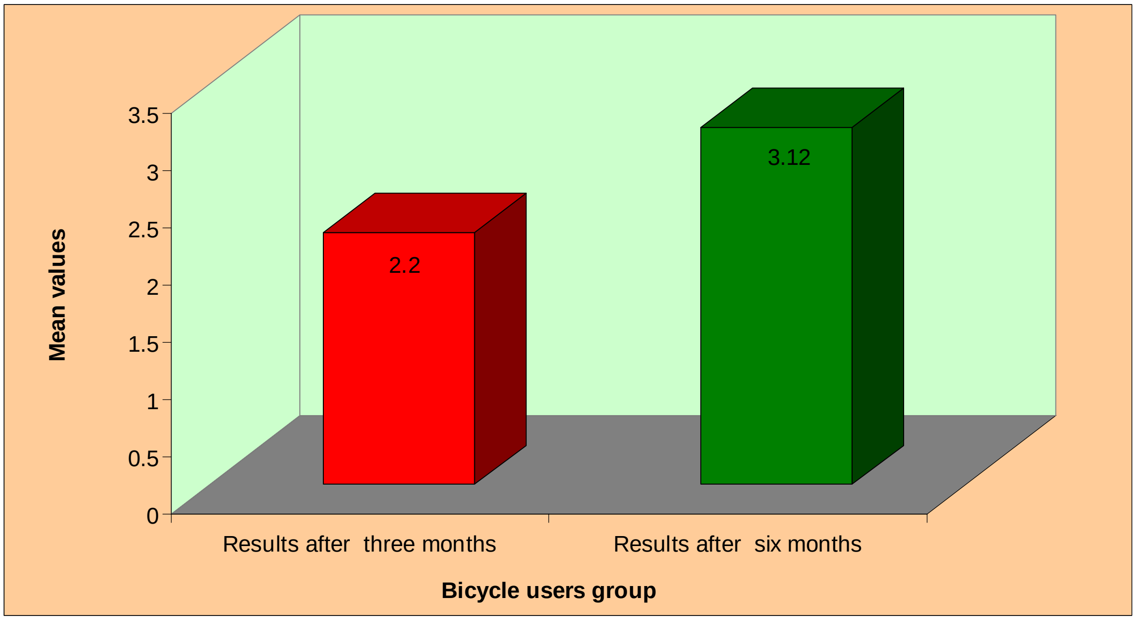


Figure 4.30. Summary of 't' test on muscular strength of bicycle users between three months and six month intervals

Figure 4.30 above explains the comparison of mean scores of muscular strength in the bicycle users' group between three and six months of bicycle use. The mean score of bicycle users after three months of bicycle use is lower than the mean score of bicycle users after six months of bicycle use. After six months of bicycle use, it is possible to conclude that bicycle riding increased the muscular strength of the bicycle users' group.

Table 4.45. Summary of 't'-test on muscular strength of bicycle users between three months and six month intervals

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Results after three months	2.04	100	.35	0.47	Not significant at 0.05 level
	Results after six months	2.01	100	.36		

Table 4.45 above shows that the calculated ‘t’ value is 0.47 and that it is significant at the 0.01 level. It means that the above null hypothesis 45 is accepted, i.e., "There is no significant difference in muscular strength between bicycle users and non-users at the end of three and six months after initial testing." It is concluded that the mean scores in muscular strength of non-bicycle users at three months after initial testing and at six months after initial testing are similar.

Objective 6: To study the effectiveness of Bicycle Utilization on Body Composition of Secondary School male students.

To achieve the duly formulated hypotheses, the paired sample ‘t’ test technique has been applied and the results are presented in the following tables and figures.

Table 4.46. Summary of ‘t’-test on body composition between bicycle users and bicycle non users at initial test prior to bicycle utilization

Details about testing		Mean	N	Std. Deviation	‘t’ value	Sig.
Initial testing results	Bicycle users group	19.09	100	1.86	0.31	Not significant at 0.05 level
	Bicycle non-users group	18.87	100	1.79		

Table 4.46 shows that obtained ‘t’ value is 0.31and it is not significant at 0.05 level. It means that the formulated above hypothesis 46 is accepted, i.e., "There is no significant difference in body composition between the bicycle users’ group and the bicycle non-users’ group during initial testing prior to bicycle utilization." It is concluded that the mean scores of the bicycle users’ group and the bicycle non-users’ group are similar in their body composition at the initial test.

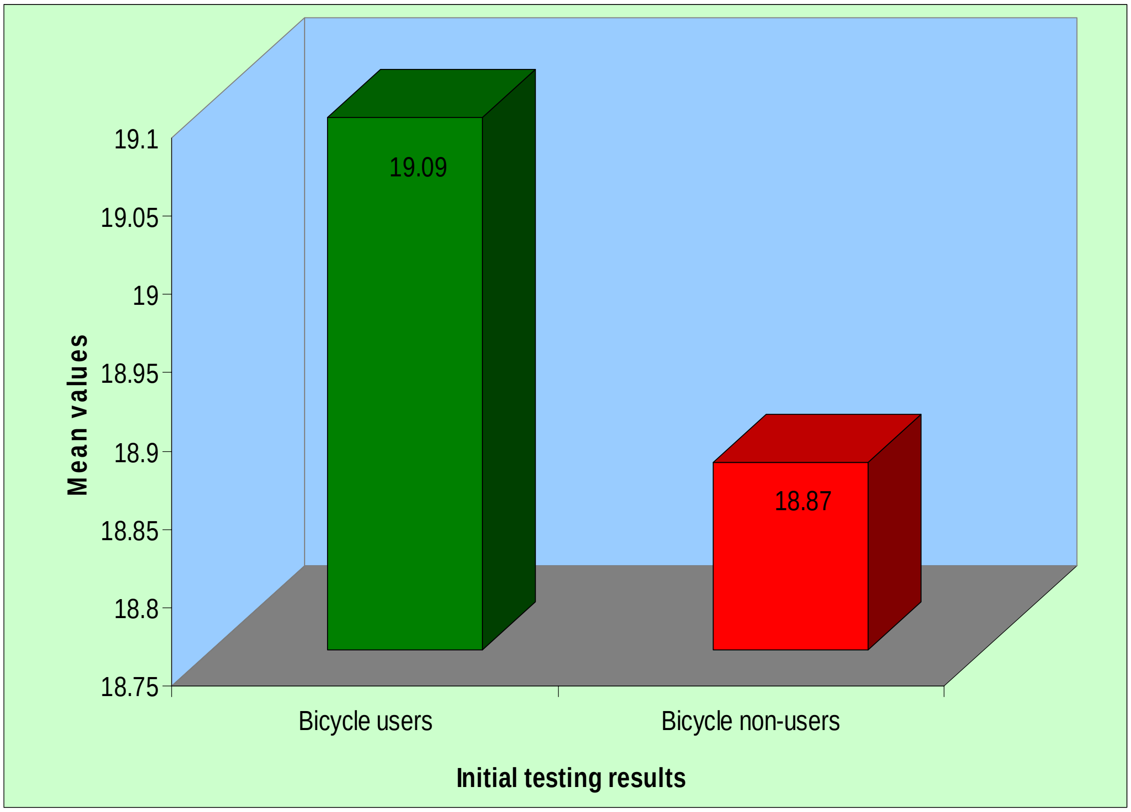


Figure 4.31. Comparison of initial test mean scores in body composition between bicycle users' group and bicycle non-users' group

Figure 4.31, it is shown that the comparison of mean scores in body composition between the bicycle users' group and the bicycle non-users' group are similar.

Table 4.47. Summary of 't'-test on body composition between bicycle users and bicycle non-users at the end of 3 months of bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Results after three months	Bicycle users group	17.55	100	1.97	0.93	Not significant at 0.05 level
	Bicycle non-users group	18.80	100	1.68		

Table 4.47 shows that the obtained t-value is 0.93 and is not significant at the 0.05 level. It means that the formulated above hypothesis 47 is accepted, i.e., "There is no significant difference in body composition between the bicycle users' group and the bicycle non-users' group after bicycle utilization for the first three months." It is concluded that the mean scores of the bicycle users' group and the bicycle non-users' group are similar in their body composition after bicycle utilization for the first three months. As a result, three months of bicycle use did not result in an increase in the body composition of the bicycle users' group.

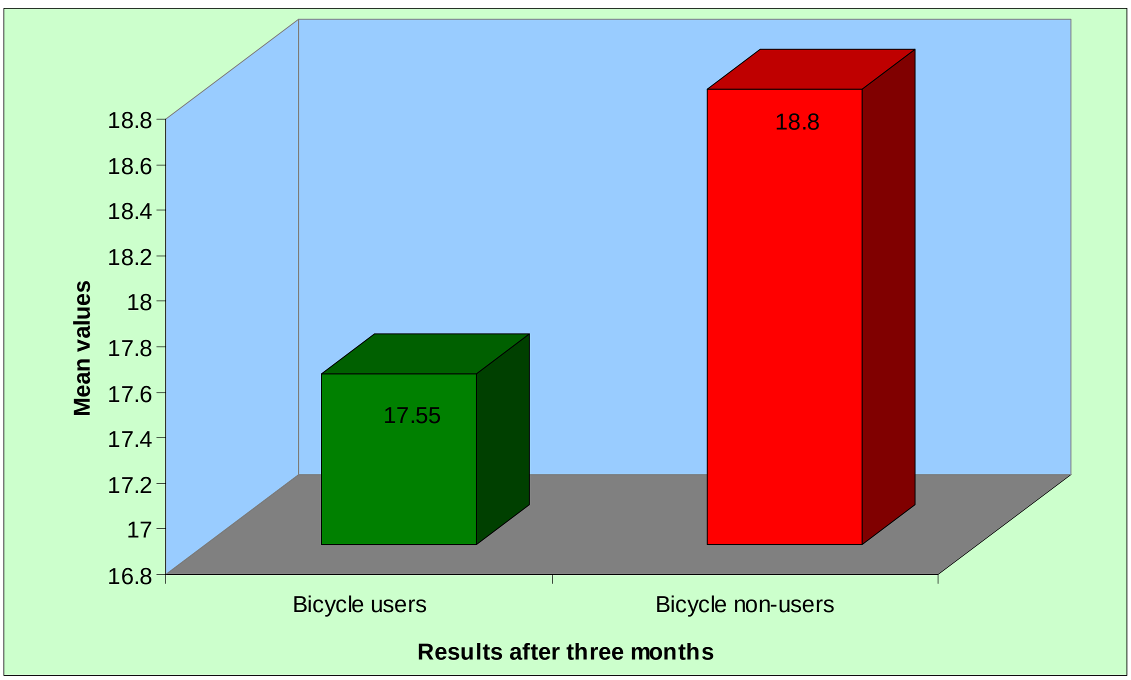


Figure 4.32. Comparison of mean scores of body composition after bicycle utilization of three months between bicycle users' group and bicycle non-users' group

Figure 4.32 is the comparison of mean scores after three months in body composition between the bicycle users' group and the bicycle non-users' group. It can be concluded that bicycle riding did not result in increasing the body composition of the bicycle users' group after bicycle utilization for three months.

Table 4.48. Summary of 't'-test on body composition between bicycle users and bicycle non-users at the end of six months of bicycle utilization

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Results after six months	Bicycle users group	18.09	100	1.65	0.20	Not significant at 0.05 level
	Bicycle non-users group	18.71	100	1.47		

Table 4.48 above shows that the calculated t-value is 0.20, which is not significant at the 0.05 level. It means that the null hypothesis 48 is accepted, i.e., "There is no significant difference in the body composition between the bicycle users' group and the bicycle non-users' group after bicycle utilization for six months." It is concluded that the mean scores of the bicycle users' group and the bicycle non-users' group are similar in their body composition after bicycle utilization for six months. Hence, it is found that bicycle riding did not result in increasing the body composition of the bicycle users' group after bicycle utilization for six months.

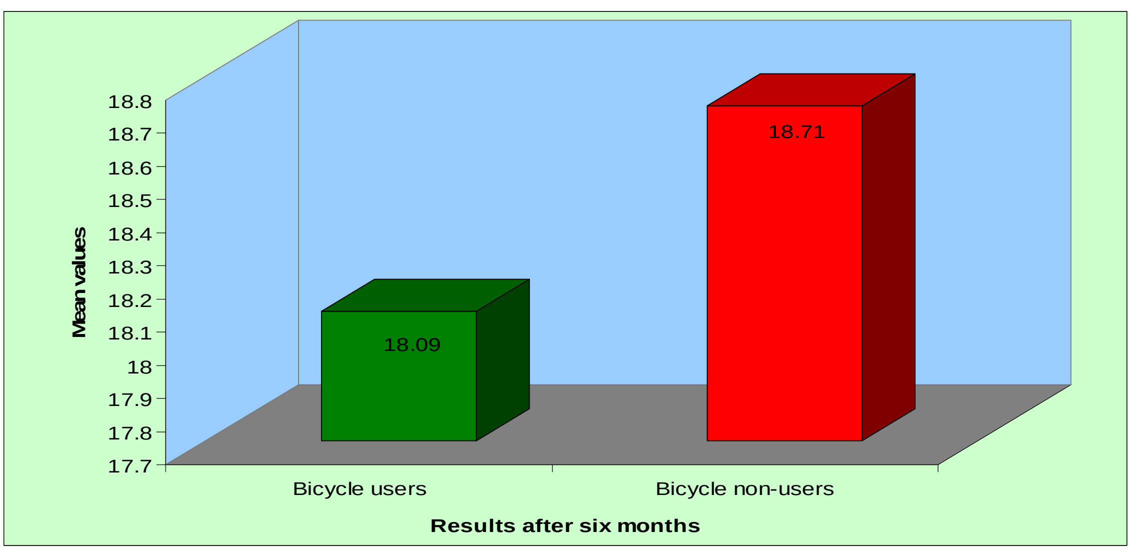


Figure 4.33. Comparison of mean scores of body composition after bicycle utilization of six months between bicycle users' group and bicycle non-users' group

Figure 4.33 shows the comparison of mean scores after six months in body composition between the bicycle users' group and the non-bicycle users' group. It is inferred that the mean scores of the bicycle users' group and the bicycle non-users' group are similar in their body composition after bicycle utilization for six months. As a result, after six months of bicycle use, it is possible to conclude that bicycle riding did not increase the body composition of the bicycle users' group.

Table 4.49. Summary of 't'-test on the body composition of bicycle users' group between initial testing and after three months' utilization of bicycle

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle users group	Initial test results	19.09	100	1.86	0.70	Not significant at 0.05 level
	Results after three months	17.55	100	1.97		

Table 4.49 above shows that the calculated t-value is 0.70 and that it is not significant at the 0.05 level. It means that the null hypothesis 49 is accepted, i.e., "There is no significant difference in body composition of bicycle users between the initial testing prior to bicycle utilization and at the end of three months of bicycle utilization." It is concluded that the mean scores of bicycle user groups in the tests conducted at the end of three months of bicycle utilization and prior to bicycle utilization are similar in their body composition. Hence, it is found that bicycle riding did not result in increasing the body composition of the bicycle users' group after three months of bicycle utilization.

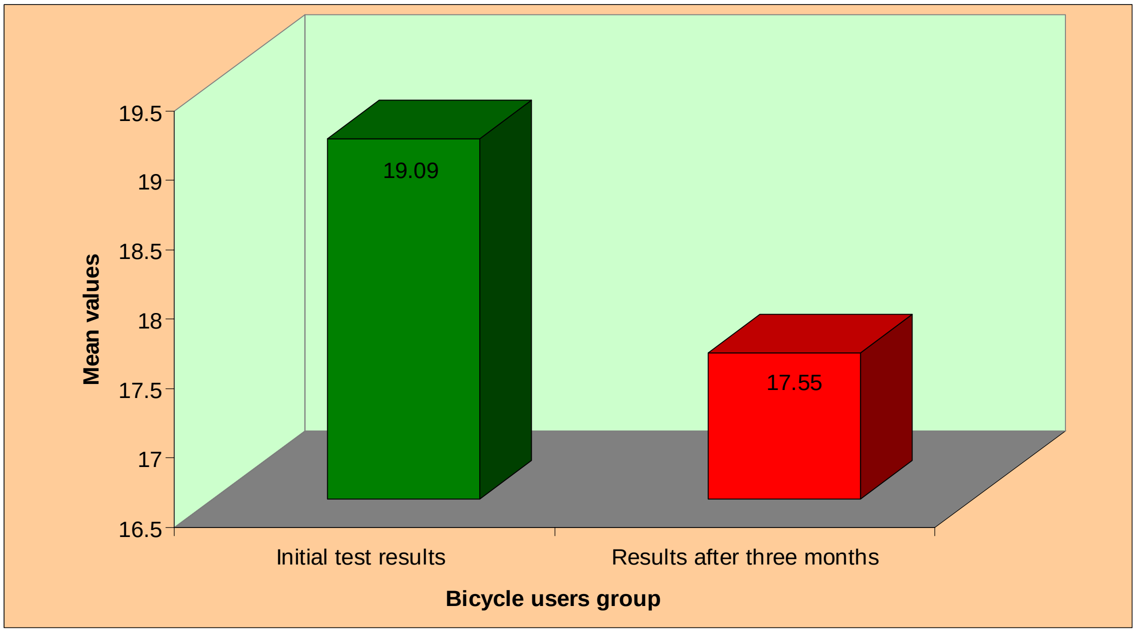


Figure 4.34. Comparison of mean scores in body composition of bicycle users' group between initial testing and after three months' utilization of bicycle

From the above figure 4.34, we see the comparison of mean scores in body composition between initial testing and after the period of bicycle utilization for three months in the bicycle users' group. The mean scores of bicycle user groups in the tests conducted at the end of three months of bicycle utilization and prior to bicycle utilization are similar in their body composition. After three months of bicycle use, it is possible to conclude that bicycle riding did not increase the body composition of the bicycle users' group.

Table 4.50. Summary of 't'-test on the body composition of bicycle users' group between initial testing and after six months' utilization of bicycle

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle users group	Initial test results	19.09	100	1.86	0.28	Not significant at 0.05 level
	Results after six months	18.09	100	1.65		

Table 4.50 above shows that the calculated 't' value is 0.28 and that it is not significant at the 0.05 level. It means that the null hypothesis 50 is accepted, i.e., "There is no significant difference in body composition of bicycle users between the initial testing prior to bicycle utilization and at the end of six months of bicycle utilization." It is concluded that the mean scores of bicycle user groups in the tests conducted at the end of six months of bicycle utilization and prior to bicycle utilization are similar in their body composition. Hence, it is found that bicycle riding did not result in increasing the body composition of the bicycle users' group after six months of bicycle utilization.

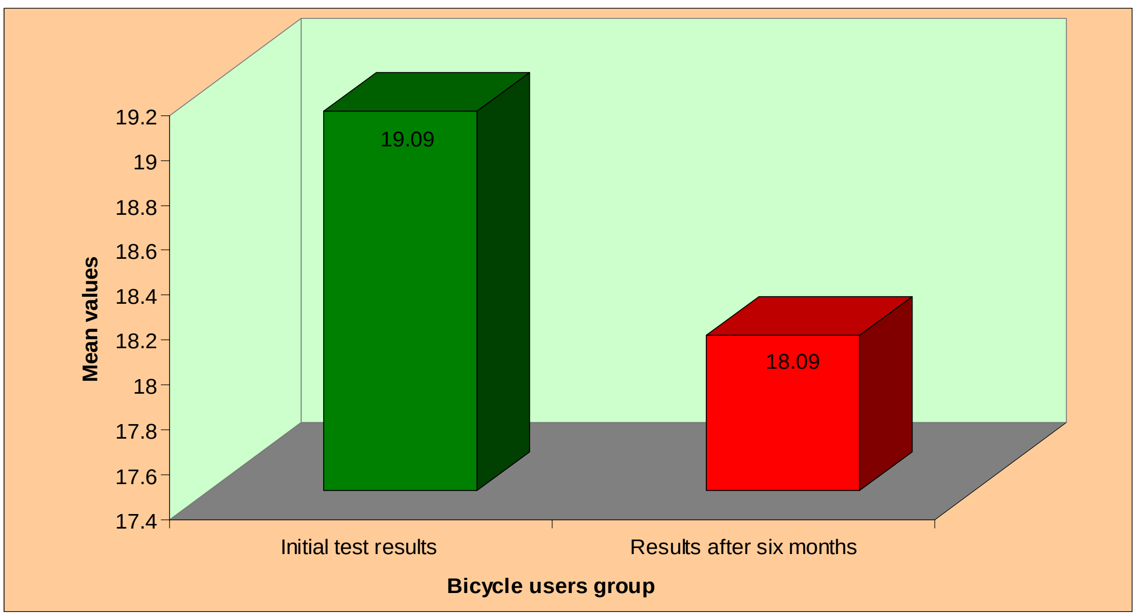


Figure 4.35. Comparison of mean scores in body composition of bicycle users' group between initial testing and after six months' utilization of bicycle

Figure 4.35 shows that comparison of mean scores of bicycle users' group in their Body Composition between initial testing and after the period of bicycle utilization of six months. It is concluded that the mean scores of bicycle user groups in the tests conducted at the end of six months of bicycle utilization and prior to bicycle utilization are similar in their body composition.

Hence, it can be stated that bicycle riding did not result in increasing the body composition of the bicycle users' group after six months of bicycle utilization.

Table 4.51. Summary of 't'-test on body composition of bicycle non-users between initial testing and at the end of three months

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Initial test results	18.87	100	1.79	0.95	Not significant at 0.05 level
	Results after three months	18.80	100	1.68		

Table 4.51 shows that the obtained 't'-value is 0.95 and is not significant at the 0.05 level. It means that the above-formulated hypothesis 51 is accepted, i.e., "There is no significant difference in body composition of bicycle non-users between the initial testing and at the end of three months." It is concluded that the mean scores of bicycle non-user groups in the tests conducted at the end of three months of study and prior to the study are similar in their body composition.

Table 4.52. Summary of 't'-test on body composition of bicycle non users between initial testing and at the end of six months

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Initial test results	18.87	100	1.79	0.06	Not significant at 0.05 level
	Results after six months	18.71	100	1.47		

Table 4.52, the obtained ‘t’ value is 0.06, which is not significant at the 0.05 level. It means that hypothesis 52 is accepted, i.e., "There is no significant difference in body composition of bicycle non-users between initial testing and at the end of six months." It is concluded that the mean scores of body composition of the bicycle nonuser group at the start of the study and after six months are similar.

Table 4.53. Summary of ‘t’ test on body composition of bicycle users between three months and six month intervals

Details about testing		Mean	N	Std. Deviation	‘t’ value	Sig.
Bicycle users group	Results after three months	17.55	100	1.97	0.21	Not significant at 0.05 level
	Results after six months	18.09	100	1.65		

Table 4.53 above shows that the calculated ‘t’ value is 0.21 and that it is not significant at the 0.05 level. It means that the above null hypothesis 53 is accepted, i.e., "There is no significant difference in body composition of bicycle users at the end of three and six months of bicycle utilization."

It is concluded that the mean scores of bicycle user groups in the tests conducted at the end of three months of bicycle utilization and at the end of six months are similar in their body composition. Hence, it is found that bicycle riding did not result in increasing the body composition of the bicycle users’ group after six months of bicycle utilization.

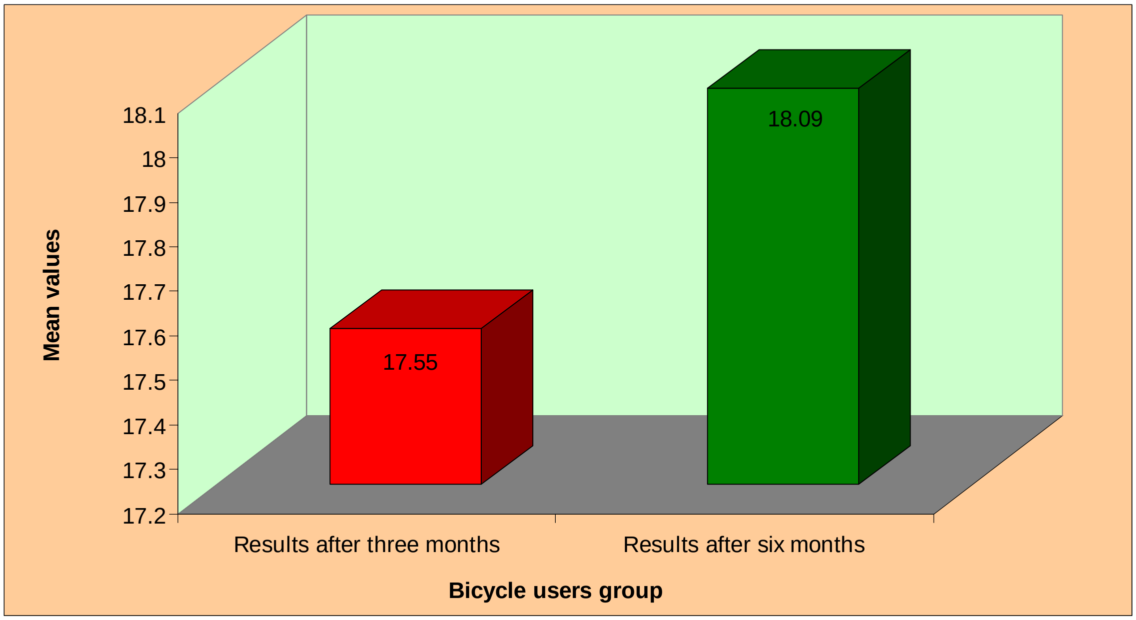


Figure 4.36. Summary of 't' test on body composition of bicycle users between three months and six month intervals

Figure 4.36 above explains the comparison of mean scores of body composition after three months of bicycle use versus six months of bicycle use in the bicycle users' group. It is concluded that the mean scores of bicycle user groups in the tests conducted at the end of three months of bicycle utilization and at the end of six months are similar in their body composition. So, it can be said that the group of people who used to cycle for three and six months did not change the way their bodies looked as a result of bicycle utilization.

Table 4.54. Summary of 't' test on body composition of bicycle users between three months and six month intervals

Details about testing		Mean	N	Std. Deviation	't' value	Sig.
Bicycle non-users group	Results after three months	18.80	100	1.68	0.18	Not significant at 0.05 level
	Results after six months	18.71	100	1.47		

Table 4.54 above shows that the calculated t-value is 0.18 and that it is not significant at the 0.05 level. It means that the null hypothesis 54 is accepted, i.e., "There is no significant difference in body composition of bicycle non-users at the end of three and six months after initial testing."It is concluded that the mean scores of bicycle non-user groups in the tests conducted at the end of three months and at the end of six months of the study are similar in their body composition. It can be stated that mean scores in the body composition of non-bicycle users after three months from the time of initial testing and after six months from initial testing are similar.

DISCUSSION OF THE FINDINGS

To be fit and healthy, individuals need to be physically active. Regular physical activity can help protect one from serious diseases such as obesity, heart disease, cancer, mental illness, diabetes, and arthritis. Riding bicycle regularly is one of the best ways to reduce one's risk of health problems associated with a sedentary lifestyle. Cycling is a healthy, low-impact exercise that can be enjoyed by people of all ages, from young children to older adults. It is also fun, cheap and good for the environment.

The effectiveness of bicycle utilization is important for increasing physical fitness among students in the modern age. Such an important phenomenon has been neglected altogether by researchers in India. In the Indian context, studies on the effectiveness of bicycle utilization are scarce. Cycling can help protect every individual from serious diseases such as stroke, heart attack, some cancers, depression, diabetes, obesity, and arthritis. Riding a bike is a low-impact, healthy form of exercise for people of all ages. Cycling is easy to fit into daily routine by riding to the shops, park, school or work.

Cycling as a means for day-to-day travel has gained attention from the transport and environmental sectors for several advantages over motorized travel. More recently, the health sector has begun to embrace cycling for its potential to increase physical activity levels in children (Trapp *et al.,* 2011), adults (Beenackers *et al.,* 2012; Craig *et al.,* 2012; Rissel *et al.,* 2010; Titze, Stronegger, Janschitz, and Amp; Oja, 2008; Wanner, Gotschi, Martin-Diener, Kahlmeier and AmpMartin, 2012) and older adults (Heesch, Giles Corti and Amp Turrell, 2014).

Regular physical activity provides a wide range of health benefits (Lee *et al.,* 2012; Physical Activity Guidelines Advisory Committee, 2008). The World Health

Organization recommends a minimum of 150 minutes of moderate physical activity per week (WHO, 2010). But despite of substantial benefits, increasing proportions of western and other populations fail to achieve recommended levels of activity. Integrating cycling into daily routines provides a promising approach to increasing physical activity, given the many people who spend 30 minutes or more commuting daily yet struggle to find the extra half-hour to exercise (Bauman *et al.*, 2012; Trost, Owen, Bauman, Sallis and Amp Brown, 2002). The combination of mobility and physical activity is also cheap and does not require major skills, making it suitable for large segments of the population.

The findings of the present study showed that the explosiveness of non-bicycle users is significantly lower than that of the bicycle user group. As a result, it can be concluded that bicycle riding increased the explosiveness of bicycle users after three months of bicycle use, and other findings showed that there is a significant difference in the explosiveness of bicycle users between the initial testing prior to bicycle use and at the end of six months of bicycle use. Some studies argued that, to be health-enhancing, activity should generally be of at least moderate intensity. There is no exact lower threshold, and duration and intensity are typically aggregated linearly, though some research suggests that higher intensity cycling might provide even greater benefits (Schnohr Marott Jensen and Jensen, 2012).There is consensus that regular cycling, such as on a daily or weekly basis, is more important for health than occasional vigorous exercise; however, the exact trade-off between intensity and frequency remains poorly understood. Even activity frequencies of once per month have been associated with benefits. There are no noteworthy gender differences in how physical activity from cycling affects health, aside from breast cancer (Physical Activity Guidelines Advisory Committee, 2008).

Previous research suggested that searching the scientific literature for "explosive strength training cyclists" yields only one study published after Ronnestad and Mujika (2013) review. Beattie *et al.* (2017) defined the explosive strength training concept as a medium to high load, high velocity movement concept that is not in line with the prescribed definition of Bastiaans *et al.* (2001). However, the study combined maximal and explosive strength training rather than focusing on explosive strength training alone. This underlines the fact that a lot of questions remain unanswered regarding the explosive strength training concept for cyclists.

The findings of the present study showed that the balance of non-bicycle users is significantly lower than the bicycle users' group due to the utilization of bicycles. As a result, after three months of use, it is possible to conclude that bicycle riding increased the balance. Bicycling improved the balance of bicycle user groups after six months of use compared to three months. The current study's findings indicated that three months of bicycle use increased the agility of the bicycle users' group. Bicycle riding increased the balance of bicycle users' groups after six months of utilization compared to three months. A few studies have been conducted in this field of study. Previous researches had suggested that spinning is reported as an exercise that consumes twice as many calories as a general bicycle exercise (Battista *et al.*, 2008; Caria *et al.*, 2007; Hazelhurst and Claassen, 2006; Kang *et al.*, 2005; López-Miarro *et al.*, 2010). Performance-related physical fitness was evaluated by conducting tests related to aerobic capacity, muscle strength, muscle endurance, flexibility, and agility. Aerobic capacity was evaluated by measuring the time taken to finish a 1200m sprint. Muscle strength was evaluated based on the measurement of back muscle strength (Model 5402, Takei, Niigata, Japan) using a digital measuring instrument, muscle endurance by measuring the number of sit-ups performed in 60 seconds, flexibility by measuring sit and reach, and agility by measuring the side-step test.

Regular physical activity plays an important role in improving the quality of life by preventing various diseases related to the cardiovascular and pulmonary systems and by preventing the incidence of degenerative diseases of the musculoskeletal system (Petersen and Ueda, 2008). In addition, regular exercise is known to reduce mental depression and anxiety and promote self-confidence (American College of Sports Medicine, 2013). In particular, the development of physique and physical fitness in adolescence has been reported to be particularly important since the poor health outcomes at this age may carry over to adulthood and youthfulness (Cattuzzo *et al.*, 2016). Regular physical activity has been shown to improve memory and learning skills; therefore, it is particularly important for school-aged adolescents (Chaddock *et al.,* 2011). Many researchers noted that cycling can help improve heart health. For example, one association between active commuting and incident cardiovascular disease, cancer, and mortality: a prospective cohort study (2017) (trusted source) suggested that people who cycle to work experience notable health benefits, including improved cardiovascular functioning. In addition to a 46% lower risk of developing cardiovascular disease, commuters who cycle to work also have a 52% lower risk of dying from the condition. The results of the study also indicated that, in addition to improving heart health, cycling to work may reduce the risk of developing cancer.

The findings of the present study showed that the cardiovascular endurance of the non-bicycle users' group is significantly lower than that of the bicycle users' group due to the utilization of bicycles. After three and six months of bicycle use, bicycle riding increased cardiovascular endurance in the bicycle users' group. Bicycle riding improved cardiovascular endurance in groups of bicycle users after six months of use compared to three months. Indoor cycling is a wonderful way to improve cardiovascular health. It’s similar to other forms of cardio, such as running, swimming, and elliptical training. It’s ideal for people who want a cardio workout without putting too much stress on their joints. A small 2017 study on female middle school students found that indoor cycling was even better than bicycling at improving physical fitness. A few studies have been conducted in this area of research. Some studies argued that the health benefits of physical activity (PA) were well established (CDC, 2015). Exercise is pertinent to the physical health of children and if started early in life, cascades into a multitude of health benefits, including reduced risk for chronic diseases such as coronary heart disease, type-2 diabetes, obesity, cancer and arthritis (Carson *et al.*, 2014; Hills, Dengal and Amp Lubans, 2015; Iannotti Kogan Janssen and Amp Boyce, 2009). Most recently, physical activity has also reflected stable and independent links to areas of cognitive functioning in youths (Davis Tkacs Tomporowski and Amp Bustamente, 2015).

The findings of the current study showed that, the muscular strength of non-bicycle users is significantly lower than that of bicycle users, which is due to the use of bicycles. As a result, it is possible to conclude that bicycle riding resulted in an increase in muscular strength of the bicycle users' group following bicycle utilization.

Some studies argued that the estimated risk reductions between the most active and the least active subjects are substantial, that is, about 30% for all-cause mortality; 20–35% for cardiovascular disease, coronary heart disease, and stroke; between 30% and

40% for type 2 diabetes; about 30% for colon cancer; and about 20% for breast cancer (Physical Activity Guidelines Advisory Committee, 2008). Previous research suggested that several meta-analyses have shown a nonlinear dose–response relationship between physical activity and health, with the least active individuals benefiting the most from any given dose of physical activity (Carnethon, 2009; Harriss *et al.*, 2009; Lee and Amp Skerrett, 2001; Samitz, Egger and Amp Zwahlen, 2011; Sattelmair *et al.*, 2011; Woodcock, Franco, Orsini and Amp Roberts, 2011). For example, a meta-analysis of 22 cohort studies of that found that compared with no physical activity, 2.5 hours/week of moderate-intensity activity (equivalent to 30 min daily on 5 days a week) was associated with a 19% reduction in mortality risk, and 7 hours/week of physic (i.e., activity one hour daily) with a 24% reduced mortality risk (Woodcock *et al.*, 2011).

The World Health Organization recommends that ‘adults should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week, or an equivalent combination of moderate- and vigorous-intensity activity’ (WHO, 2010). Despite the consistent evidence for the benefits of physical activity and the fact that cycling contributed to physical activity in many of these studies, they usually do not provide cycling-specific effect estimates. However, cycling is generally at least of moderate intensity, so one can assume that their findings apply equally to cycling. A relatively small but growing number of studies specifically on the health effects of cycling have been conducted. Findings are mostly consistent with effects of overall physical activity, although inconclusive results are more common, depending on the health outcome and population studied and how cycling is measured (Kelly *et al.*, 2014; Oja *et al.*, 2011; Saunders, Green, Petticrew, Steinbach and Amp Roberts, 2013).

Schools serve approximately 56 million youths each year (National Centre for Education Statistics, 2016) and children spend approximately 30 hours each week at school; schools are a logical platform to address children's lack of physical activity (Dobbins, Husson, DeCorby and Amp LaRocca, 2013; Kriemler *et al.*, 2011). Schools offer an opportunity to reach a wide range of children and also target those most in need, while also presenting the possibility of adding social support for engaging in physical activity (Hamilton, Warner and Amp Schwarzer, 2016; Salvy *et al.*, 2009). Moreover, findings consistently reveal a relationship between school-based physical activity and academic gains, including increased academic achievement; higher outcomes reading, reading and English and improved cognition and concentration (CDC, 2015; Rasberry *et al.*, 2011). Although, schools are often constrained by budgets and curriculum requirements (Rasberr *et al.*, 2011). No PA studies to date have shown that time allotted to school-based physical activity detracts from academic performance (Babey Wu, and Amp Cohen, 2014; Donnelly *et al.*, 2016; Rasberry *et al.*, 2011). As such, finding opportunities for educators to embed PA supports the SUPP enhancing that enhance health and academic outcomes for youths, which are both feasible and acceptable for educators, is paramount to a sustainable intervention.

DISCUSSION OF THE HYPOTHESES

The present study had been designed with six objectives, and to accomplish the objectives, 54 hypotheses were formulated, which means every objective consisted of nine null hypotheses each. Based on the corresponding hypotheses, all six objectives of the current studies were briefly discussed below.

In order to actualize the first objective, which was framed under physical fitness, nine null hypotheses were formulated with the intention of proving the effectiveness of bicycle utilization on the explosiveness of secondary students. Since the t-test results, null hypotheses were rejected and alternative hypotheses were formulated, which proved that a time period of three months as well as six months of bicycle utilization was capable of improving (by a significant amount) the explosiveness of secondary school students. Hence, it can be inferred from the result that regular bicycling has potential enough to promote explosiveness in bicycle users.

The second objective was all about physical fitness, specifically male secondary school students' balance. In order to achieve the goal, nine null hypotheses regarding the effectiveness of bicycle use on secondary students' balance were developed. On the basis of the t-test results, null hypotheses were rejected and alternative hypotheses were formulated, which proved that a time span of three months as well as six months of bicycle utilization was capable of improving (by a significant amount) the explosiveness of secondary school students. Hence, it can be concluded from the result that regular bicycling has the potential to promote balance in bicycle users.

The third objective is uniquely concentrated on agility within the broad reality of physical fitness. In order to justify the objective, nine null hypotheses were articulated with the purpose of proving the effectiveness of bicycle utilization on the agility of secondary students. Based on the t-test results, null hypotheses were rejected and alternative hypotheses were formulated, proving the significant difference between bicycle users and bicycle non-users with regard to the effectiveness of bicycle utilization on agility. The results of the "t"-test evidenced that at an interval of three months as well as six months of bicycle utilization, there was a statistically significant effect on the agility of secondary school students among bicycle users. Hence, a valid conclusion can be drawn from the results of the "t"-test based on the third objective that regular bicycling has the potential to promote the agility of bicycle users.

Object four in the study was framed to test the effectiveness of bicycle utilization on cardiovascular endurance in secondary school students. In order to discover the truth about the objective, four testable hypotheses were developed with the goal of demonstrating the effectiveness of bicycle use on cardiovascular endurance in secondary school students. Based on the t-test results, null hypotheses were rejected and alternative hypotheses were formulated proving the significant difference between bicycle users and bicycle non-users about the effectiveness of bicycle utilization on cardiovascular endurance. The results of ‘t’ testing revealed that bicycle use over three and six months could demonstrate a significant effect on cardiovascular endurance in secondary school students. Hence, it can be inferred from the result of the ‘t’ test that regular bicycling is potential enough to promote cardiovascular endurance in bicycle users.

A health-related object was constructed as the fifth object to rationalize the effectiveness of bicycle utilization on muscular strength. In order to accomplish the reality of muscular strength under the fifth object, nine null hypotheses were being framed with an orientation toward evidencing the effectiveness of bicycle utilization on the muscular strength of secondary school students. Based on the t-test results, null hypotheses were rejected and alternative hypotheses were formulated, proving the significant difference between bicycle users and bicycle non-users with regard to the effectiveness of bicycle utilization on muscular strength. The results drawn through the "t"-test evidenced that a time period of three months as well as six months of bicycle utilization were sufficient to improve (have a significant effect on) the muscular strength of secondary school students. Hence, it can be inferred from the result derived through the ‘t’ test that regular bicycling has the potential to promote muscular strength in bicycle users.

The sixth and final object of this study was also related to health and fitness, specifically body composition. In order to actualize the sixth objective, nine null hypotheses were formulated with the intention of assessing the effectiveness of bicycle utilization on the body composition of secondary students. Since t-test results, null hypotheses were accepted by proving no significant difference between bicycle users and bicycle non-users with regard to the effectiveness of bicycle utilization on body composition. The t-test results established the ineffectiveness of bicycle utilization on body composition of secondary school students after three and six months of bicycle utilization. Hence, it could be concluded that regular bicycling may not promote the body composition of bicycle users due to scientific reasons.

Chapter-V

Summary, Conclusions and Recommendations

Chapter - V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Sporting activities are very essential for every individual which keeps them fit and fine with physical strength. The power and potential of sports cannot be undermined and its latent has been increasingly recognized at both International and National levels. Globalization of sports was focused since 1870s and then on wards sports have gained attention at national and global level. Status of sports in various countries is prestigious viewed in recent times. It has great importance in each stage of life. It also improves the personality of people. Sports keep our all organs alert and our hearts become stronger by regularly playing some kind of sports. Sports activities in schools ensure discipline which can be beneficial in all areas of life. Through sports, students acquire tactical, mental, and physical training. Students can focus better and have a clearer vision of life managing both sides of life; quality of life and quality of education. These traits are essential for academic success.

Sports offer a value-added proposition to every curriculum area, challenging critical thinking skills, decision making and moral reasoning. The introduction of sports in the school environment, particularly through team activities provide a social network for children based on common interests outside the classroom. Sports can teach values such as fairness behaviours, team building, equality, discipline, inclusion, perseverance and respect. Sports have the power to provide a universal framework for learning values, thus contributing to the development of soft skills needed for responsible citizenship.

Sports teacher’s students to be emotionally strong, most of the students often have to deal with some of the other emotional issues in their life, either at home or in school. The skill they develop through sports helps them to accept all defeats as well as wins. Hence, students who love games and sports are in a much better position to deal with tough situations.

A variety of sports are played across India including football, cricket, golf, tennis, boxing, kabaddi, kho-kho, chess, cycling etc. India has also hosted many national and international level sports events including Asian Games, Cricket World Cup, Hockey World Cup, Common Wealth Games etc. As a first move towards developing an organized and systematic framework for the development and promotion of sports, National Sports Policy was enacted in 1984. The policy was amended in 2001 to increase the coverage, upgradation and development of infrastructure and to strengthen scientific and coaching support among others.

Cycling is a poor man's mode of transportation, a rich man's hobby and a medical activity for the elderly. Cycling is the riding of bicycles for leisure or as part of competition. Cycle as sport is a physical activity that is competitive in nature and uses bicycles. It includes different categories such as road bicycle racing, mountain biking, time trailing, cycle cross, track cycling, cycle speedway and BMX. Bicycle races are popular all over the world, especially in Europe. The countries most devoted to bicycle racing include Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain and Switzerland. As bicycles became more and more affordable in the mid-1800s, cycling began to be taken up by the masses, first recreationally and soon after as a competitive sports. Bicycle racing is recognized as Olympic sports since from 1890s. Cycling is a core Olympic sport and one of five sports that have been contested at every summer Olympic Games since 1896. Olympic cycling was added to the women's program in Los Angeles in 1984.

Cycling as a sport was introduced in India with the efforts of Janki Das in the mid-thirties. Cycling was one of the sports featured at the 1951 Asian Games, which were held at New Delhi's National Stadium. Cycling Federation of India (CFI) is a pioneer in the promotion of cycling sports in India and is affiliated with the Indian Olympic Association, Asian Cycling Confederation and Union Cycliste International. This is the sole body recognized by the Ministry of Youth Affairs and Sports, Government of India, for the promotion of the sport of cycling in India. The primary mission of CFI is to promote sportsmanship and fair play. CFI directs, develops, regulates, and controls all forms of cycling in the country. It promotes cycling at all levels throughout India. It conducts various competitions under the following categories: road events, track events, and mountain bike events.

There is a positive correlation between physical activities and academic performance (Centres for Disease Control and Prevention, 2010). When children, including adolescents, can participate in physical activities for at least 60 minutes daily, it has multiple health benefits. Nowadays, there is a lack of physical activities among youth due to the overuse of technology. Even if schools can facilitate a unique venue for the formation of a healthy generation by serving nearly 56 million youth, they face a collective challenge in balancing physical activity and academic learning (Centers for Disease Control and Prevention, 2010). Because there is a problem with allocating quality time for physical exercise during school time at the secondary school level, and the state government is running a scheme of providing bicycles with the goal of reducing dropout rates, it is the best and most rational way to use the bicycles for nurturing a culture of physical fitness.

The present study was conducted on two hundred (200) government secondary school male students, comprising two groups: 100 bicycle users and 100 non-bicycle users. The 200 selected male students belonged to 8th grade government schools (between the age groups of 13 and 15) from the outskirts of Shivamogga district. This study was limited to five taluks in Shivamogga districts specifically Bhadravathi, Thirthahalli, Shikaripura, Hosanagara and Shivamogga taluks. The selection of data on 100 bicycle users among 8thgrade male students from the five taluks of Shivamogga district was based on distance criteria: those who cycled 5 to 7 kilometres per day between home and school. The 200 selected students in 8thgrade were divided into two groups of 100 each: 100 bicycle users and 100 bicycle non-users. For the present study, 20 bicycle users and 20 bicycle non-users were selected from two schools in each taluks.

Quasi-experimental research designs as the name suggests, use non-experimental (or non-researcher induced) variation in the main independent variable of interest, essentially imitating experimental conditions in which some subjects are exposed to treatment and others are not on a random basis. In this case, the result of the study showed the impact of bicycling on secondary school students' physical fitness, especially (a) three kinds of skill benefits such as explosiveness, balance and agility and (b) three kinds of health-related benefits such as cardiovascular endurance, muscular strength and body composition.

Each variable in the present study was measured in different ways and explosiveness was calculated through the vertical jump test (Sargent, 1921). Whole-body balance ability was measured through the Stork Balance Stand Test (Johnson and Nelson, 1979). The agility was measured through the SEMO agility test (Kirby, 1971). Cardiovascular endurance was measured through the Harvard Step Test (Brouha *et al.*, 1943). Muscular strength was tested through the Plank test (Strand et al., 2014) and the development of body composition was calculated using body mass index. The results of the tests of bicycle users and non-bicycle users were compared based on their respective means, standard deviations and t-test statistical techniques in order to find out the significance of the difference between the bicycle users and non-bicycle users' data.

Analysis of the data obtained through different tests was carried out systematically. Data regarding explosiveness, balance, agility, cardiovascular endurance, muscular strength and body composition were descriptively presented with the help of tables and graphs for a better understanding of the results.

CONCLUSION

1. Physical fitness comprising skills and health benefits is an important element in defining the quality of individual lives in society. The formation of a healthy society is possible only through the formation of a generation that is physically fit, psychologically sound, intellectually enlightened, socially acceptable and mentally upright. Physical fitness and wellness are the most primary requirements for the development of a socially acceptable personality. Good health and fitness enable every person to live their lives to their fullest potential without being physically or mentally disturbed or unfit. Any kind of physical disturbance may

lead to a deterioration of wellbeing in daily life. Acts of healthy living such as exercising and eating well are the best ways to maintain one's wellbeing and contribute to society's wellbeing. People who are serious about their health and wellbeing will take precautions to maintain their survival fitness and will engage in health promoting exercises on a regular basis. Being healthy and fit enables everyone to stay active and healthy in society, family, the workplace, etc. Physical fitness and wellbeing enhance even the confidence and concentration levels of every person. A physically fit person can manage the routine work efficiently without getting fatigued. He can easily handle any difficult situation that comes into his way. It also possesses qualities like good human relations, maturity and self-respect.

2. Among a variety of physical benefits, the health aspects of regular cycling have gained attention in the health sector, allowing in aiming to increased levels of physical activity by encouraging greater investment in cycling rather than relying on other health-related machines. There are a few research studies providing epidemiological evidences for health effects to quantify health impacts in well planned settings. Individual health benefits from bicycle use as a regular physical activity have been shown to outweigh the public health impacts of cycling. There were a number studies were conducted on bicycle utilisation and its health benefits, but there was research gap found for the present study. Hence the study was conducted on bicycle utilisation under the title "Effectiveness of Bicycle Utilization on Physical fitness Components among Secondary School students of Shivamogga District".

3. Physical fitness can be classified into two categories viz., (a) health related fitness and (b) skill related fitness. While health fitness defines the stability of the health condition of every human being and skill related fitness defines the stamina of sportspersons through sporting skill related fitness. Hence 3 health related and 3 skill related variables were being selected for the study. The selected variables for the study are 1) explosiveness, 2) balance, 3) agility, 4) cardiovascular endurance, 5) muscular strength and 6) body composition.

4. The current research was done on 200 male students from government secondary schools, comprising two groups of 100 cyclists and 100 non-cyclists. The selected 200 male children were from Shivamogga district's periphery 8th grade government schools, and they ranged in age from 13 to 15. Bhadravathi, Thirthahalli, Shikaripura, Hosanagara and Shivamogga were five selected taluks of the Shivamogga district that were included in the research. Based on the distance travelled between home and school around 5 to 7 kilometers per day, 100 male eighth-graders from the five taluks of Shivamogga districts were chosen as bicycle users. The selected 200 eighth-grade pupils for the study were split into two groups of 100 each: 100 bicycle users and the remaining 100 bicycle non-users.

5. The study was conducted over six months comprising three stages of tests : a) initial testing b) testing at the end of three months and c) testing at the end of six months.

6. After the study of six months analysis were done over the data collected through different tests. The findings of the study are followings.

- The advancement of explosiveness of 100 bicycle users was found than 100 bicycle non-users among secondary school male students over time span of 6 months that proved effectiveness of bicycle utilisation.
- Effectiveness of bicycle utilization on balance of secondary school male students of 100 bicycle users was found more than that of 100 bicycle non-users.
- Agility of 100 bicycle users was improved due to bicycle utilisation over the agility of 100 bicycle non-users.
- The advancement on cardiovascular endurance of 100 bicycle users was found evident due to effective bicycle utilisation than that of 100 bicycle non-users among secondary school male students.
- Muscular strength of 100 bicycle users was found high due to bicycle utilisation than muscular strength of 100 bicycle non-users among secondary school male students.
- 6 months effective bicycle utilisation showed no significant change on body composition of secondary school students between bicycle users and bicycle non users.

7. The study was designed with six objectives to find the effectiveness of bicycle utilization on body composition of secondary school male students. The difference on the body composition of 100 bicycle users and 100 bicycle non-users among secondary school male students was found. The study proved that there are significant differences between bicycle users and non-users with regard to their explosiveness, balance, agility, cardiovascular endurance and muscular

strength Hence, it can be concluded that, bicycling is one of the best physical activities at the secondary school level in order to promote the physical fitness of adolescents without any kind of compromise between intellectual and physical developments.

RECOMMENDATIONS

Based on the findings of the present analytical study, the following recommendations are formulated:

- With an aim of encouraging and utilizing the health and skill related benefits of bicycling for secondary school students, the government of Karnataka must take the necessary steps in promoting the 'Free Bicycle Distribution Scheme' in more perfect manner.
- There shall be a perfect system for avoiding any kind of malpractice in distributing bicycles under the 'Free Bicycle Distribution Scheme' to a targeted group of students and in utilizing bicycles for health benefits.
- Physical education teachers at every school shall be trained to guide secondary schools regarding the utilization of bicycle.
- Since it was a quasi-experimental study, a true experimental study can also be conducted on secondary school students to ensure the real impact of bicycling on secondary school students.
- A study on diet patterns and their influence on the performance of bicycle users may be conducted.
- An examination of the reasons for the fall in the number of cyclists participating competitive cycling is needed.

- Sports authorities at the state and national levels shall hold bicycle competitions at the state and national levels among secondary school students.
- Curriculum developers shall initiate the inclusion of bicycle training as a part of the school curriculum.
- Similar study may be conducted on skill and health-related benefits of bicycle users in different districts of Karnataka so that we can ensure whether food habits, culture, climate, geographical area, etc. of different districts will impact the skill and health benefits of bicycle users.
- A descriptive study on the attitudes and feedback of beneficiaries of the 'Free Bicycle Distribution Scheme' in Karnataka can be conducted.
- A study on government assistance and its effective utilization in the 'Free Bicycle Distribution Scheme' can be conducted.
- A case study can be initiated on the development of sporting skills among bicycle users who benefited from the 'Free Bicycle Distribution Scheme'.
- A study may be conducted on the 'Free Bicycle Distribution Scheme' of Karnataka in encouraging the enrolment of girls in schools.
- A study on the 'Free Bicycle Distribution Scheme' of Karnataka in enhancing secondary school students' studies and ability to retain information.
- Study on the impact of 'Free Bicycle Distribution Scheme' of Karnataka in motivating secondary school students' education and enhancing their willpower will be conducted.
- A study on the impact of the 'Free Bicycle Distribution Scheme' of Karnataka in enhancing the quality of secondary school education could be initiated.

Bibliography

BIBLIOGRAPHY

Abu Omar K. Rutten. (2008). Relation of leisure time, occupational, domestic and commuting physical activity to health indicators in Europe. *Prev. Med., 47*, 319–323.

Amador García Ramos, Danica Janicijevic, Juande Cobo Font, Daniel Marcos Frutos, John F.T. Fernandes, Wolfgang Taube & Alejandro Pérez-Castilla. (2020). Knowledge of results during vertical jump testing: an effective method to increase the performance but not the consistency of vertical jumps. *Sports Biomechanics, 23*(29), 1-15.

Amir Hossein Haghighi, Javad Cheraghian, Mohammad Reza Hamedinia & Javad Harati. (2018). Comparing the effect of a jump rope training on physical and motor fitness components among primary school boy and girl students. *Journal of Physical Fitness Medicine and Treatment in Sports, 3*(1), 1-7.

Amuthamozhi Sivachandiran. (2020). Evaluation of physical fitness among student population using modified Harvard step test. *Indian Journal of Research, 9*(1), 72-73.

Andersen, L.B., Schnohr, P., & Schroll. (2000). All-cause mortality associated with physical activity during leisure time, work, sports, and cycling to work. *Arch. Intern. Med., 160*, 1621–1628.

Apoorva Uday Munagekar & Apoorva Likhite. (2021). Comparison of physical fitness index (PFI) between spinning (indoor cycling) female practitioners and Zumba female practitioners using modified Harvard's step test. *International Journal of Physiotherapy and Research, 9*(2), 3800-3807.

Atsushi Imai & Koji Kaneoka. (2016). The relationship between trunk endurance plank tests and athletic performance tests in adolescent soccer players. *The International Journal of Sports Physical Therapy, 11*(5), 718-724.

Bourne, J.E., Sauchelli, S., & Perry, R. (2018).Health benefits of electrically-assisted cycling: a systematic review. *International Journal of Behavioural Nutritional and Physical Activity, 15*(116), 1-16.

Cemali Çankaya, Ramiz Arabac, Esra Kurt, Seray Doğan, Sadettin Erol, Ahmet Nazım Gürak & Faruk Korkmaz. (2018). Examining the effects of the pliometric (jump squat) exercise on vertical jump in female volleyball players. *European Journal of Physical Education and Sport Science, 5*(2), 115-124.

Chavarrias Manuel, Carlos Vivas Jorge, Collado-Mateo Daniel & Pérez-Gómez Jorge. (2019). Health benefits of indoor cycling: A systematic review. *Medicine*, *55*(8), 452.

Clutch, D., & Wilton, M. (1983).The effect of depth jumps and weight training on leg strength and vertical jump. *Res. Q., 54,* 5-10.

Daniel Piatkowski & Melissa Bopp. (2021). Increasing bicycling for transportation: A systematic review of the literature. *American Society of Civil Engineers, 147*(2), 1-8.

Dharmesh Parmar & Nikita Modh. (2015). Study of physical fitness index using modified Harvard step test in relation with gender in physiotherapy students. *Medicine Science, 4*(7), 1215-1217.

Emily Frith & Paul D. Loprinzi. (2019). Association between motor skills and musculoskeletal physical fitness among preschoolers. *Maternal and Child Health Journal*, *23*(18), 1003-1007.

Eshita & Lakhvinder Kaur. (2018). Influence of height and weight on physical fitness index of amateur gymers of age 17 years. *International Research Journal of Engineering and Technology, 05*(06), 3236-3240.

Garcia, A.W., Pender, N.J., Antonakos, C.L., & Ronis, D.L. (1998).Changes in physical activity beliefs and behaviours of boys and girls across the transition to junior high school. *Journal of Adolescent Health, 22*(5), 394-402.

Garden Tabacchi, Guillermo F. Lopez Sanchez, Fatma Nese Sahin, Meltem Kizilyalli, Rosario Genchi, Michele Basile, Musa Kirkar, Carlos Silva, Nuno Loureiro, Eduardo Teixeira, Yolanda Demetriou, David Joseph Sturm, Simona Pajaujene, Ilona J. Zuoziene, Manuel Gómez López, Ante Rada, Jelena Pausic, Nemanja Lakicevic, Luca Petrigna, Kaltrina Feka, Ana Ribeiro, Marianna Alesi & Antonino Bianco. (2019). Field based tests for the assessment of physical fitness in children and adolescents practicing sport: a systematic review within the ESA program, *Sustainability, 11*(24), 1-21.

Grover Pranjal, Pardeshi Tejal, Phadke Shweta & Tilak Pranati. (2020). Co-relation of timed forearm plank test with basal metabolic rate in sedentary urban females of age group 25 to 55 years. *International Research Journal of Engineering and Technology, 07*(08), 340-348.

Hanjababambarun Sharma, Shalini Gandhi, Konthoujam Kosanameitei, Jyoti Dvivedi & Sanjay Dvivedi. (2017). Anthropometric basis of vertical jump performance: a study in young Indian national players. *Journal of Clinical and Diagnostic Research, 11*(2), 01-05.

Heinberg, L.J., & Thompson, J.K. (2009).*Obesity in Youth : Causes, Consequences and Cures.* Washington, D.C.: American Psychological Association.

James D. George, Jeffrey R. Tolley, Pat R. Vehrs, Joel D. Reece, Fatih M. Akay & Edward D.J. Cambridge. (2018). New approach in assessing core muscle endurance using ratings of perceived exertion. *J. Strength Cond. Res., 32*(4), 1081-1088.

Jason Anderson & Amy Lightfoot. (2019). The school education system in India: An overview. *Research Gate, 07*(01), 1-61.

Jessica Bourne, E., Sauchelli Sarah, Perry Rachel, Page Angie, Leary Sam, England Clare & R. Ashley Cooper. (2018). Health benefits of electrically-assisted cycling: A systematic review. *International Journal of Behavioural Nutrition and Physical Activity, 15*(1), 1-15.

Kaja Pogačaret. (2020). Determinants of bicycle use among student population: Exploratory research of social and infrastructure factors. *Research Gate, 3*(6), 1-17.

Karthik Muralidharan & Nishith Prakash. (2017). Cycling to school: Increasing secondary school enrolment for girls in India. *American Economic Journal, 9*(3), 321–350.

Kwong Chung Hung, HoWa Chung, Clare Chung Wah Yu, Hong Chung Lai & Feng Hua Sun. (2019). Effects of 8-week core training on core endurance and running economy. *Plos One, 14*(3), 1-12.

Loprinzi, P.D., & Davis, R.E. (2016). Bouted and non-bouted moderate to vigorous physical activity with health-related quality of life. *Preventive Medicine Reports, 3,* 46–48.

Luca Petrigna, Bettina Karsten, Giuseppe Marcolin, Antonio Paoli, Giuseppe D'Antona, Antonio Palma & Antonino Bianco. (2019). A review of countermovement and squat jump testing methods in the context of public health examination in adolescence: reliability and feasibility of current testing procedures. *Frontiers in Physiology, 10,* 1364-1384.

Maher, J.P., Pincus, A.L., Ram, N., & Conroy, D.E. (2015). Daily physical activity and life satisfaction across adulthood. *Developmental Psychology, 51*(10), 1407–1419.

Merkes Paul, Mensapà Paolo & Abbiss Chris. (2020). Sprinting in road cycling literature review. *Journal of Science and Cycling, 9*(3), 29-52.

Meryem Gülac. (2019). Examination of the correlation between dynamic balance and leg strength of 11 and 12-year-old children who have fencing training. *Asian Journal of Education and Training, 5*(1), 39-43.

Mohan Balaji, Vigneshwar, R., Rathna Narand, R., & Iyyanar K. (2019). Design fabrication and performance of push plank equipment for fitness. *International Journal of Engineering Research and Technology, 8*(08), 152-155.

Mohar Kassim & Mat Berahim. (2015). Football training development programme under-15 state level. *Australian Journal of Basic and Applied Sciences*, *9*(34), 103-109.

Muthukumaran Jothilingam, Shaziya Thabasum, T., & Jagatheesan Alagesan. (2019). A study on effectiveness of reaction ball training on agility among young adults. *Journal of Critical Reviews, 6*(6), 2600-2604.

Nan Zeng, Mohammad Ayyub, Haichun Sun, Xu Wen, Ping Xiang & Zan Gao. (2017). Effects of physical activity on motor skills and cognitive development in early childhood: A systematic review. *Hindawi Bio. Med. Research International, 7*(6), 1-13.

Oja, P., Titze, S., Bauman, A., de Geus, B., Krenn, P., Reger-Nash, B., & Kohlberger, T. (2011). Health benefits of cycling: A systematic review. *Scandinavian Journal of Medicine and Science in Sports, 21*(4), 496-509.

Pamela E. Jeter, Ame´lie Franc¸ Oise Nkodo, Steffany Haaz Moonaz & Gislin Dagnelie. (2014). A systematic review of yoga for balance in a healthy population. *The Journal of Alternative and Complementary Medicine, 20*(4), 221–232.

Pawiter Singh. (2018). Assessment of agility, strength and flexibility parameters between badminton and lawn tennis players. *International Journal of Physiology, Nutrition and Physical Education, 3*(2), 221-223.

Pengpid, S., & Peltzer, K. (2019). Sedentary behaviour, physical activity and life satisfaction, happiness and perceived health status in university students from 24 countries. *International Journal of Environmental Research and Public Health, 16*(12), 2084.

Pooja Ojha, Nitin Pandey & Seema Singh. (2018). Physical fitness score and academic performance in medical students. *National Journal of Physiology, Pharmacy and Pharmacology, 8*(7), 1031-1034.

Pranjal Grover, Tejal Pardeshi, Shweta Phadke & Pranati Tilak. (2020). Correlation of timed forearm plank test with basal metabolic rate in sedentary urban females of age group 25 to 55 years. *International Research Journal of Engineering and Technology, 07*(08), 2510-2513.

Pucher, J., & Buehler, R. (2008). Making cycling irresistible: lessons from the Netherlands, Denmark and Germany. *Transport Reviews, 28*(4), 495-528.

Rafał Szafraniec, Janusz Bartkowski & Adam Kawczyński. (2020). Effects of short-term core stability training on dynamic balance and trunk muscle endurance in novice Olympic weight lifters. *Journal of Human Kinetics, 31*(74), 43-50.

Sandip Sankar Ghosh & Chayan Majumder. (2013). A study on agility and dynamic balance of kho-kho handball and basketball players. *International Journal of Scientific Research, 2*(7), 442-444.

Shraddha Patil & Aashirwad Mahajan. (2020). Effect of graded plank protocol on core stability in sedentary dentists. *International Journal of Research and Review, 7*(2), 407-411.

Singgih Hendarto, Tandiyo Rahayu & Soegiyanto. (2018). Development of taekwondo physical instruments: Test ages of 14-17 years old. *Journal of Physical Education and Sport, 18*(4), 2207-2220.

Thomas Götschi, Jan Garrard & Billie Giles Corti. (2016). Cycling as a part of daily life: A review of health perspectives. *Transport Reviews, 36*(1), 45-71.

Vedrana Sember, Janja Groselj & Maja Pajek. (2020). Balance tests in pre-adolescent children: retest reliability, construct validity and relative ability. *International Journal of Environmental Research and Public Health, 17*(3), 1-13.

Youne´s Hachana, Helmi Chaabene, Ghada Ben Rajeb, Riadh Khlifa, Ridha Aouadi, Karim Chamari and Tim J. Gabbett. (2014). Validity and reliability of new agility test among elite and sub-elite under 14-soccer players. *Plos One, 9*(4), 144-150.

Zakiuddin, M., Saha, S., & Khalid, Z. (2016). A cross sectional study of physical fitness index using modified Harvard step test in relation with body mass index in medical students. *J. Evolution Med. Dent. Sci., 5*(42), 2621-2624.

Zhang Z., & Chen, W. (2019).A systematic review of the relationship between physical activity and happiness. *J. Happiness, 20,* 1305–1322.

Appendices

APPENDICES

Appendix-1

SCORE SHEET OF FITNESS COMPONENTS

Health related score sheet

School Name : ……………………………………….

Sl. No.	Name of the Student	Harvard Step Test				Plank Test				Height	Weight	BMI
		1	2	3	4	1	2	3	Best Performance			
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

Physical Fitness Related Score Sheet

School Name : ……………………………………….

Sl. No.	Name of the student	Power (Vertical Jump)					Balance Test (Stork Single Leg)				SEMO Agility Test
		Sample	1	2	3	Best	1	2	3	Best	
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

Appendix-2

RESEARCH PUBLICATIONS

'Akshar Wangmay' UGC Care Listed, International Research Journal, ISSN: 2229-4929, March 2022, Special Issue-V, Volume-I
"Current Scenario in Languages, Social Sciences, and its Impact on Social Development"

An Study on The Effectiveness of Bicycle Utilization on Explosiveness Power of Secondary School Students

Praveena A[1] Dr. Appanna M Gasti[2]
[1] Research Scholar, Department of P.G. studies and research in Physical Education, Kuvempu University, Shankaraghatta, Shivamogga
[2]Retired Deputy Director, Department of P.G. Studies and research in Physical Education, Kuvempu University, Shankaraghatta, Shivamogga District, India.

Abstract:

Health, wellbeing and physical fitness are most important factors in leading a happy life. Strength and conditioning training are now an integral part in acquiring Health and physical fitness. Explosive power development is essential for getting stronger, speedy movements, loss of body fat, growth of new muscles, etc. there are number of ways to improve the explosive power of students in their teenage. Bicycle has a powerful impact on physical fitness and health of students. The purpose of this research paper was to find out the effectiveness of bicycling in enhancing explosive power of secondary school students. It as a quasi-experimental study conducted over 200 male students comprising two groups; 100 bicycle using students and 100 bicycle non using students. Statistical techniques used for this study are percentage analysis and 't' test. The study showed that there is a significant difference between bicycle user groups and bicycle non users' groups which means bicycling showed an increase in explosive power of the students.

Keywords: bicycle and its Impact, explosive power of students, physical fitness of teenagers.

Introduction

Obesity, physical inactiveness, tiredness, physical weakness, etc are the more or less damages the lives of the learners during their teenage due to their overinfluence of mobile and technological over dependency. Most of the learners reluctant to have physical exercise due to educational stress. Being physically fit and healthy one needs to be physically active. Healthy mid and body only can support wellness of mind, body and intellect. Regular physical activity can help protect everyone from serious diseases such as obesity and physical ups and downs. Cycling is a healthy, low-impact exercise that can be enjoyed by people of all ages, from young children to older adults. It is also fun, cheap and good for the environment. Since sports in the time of school hours is limited to time and space, hence riding bicycle regularly can be considered as one of the best ways to maintain health of the teenagers during their school life. It is also one of the best ways to reduce the risk of health problems associated with a sedentary lifestyle. The cycling is very economical too for the students. Cycling to school is one of the most time-efficient ways to combine regular exercise with your everyday routine. Cyclising can even keep the learner physically fit by increasing the his/her explosive power.Cycling is a form of physical activity that electively taxes the cardiorespiratory and metabolic functions of the whole body in a wide range of intensities and thus lends itself to many potential health benefits.

Cycling is a form of physical activity that effec-tively taxes the cardiorespiratory and metabolic functions of the whole body in a wide range of intensities and thus lends itself to many potential health benefit

Review of literature

There are number studies conducted on explosive power some of which are briefed below. Clutch D, Wilton M (1983). conducted a research study on the explosive power of four groups: a resistance training only group, a resistance training and depth jumping group, a volleyball playing and resistance training group, and a volleyball playing, resistance training and depth jumping group. Cronin and Hansen (2003) investigated strength and power (explosive power) as predictors of sports speed.Abu-Omar & Rutten (2008) again made a study on active commuting combinewalking and cycling. Andersen LB, (2000) had depth study on All-cause mortalityassociated with physical activity during leisure time, work, sports, and cycling, walking and cyclingto work. Even though there are number studies are being conducted on cycling benefits and explosive power separately, there is found a research gap for the present study on effectiveness of bicycle utilisation on in the increase of explosive power among teenagers.

Objectives

The objective of this quasi-research study was to study the effectiveness of bicycling in the development of explosive power among secondary school students.

Methodology/Design

This was a quasi-experimental study conducted over 200 hundred 9th-grade male students (between age group of 14 to 16) in Shivamogga district, Karnataka. This quasi-experimental design

Journal of the Asiatic Society of Mumbai
ISSN : 0972-0766 UGC Care Group 1 Journal

A STUDY ON EFFECTIVENESS OF BICYCLE UTILIZATION TO DEVELOPE BALANCE IN PHYSICAL FITNESS AMONG SECONDARY SCHOOL STUDENTS

Praveena A
Research Scholar, Department of P.G. studies and research in Physical Education, Kuvempu University, Shankaraghatta, Shivamogga

Dr.Appanna M Gasti
Department of Physical Education, Kuvempu University, Shankaraghatta, Shivamogga District, India.

Abstract:
Balance of physical fitness is one of the most inevitable fitness components of every human person and it is an imperative factor for success of every sports person. Even though health, wellbeing and physical fitness are the most important factors in leading a happy life, balance has got specific and unique space in defining these three factors. Gaining balance of physical fitness includes body awareness, body Coordination, Joint Stability, improvement Reaction Time, gaining long term health, etc. Balance is the ability to maintain control of a particular body position whilst performing a given task with minimal postural sway. This could be achieved simply by sitting at a table, standing on one leg or riding a bike/bicycle. Maintaining control of body positioning requires good static and dynamic balance, reducing the energy required to perform a host of tasks and activities whilst minimising fatigue. Since bicycles have a powerful impact on physical fitness and health of students, it can definitely contribute to the development of balance. The purpose of this research paper was to find out the effectiveness of bicycling in enhancing the balance of secondary school students. It was a quasi-experimental study conducted over 200 male students comprising two groups; 100 bicycle using students and 100 bicycle non using students. Statistical techniques used for this study are percentage analysis and 't' test. The study showed that there is a significant difference between bicycle user groups and bicycle non users' groups which means bicycling showed an increase in balance of physical fitness of the students.
Keywords: bicycle and its Impact, balance, physical fitness, teenagers and balance.

Introduction

Even though the concept of balance is a general topic, many may not understand what it refers to and why it's so important and how it can be developed. There are several reasons why body balance is important. After all, measuring the body allows humans to improve their health, fitness and quality of life. Balance is important since it plays an important role in understanding one's health and wellness and allows everyone to accurately gain one's health and plan lifestyle and diet accordingly, (Andersen LB, 2000). A healthy and balanced physical fitness system gives one more energy and strength and helps him/her move freely and confidently. Keeping one's balance system healthy is especially important if one has problems due to health issues. Balance is defined as your ability to carry out tasks while maintaining a controlled body position.

Health and physical fitness are two important factors in defining a healthy generation. Hence the role of school education is more decisive in this matter. The entire school education is well designed to foster the physical, mental, psychological, and social wellbeing of every student with a good orientation, (Abu-Omar K, Rutten, 2008). Balance is one of the key components of fitness and is valuable in many sports and physical activities. Being able to maintain balance is important for children as it helps in

Appendix-3

PLAGIARISM CHECK CERTIFICATE

Ouriginal
by Turnitin

Document Information

Analyzed document	KU-TH-PHY-PRAVEENA-A-22.pdf (D150517108)
Submitted	2022-11-22 08:19:00
Submitted by	Walmiki R H
Submitter email	walmiki_rh@rediffmail.com
Similarity	1%
Analysis address	walmiki_rh.kuvempu@analysis.urkund.com

Sources included in the report

SA	**V.SUBRAMANI Ph.D Thesis REG.NO17172.docx** Document V.SUBRAMANI Ph.D Thesis REG.NO17172.docx (D37682455)	3
SA	**Main.docx** Document Main.docx (D54106750)	1
SA	**RKU_Hitesh_Modhavadiya.docx** Document RKU_Hitesh_Modhavadiya.docx (D46657236)	1
SA	**Mukesh Mishra thesis....Physical Education..docx** Document Mukesh Mishra thesis....Physical Education..docx (D34228473)	2
SA	**Garden City University / VASSUPRATHA MPT DIOSSERTATION.pdf** Document VASSUPRATHA MPT DIOSSERTATION.pdf (D71019624) Submitted by: pinky181297@gcu.ac.in Receiver: sudhan.sg.garden@analysis.urkund.com	3
SA	**CHAPTER 2.pdf** Document CHAPTER 2.pdf (D54474238)	1
SA	**Karnataka State Womens University, Vijyapur / parvati final theis.docx** Document parvati final theis.docx (D95250806) Submitted by: kswuvlibrary@gmail.com Receiver: kswuvlibrary.kswu@analysis.urkund.com	6
SA	**all phd chapter done.docx** Document all phd chapter done.docx (D40553689)	2

Entire Document