UNIVERSITY OF CAPE COAST

EFFECTS OF NINE-WEEK FARTLEK TRAINING ON HEALTH-RELATED FITNESS OF ADIDOME SENIOR HIGH SCHOOL STUDENTS

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BY

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Thesis submitted to the Department of Health, Physical Education and Recreation of the Faculty of Science and Technology Education, College of Education Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Master of Philosophy Degree in Physical Education.

JULY 2023

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: …… Date:…….

Name: Selorm Junior Dusu

Supervisors' Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Supervisor's Signature: ……..… Date: ……..……..……

Name: Mr. Michael Agyei

ABSTRACT

Despite evidence that engagements in training methods have physical fitness gains, millions of Ghanaians seem to practice sedentary lifestyles. In order to effect change, it is very important that Physical Education teachers include fartlek as part of routine health maintenance for their students. Using the one-group pre-test post-test repeated measures pre-experimental design, this study investigated the effects of nine-week fartlek training on health-related fitness of Adidome senior high school students. Forty-eight students were selected for the study using simple random sampling (without replacement) technique. A researcher-generated data summary sheet was used to collect data and the American Alliance for Health, Physical, Education, Recreation and Dance functional fitness test was designed to measure body composition, muscular strength, cardiovascular endurance, flexibility and muscular endurance. Two hypotheses were tested with independent samples t-test, and a paired sample t-test, all at 95% confidence level. There was statistically significant difference in all the Health-Related Fitness components of the students of Adidome SHS after the 9-week fartlek training programme. This reflected in the t-test values obtained and interpreted. There was statistically significant difference in all the health-related fitness components between the male and female students of Adidome SHS after the 9-week fartlek training activities. The mean difference indicated that the male students had improved Health-Related Fitness levels than the female students. It was recommended that physical education and sports teachers should adopt the fartlek training protocols. Female students should be encourage to participate fully in training programmes to also improve their Health-Related Fitness components.

KEYWORDS

Fartlek Training

Muscular Endurance

Muscular Strength

Cardiovascular Endurance

Flexibility

Body Composition

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DEDICATION

To Madam Beatrice Fosua Sunu and my family

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LIST OF ACRONYMS

SCT	Means Social Cognitive Theory
SDT	Means Social Determination Theory
SHS	Means Senior High School
P. E	Means Physical Education
USDHHS	Means United State Department of Health and Human Services

CHAPTER ONE

INTRODUCTION

Anecdotal evidence shows that a lot of students in schools are not interested in physical activity (PA), leading to health problems, including obesity, high blood pressure, heart attack, and stroke (WHO 2008). Regular PA has been regarded as an important component of a healthy lifestyle and has been proven to increase longevity and the overall quality of life (Caspersen, Powell & Christenson, 2012).

This stand has been reinforced by scientific data linking PA to a wide array of physical and mental health benefits (Caspersen et al., 2012). Despite this evidence and the apparent heightened public awareness, millions of Ghanaians seem to practice sedentary lifestyles. In order to effect change, it is very important that Physical Education (P.E.) teachers include training methods as part of routine health maintenance for their students. Fartlek is one such training method. This chapter deals with the background to the study, statement of the problem, purpose of the study, hypotheses, significance of the study, delimitations, limitations, definitions of terms and organisation of the study.

Background to the Study

According to Ministry of Education [(MOE] (2010), PE are to be taught in all Senior High Schools (SHS) in Ghana. Yet many schools have frequently sacrificed P.E. periods for examinable school subjects such as Mathematics, English, Integrated Science and so on. This has made teaching of P.E. as well as the organisation of sporting competitions among schools and

colleges, which aimed at providing a variety of enjoyable PAs for the youth to stay healthy and fit, lose its position in the school curriculum.

Fartlek, a Swedish term that means ‘’speed play,” is a form of interval or speed training that can be effective in improving one’s running speed and endurance. It involves varying one’s pace throughout a run, alternating between fast segments, slow jogs and walks (Kumar, 2015). The concept of Fartlek training was developed back in the 1930s by a man named Gosta Holmer. According to Kumar, Gosta had been a Swedish decathlete, winning a bronze medal at the 1912 Olympics, and later became the coach of the Swedish cross-country team.

Many runners, especially beginners, enjoy Fartlek training because it involves speed work, but it is more flexible than and not as demanding as traditional interval training. Fartlek training can be done on all types of terrain, such as roads, trails, hills and tracks. Fartlek training puts a little extra stress on one’s system, but can improve both the aerobic and anaerobic capacity of the athlete (Kumar, 2015). Research shows that many coaches use Fartlek training because it provides relief from highly structured types of training (Jayasivarajan & Vasanthi, 2012). Fartlek training is generally associated with running, but can include almost any kinds of exercise. One important aspect of Fartlek training is its provision of fun and play which students enjoy most.

The awareness to stay healthy in order to enjoy a meaningful life has been the concern of the government of Ghana. A healthy nation, it is believed, leads to increased production and also lowers the health cost of the government. The Ministry of Health (MOH) has been doing its best in the

creation of health-related physical fitness awareness through the initiation of weekly health-walk programmes at all levels. This has become necessary, because in Ghana, participation in sporting activities is not popular with the adult population and this has become a worry for the nation. According to Blair and Connelly (as cited in Akosa, Nyonator, Philips & Jones, 2003), a sedentary and unfit way of life leads to high risk for several chronic diseases and premature mortality. Sedentary and unfit individuals are also more likely to develop functional limitations as they age.

Numerous scientific-professional studies emphasise the cause-effect connection of PA, physical fitness and the health of the individual (Dzepina & Cavlek, 2004; Mišigoj-Duraković, 2008). Physical fitness is a combination of physical and psychological attributes defined as a physiologic state of well-being that allows one to meet the demands of daily living or that provides the basis for sports performance or both (Warburton, Nicol & Bredin, 2006). PA is any bodily movement carried out by the skeletal muscles that require energy expenditure (Caspersen et al., 2012), which undoubtedly play a pivotal role in the life of every individual as well as every country's development. This development spans from socio-economic to the political sphere.

Health-related fitness in this context is described as a set of attributes which relates to the ability to perform physical and daily functional activities. Heath-Related fitness consists of those components of physical fitness that have a relationship with good health. The components are body composition, cardiovascular endurance, flexibility, muscular endurance and muscular strength. Body composition relates to the relative amounts of muscle, fat, bone

and other vital parts of the body (United States Department of Health and Human Services [USDHHS], 2010).

Cardiovascular endurance relates to ability of the circulatory and respiratory systems to supply oxygen during sustained physical activity (PA). A VO_2 max test in the laboratory setting is considered to be the best measure of cardiovascular fitness. Commonly administered field tests include the One mile run/walk, the 12-minute run, the PACER run for children and various bicycle, step, and treadmill tests. Flexibility is concerned with the range of motion available at a joint (USDHHS, 2010). Some experts specify that flexibility requires range of motion without discomfort or pain (Howley & Franks, 2007). Flexibility is specific to each joint of the body, thus there is no general measurement of flexibility as there is for cardiovascular endurance. Flexibility is typically measured in the lab using measurement devices such as a goniometer, flexometer and in the field with test exercises such as the sit and reach, and the zipper.

Muscular endurance relates to a muscle's ability to continue to perform without fatigue (USDHHS, 2010). Muscular endurance is specific in nature. For true assessment of muscular endurance it would be necessary to test each major muscle group of the body. Laboratory and field tests of muscular endurance are similar and are based on the number of repetitions that can be performed by the specific muscle group being tested (for example, repetitions of push-ups or abdominal curls). Muscular endurance can be measured isometrically (static contractions) or isotonically (dynamic contractions).

Muscular Strength relates to the ability of the muscle to exert force (USDHHS, 2010). According to USDHHS, strength is specific in nature. For true assessment it would be necessary to test each major muscle group of the body. Laboratory and field tests are similar and involve the assessment of one repetition maximum (the maximum amount of resistance you can overcome one time [1RM]. Strength can also be assessed isometrically (static contractions) or isotonically (dynamic contractions) using dynamometers.

Two well-established theories for understanding PA behaviour were considered for the study, namely, Social Cognitive Theory (SCT) and Self-Determination Theory (SDT). One of the theories that have received widespread attention in predicting and explaining health behaviours is SCT (Bandura, 2004). While this theory recognises how environments affect behaviour, it also focuses on the individual's potential abilities to alter environments to achieve their purpose. Bandura presented two primary determinants of behaviour in SCT, these are self-efficacy and outcome expectations.

Self-efficacy is an individual's beliefs about their capacity to exhibit a behaviour (Bandura, 2004). Self-efficacy is widely known as one of the strongest determinants of PA participation (McAuley, Blissmer, Katula, Duncan, & Mihalko, 2000). Bandura observed that outcome expectations represent an individual's beliefs about the value and likelihood of the consequences of performing behaviour. SCT assumes that the individual will act in ways that they believe will lead to positive outcomes and avoid behaviours that they believe will result in negative outcomes.

SDT explains human motivation, by focusing on the importance of human inner resources for development and behavioural regulation (Ryan & Deci, 2000). In this theory, human beings are assumed to be active in nature and have natural and innate tendencies to develop an untied sense of self (Deci & Ryan, 2008). Based on this fundamental assumption, SDT postulates that the desire to meet one's innate needs is the fundamental motive for human behaviour, but the motivation cannot be taken for granted because the environmental factors can either encourage or thwart the innate tendency to act. Deci and Ryan observed that the interaction between individual and social context is the basis for human motivation, behaviour, and well-being, which makes it an appropriate theoretical framework to understand the learning environment and student participating in physical activities.

The conceptual framework for the study is based on Bandura's SCT. The dynamic interaction of the person, behaviour, and the environmental factors will lead to healthy lifestyle. The students readiness, the students behaviour and the environment with good and well planned activities will definitely improve their health-related fitness.

A lot of literatures have talked about regular physical activity and its numerous health benefits (Akosa et al., 2003; Strong et al., 2005; Warburton et al., 2006). With changing social and economic patterns all over the world, sedentary lifestyles have become a worldwide phenomenon (Lee, Macfarlane, Lam & Stewart, 2011). This phenomenon is common in teenagers, adults, and the elderly worldwide (Timori & Esmailnasab, 2011). Despite all significant effects on human life, technology has increased the tendency to inactive lifestyles. Today, lack of PA is considered as one of the most important

problems in the field of public health (Solhi, Motlagh, Shirazi, Taghdisi & Jalilian, 2012; Tabatabaei, Taghdisi, Sadeghi & Nakhaei, 2010). PA activity has an important role in reducing the risk of diseases such as cardiovascular disease, diabetes, cancer, and in weight management to prevent obesity (Van Wier et al., 2006).

In Africa, for that matter Ghana, PA such as walking for a long distance and engaging in household chores are the lifestyle of the older generation. The current generation is living affluent sedentary lifestyles which are associated with the Western world, and this has become a worry for the nation. The high sedentary lives of most of the working class and the use of machines to replace manual labour, coupled with lack of exercise seem to be the causes of health problems in Ghana (Van Wier et al., 2006).

It is an undeniable fact that development in a country is achieved by the actions of humans through the application of cognitive, psychomotor and affective domains which are mainly guaranteed by a healthy body. The quality fitness status of the citizenry of a country directly reflects the quality of that country's development as well as the livelihood of the people. The rising physical fitness-related health problems, including obesity, high blood pressure, heart attack, and stroke are enough to send serious signals to the government (Van Wier et al., 2006).

Statement of the Problem

Regular PA has been regarded as an important component of a healthy lifestyle and has been proven to increase longevity and the overall quality of life (Caspersen et al., 2012). Recently, this stand has been reinforced by scientific data linking PA to a wide array of physical and mental health

benefits (Caspersen, et al., 2012). Despite this evidence and the apparent heightened public awareness, millions of Ghanaian students continue to practice sedentary lifestyles.

Many studies have proved that regular PA give health benefits by positively affecting body composition, immune system and musculoskeletal development for both males and females (Caspersen et al., 2012; Strong et al., 2005; Warburton et al., 2006). These studies used different training methods as intervention tools. Research also shows that Fartlek training has positive effects on health-related components (Mackenzie, 2014).

However, report from the Adidome Senior High School (SHS) clinic (2018), shows rising health-related problems like cardiovascular diseases, heart attack, diabetes among the students. It is for this reason that the study seeks to provide information about Fartlek training and find out its effects on Health-Related Fitness among students of Adidome SHS.

Purpose of the Study

The study examined the effects of nine-week Fartlek training on HRF of Adidome SHS students.

Hypothesis

The following hypotheses were set to guide the study:

1: There will be statistically significant effect of nine-week Fartlek training on Health-Related Fitness of Adidome SHS students.

2: There will be statistically significant difference between Health-Related Fitness and gender among Adidome SHS students.

Significance of the Study

This study would be beneficial to the Head and Management of the school, the P.E teachers, the students and parents as well to improve their overall quality of life. Parents would find this research very significant as it would help them make informed choices to encourage their children to actively involve themselves in regular physical activities. Students would find this research very significant as it would help them make informed choices to actively involve themselves in regular Fartlek training. This research would be significant as it would add to existing literature and also spark the interest of other researchers to study related topics in their researches.

Delimitations

The total population of Adidome SHS is 2,853 students this comprises form one gold track, form one green track, form two gold and green tracks and form three students. This study was delimited to form one gold track students only because they were in school during the data collection period. The study was also delimited to the measurement of Health-Related Fitness components with the following instruments:

1. Cardiovascular endurance was measured with 12 minutes run/walk Cooper test.
2. Body composition was measured by body mass index (BMI)
3. Flexibility was measured with sit and reach on the Acuflex box.
4. Muscular endurance was measured by pull-ups.
5. Muscular strength was measured by modified push-ups and standing broad jump.

The criterion measures from American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) functional fitness testing was also chosen for this study, whiles the SPSS window 20.0 was used to conduct the analysis. The one group pretest-posttest repeated measure design was used.

The independent samples t-test was used to determine the significant differences between and gender. Paired t-test was used to determine the significant effect of Fartlek training on Health-Related Fitness.

Limitations

The study did not use a control group which could have provided a relatively firm basis that indeed, engaging in Fartlek training intervention programme three times in a week over a period of nine weeks improved the Health-Related Fitness of the Adidome SHS students. Moreover, even though the participants were advised to engage in Fartlek training if they would want to exercise, the guarantee that they followed such instructions and that they did not do any other PA except fartlek training, which might have influenced the findings, could not be established. Also, the dietary patterns and behaviours of participants was not controlled for, subjecting the results of the study to interrogations.

In trying to limit the effects of these limitations, participants were advised on the negative effects of eating junk foods on their HRF both at home and during school hours. Also, participants were taken through the fartlek training intervention at the same time to avoid discrepancies in the effects of the intervention.

Definition of Terms

Fartlek: Is a Swedish terms which means 'Speed play'

Fartlek training: It involves varying one's pace throughout a run, alternating between fast segments, slow jogs and walks.

Gold Track: Gold track represents the second batch of students who would go to school after the green track goes for a semester break.

Green Track: Green track represents the first batch of students who would go to school for a semester.

Organisation of the Study

The study was organised under five chapters. The first chapter focused on the introduction. It comprised the background to the study, statement of the problem, purpose of the study, research hypotheses, significance of the study, delimitations, limitations, and definitions of terms. In Chapter Two, the theoretical framework, conceptual framework and related literature was reviewed to support the study. This was grouped under themes to reflect the research hypothesis. Topics such as definition and concept of PA and HRF, health benefits of engaging in physical activity, factors that hinder student's participation in PA, concept of Fartlek training, and benefits of Fartlek training were covered.

Chapter Three provided the methodological framework where the research design, study area, population, sampling procedure, data collection instruments, data collection procedures, and data processing and analysis were highlighted. In the fourth chapter the results of the study were discussed. The

fifth chapter dealt with the summary, conclusions and recommendations. Suggestions for further research were also discussed.

CHAPTER TWO

LITERATURE REVIEW

This study examined the effects of nine-week fartlek training on health-related fitness (HRF) among students of Adidome senior high school (SHS). This chapter reviewed related literatures based on the following sub-headings;

1. Theoretical Framework
2. Conceptual Framework
3. Concept of Health-Related Physical Fitness
4. Factors that affect Health-Related Physical Fitness
5. Fartlek Training
6. Benefits of Fartlek Training
7. Effects of Fartlerk Training on HRF

Theoretical Framework

The study was based on Bandura's Self-Determination Theory (SDT) and Social Cognitive Theory (SCT) (Ryan & Deci, 2000).

Self-determination Theory

SDT has been proposed as one way of looking at motivation. SDT is a general theory which has frequently been applied in the exercise domain. The framework posits that human motivation lies along a continuum which represents varying degrees of autonomy. Autonomy refers to behaviours being self-determined or freely initiated by the individual (Deci & Ryan, 2008). The self-determination continuum comprises both intrinsic and extrinsic components.

Intrinsic motivation occupies the most self-determined end of the continuum and involves motivation derived from the sheer pleasure and satisfaction of engaging in the behaviour itself (Deci & Ryan, 2008). Intrinsic motivation is not, in itself, a cognitive strategy, however, it is a necessary component of a long-term commitment to exercise and represents a primary area of applied research in exercise psychology. An exerciser who is intrinsically motivated might swim, for example, because they enjoy the feeling of their body moving through the water.

Four distinct behavioural regulations comprise the extrinsic part of the motivational continuum. These four regulations, according to Deci and Ryan (2008), successively decrease in their degree of self-determination from autonomous regulations to controlling regulations. In Deci and Ryan's work, they observed that integrated and identified regulations represent the more autonomous forms of extrinsic motivation. Integrated regulation, according to these authors, represented the individual's belief that behaviour is an important part of their identity and is consistent with their personal values. Individuals who demonstrate integration might go running because they believe they are a runner and therefore running is consistent with their sense of identity.

Identified regulation refers to being motivated to perform behaviour because it is personally significant and results in outcomes which are valued by the individual (Deci & Ryan, 2008; Ryan & Deci, 2000). For example, individuals might engage in resistance training because they know that weight bearing activities are important for a healthy bone. An individual who exercises for external reasons might do so to appease their spouse or their

physician. It is also possible that an individual will be amotivated. That is, they will engage in behaviour without feeling any motivation, or they will exhibit a complete lack of intention to exhibit a behaviour.

One important contention of SDT is that the external regulations and a motivation are less adaptive in nature while intrinsic motivation results in positive motivational consequences. Research has supported this contention with motivation being linked to behavioural disengagement and negative psychological conditions (Deci & Ryan, 2008).

In an exercise context, research has examined individuals at various stages of exercise adoption and found that individuals with tendencies toward more regular exercise are more self-determined in their motivation (Edmunds, Ntoumanis & Duda, 2006). This suggestion can be highlighted by research examining the relationships between obligatory exercise and motivation. In a study involving regular exercisers, Duncan, Hall, Rodgers and Wilson (2012) observed that individuals who are preoccupied with exercise, or who exercise at greater frequency, tend to score higher on identified regulation. Furthermore, individuals who experience negative emotional consequences (e.g., anger and depression) when they miss an exercise session tend to score highly on interjected regulation.

While some individuals participate in regular PAs simply for the enjoyment of exercising, others appear to exercise to attain intrinsic or extrinsic rewards such as losing weight, being more attractive, or obtaining recognition from significant others (Deci & Ryan, 2008). Deci and Ryan observed that individuals who exercise out of enjoyment rather than being motivated by intrinsic or external rewards are more likely to adhere to a

specified exercise programme. Since the goal of health professionals is to promote a continued active lifestyle in individuals, studying the cognitions that are related to motivation has been at the centre of much investigation into understanding how to promote long-term behaviour change.

Although there are many approaches to initiating behaviour change, research has shown that long-term engagement in exercise is ineffective without consistent motivational environment based on autonomously supportive interventions (Silva et al., 2011). The SDT, in contrast, focuses on the processes through which a person acquires the motivation for initiating new health-related behaviours and maintaining them over time. SDT assumes that individuals by nature are active, interested, curious, self-motivated, and eager to succeed. These individuals can be alienated, passive or disaffected. These differences stem from the interaction between the individual's inherent active nature and the social environments that either support or thwart that nature (Deci & Ryan, 2008).

Furthermore, SDT proposes that individuals have three basic psychological needs, autonomy, competence and relatedness. Autonomy refers to being the perceived origin or source of one's own behaviour; Competence refers to feeling effective in one's ongoing interactions with the social environment and experiencing opportunities of fulfillment; while relatedness refers to feeling connected to others and having a feeling of belongingness with individuals and the community (Deci & Ryan, 2008). When these three basic psychological needs are satisfied, according to the authors, an individual's inherent activity will be supported, optimal

motivation will be promoted, and positive psychological, developmental, and behavioural outcomes will be produced.

Conversely, social environments that thwart satisfaction of these needs yield less optimal forms of motivation and have deleterious effects on a wide variety of well-being outcomes. It is evident that the SDT is a dialectic theory which views the environment as nurturing need-satisfaction and motivation.

Social cognitive theory

One of the theories that has received widespread attention in predicting and explaining health behaviours is SCT (Bandura, 2004). While this theory recognises how environments affect behaviour, it also focuses on the individual's potential abilities to alter environments to achieve their purpose. There are two primary determinants of behaviour in SCT, these are self-efficacy and outcome expectations.

Self-efficacy (SE) is a set of beliefs and expectations about how capable a person feels in performing the necessary behaviours to achieve a desirable outcome (Bandura, 2004). An exerciser may feel high SE about engaging in a weight-training programme to gain strength, yet feel far less SE in performing other exercises. High SE about the activity usually results in a higher likelihood the person will begin and adhere to that activity. SE is specific to a behaviour and situation, and is not usually generalised to other types of tasks (e.g., competitive sport versus exercise) or situations (e.g., running competition).

SE affects a person's expectations of success and failure, and therefore, influences a person's selection of those activities, the degree of effort expended on the activities, and the extent to which a person will persist

at the activities, especially after experiencing failure or not meeting expectations. For instance, exercisers who do not experience rapid success, that is, meet goals quickly, will presume that the task is of insurmountable difficulty and quit exercising, perhaps due to low SE.

In their review of over 100 studies on the effects of SE on exercise behaviour, McAuley, Blissmer, Katula, Duncan and Mihalko (2000) concluded that higher SE leads to greater likelihood of exercise participation and maintenance, if the individual: (a) is allowed to select the type of exercise behaviour undertaken, a concept called perceived choice, (b) possesses certain thought patterns, such as optimism and feelings of intrinsic motivation (i.e., exercising for pleasure and enjoyment), (c) expends optimal effort and feels capable of redoubling efforts in the face of barriers and challenges, and (d) has reasonably high expectations of successful performance and desirable outcomes.

To McAuley et al. (2000), the strongest influence of SE on exercise behaviour is performance accomplishments. Improving SE as a method to favourably influence exercise behaviour has considerable promise, however, it is likely that additional moderating factors must be included to help exercisers maintain this habit. The other constructs of the theory are task, planning, and coping SE, goal setting, and outcome expectancy. Task SE is an individual's confidence in their ability to perform certain parts of a task. Coping SE is an individual's confidence when performing tasks under challenging conditions. Goal setting enhances self-regulation, which has an impact on SE. Outcome expectancy means beliefs related to a particular behaviour that lead to specific results.

SCT also specifies how personal, environmental, and behavioural variables relate to each other. SE stems from personal variables, such as the individual's age, gender, and general health, and from environmental variables, such as access to safe exercise facilities and social support for physical activity (Bandura, 2004).

Conceptual Framework

The conceptual framework of this study was based on Bandura SCT. SCT is suitable for understanding physical activity and health behaviours due to the interactions among individual, environment, and behaviour (Bandura, 2011). The conceptual framework underpinning this study is presented in Fiqure 1.

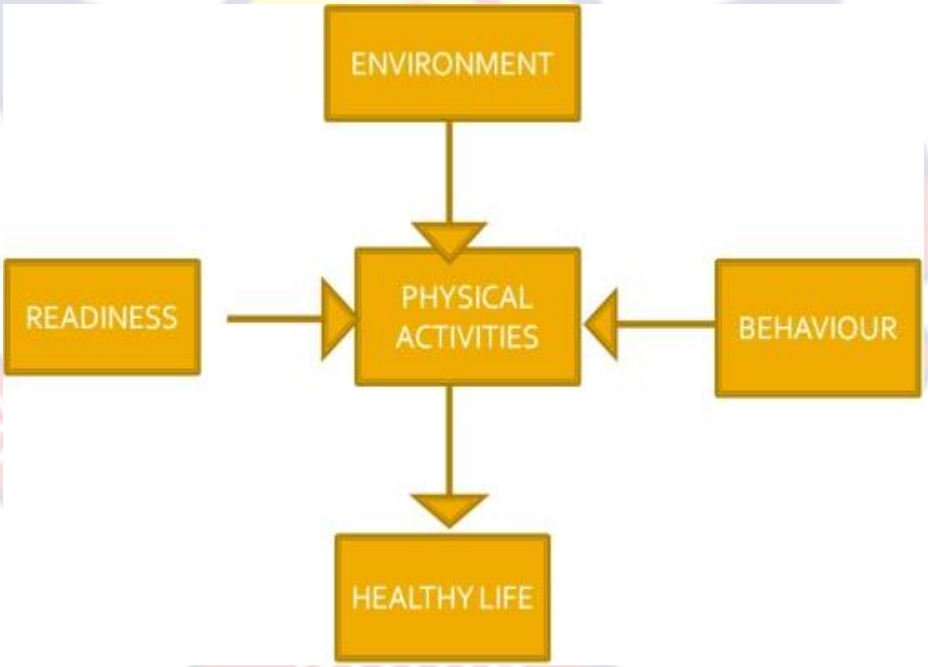

Figure 1: A Diagrammatic Representation of the Conceptual Framework (Bandura, 2011)

Based on SCT, the student's readiness, the student's behaviour and the environment with good and well planned activities will definitely improve their health.

Environment

The environment component refers to the physical and social environment in which the behaviour occurs. The environment here consists of the neighbourhood, buildings, recreational activities, work and play. Environment may also be the climate, community resources, the built environment, the information environment or the social support norms, beliefs and attitude. These environments affect our daily decisions in life. The environment influences how a person thinks and feels, which in turn influences participation in PA. When the environment is conducive and friendly, students will be enthused to participate in any PA.

Behaviour

Behaviour refers to a person's beliefs and actions regarding their health and wellbeing. Behaviour is acquired not only through their own experiences, but also by observing the actions of others and the results of those actions. When the student has a good belief about his health it will encourage their participation in PA.

Readiness

Readiness is the person's willingness and eagerness to participate or to do something. Readiness is getting ready for actions. When the students have that eagerness or that willingness, it will help their participation in PA. It means the students become more effortful, active, pay attention and highly motivated for action.

Physical activity

PA in this context refers to all movements like walking, jogging, running and play that can be done at any level of skill and for enjoyment by everybody. When all the above components are set, and the environment is conducive, the students have a strong positive belief in their actions and are willing to participate in PAs. This will subsequently improve their health and well-being. Generally, SCT posits that personal, environmental, and behavioural factors are reciprocally influential in determining behaviour and behaviour change. This suggests that individuals who believe they can be physically active (i.e., higher self-efficacy) will expect favourable results from PA (i.e., outcome expectations) and will be more likely to implement the self-regulatory behaviours essential to adopting and maintaining an active lifestyle (Bandura, 2004). The dynamic interaction of the person, behaviour, and the environmental factors will lead to healthy lifestyle.

Concept of Health-related Physical Fitness

Physical fitness refers to a physiologic state of well-being that allows one to meet the demands of daily living or that provides the basis for sports performance, or both (Brown et al., 2004). According to Malina (2010), physical fitness is a state of health and well-being and, more especially, the ability to perform aspects of sports, occupations and daily activities without undue fatigue. Bouchard, Blair and Haskell (2007) also stated that physical fitness is generally achieved through proper nutrition, moderate to vigorous physical exercise and sufficient rest.

Physical fitness is grouped into two main types; Health-related fitness (HRF) and Performance-related fitness (PRF). HRF which is the focus of this

study, involves the components of physical fitness related to health status. This comprises cardiovascular endurance, muscular strength, muscular endurance, body composition and flexibility.

Cardiovascular endurance

Cardiovascular endurance is considered the most important aspect of physical fitness because those who possess it have a decreased risk of heart diseases, the number one killer in our society (Williams, 2001). PAs improve the cardiovascular and the respiratory system. PA and fitness can be a significant contributor to disease or illness treatment. Even with the best disease-prevention practices, some people will become ill. Regular exercise and good fitness have been shown to be effective in alleviating symptoms and aiding rehabilitation after illness for such hypokinetic conditions as diabetes, heart attack, back pains, and others. PA and fitness are methods of health and wellness promotion. They contribute to quality living associated with wellness, the positive component of good health (Lindsey, Insel & Roth, 2002).

Cardiovascular endurance is the ability to deliver essential nutrients, especially oxygen to the working muscles of the body, and to remove waste products during prolonged physical exertion. Cardiorespiratory endurance requires the utilisation of oxygen, which is only possible if the circulatory and respiratory systems are capable of these functions. Cardiovascular endurance is expressed in terms of maximal oxygen intake (VO2max) which is the greatest amount of oxygen that can be utilised by the body in intense exercise. Vigorous exercise improves the functioning of the cardio-respiratory system and is directly related to coronary risk.

The heart is a muscle and to be stronger it must be exercised like any other muscle in the body. If the heart is exercised regularly its strength increases and if not, it becomes weak. The benefits of cardiovascular endurance far outweigh the benefits of the other components of HRF. With efficient circulatory and respiratory systems, people experience little difficulty in keeping pace with the body's needs for oxygen, fuel and waste removal. Regular exercise also improves metabolism at the cellular level. It increases the number of capillaries in the muscles so that they can be supplied with more oxygen and fuel. It also trains the muscles to make the most use of available oxygen and fuel so that they work more efficiently.

Cardiovascular fitness reduces the risk of heart diseases, hypokinetic conditions and early death. The best evidence indicates that cardiovascular fitness is associated with reduced risk for heart disease. A classic research study at the Cooper Institute for aerobics research showed that less fit people are especially at risk and women who accumulated at least three hours of brisk walking each week cut their risk of heart attack and stroke by more than half (Fahey, Insel & Roth, 2002). Fahey et al., established that obesity and diabetes are also on the list of risk factors. A person whose body weight is more than 30% above the recommended level is at a higher risk for heart disease and stroke, even if no other risk factors are present.

Excess weight increases the strain on the heart by contributing to high blood pressure and high cholesterol levels. Development of cardiovascular endurance helps one's body to work longer and at a greater level of intensity (Corbin, Lindsey, Welk & Corbin, 2002). Cardiovascular fitness assessment test results can be used to set a specific oxygen consumption goal for

cardiovascular endurance programme. The goal should be high enough to ensure a healthy cardiorespiratory system, but not so high that it will be impossible to achieve. Through endurance training, an individual may be able to improve VO_2 max by 10-30% (Fahey et al., 2002).

Apart from setting goals, choosing the appropriate physical activities is important. Cardio-respiratory endurance exercise includes activities that involve the rhythmic use of large-muscle groups for an extended period of time, such as jogging, walking, cycling, aerobic dancing and other forms of group exercise, and swimming. Having fun is a strong motivator; select a physical activity programme that is easier to stay with. Exercising with a friend can also be helpful as a motivator (Booher & Inbodeau, 2000).

To build cardiovascular endurance, one should exercise 3-5 days per week. Beginners should start with 3-days per week up to 5-days per week. Training more than 5-days per week can lead to injury and it is not necessary for the typical person on exercise designed to promote wellness.

Intensity is the most important factor in achieving training effects. The individual must exercise intensely enough to stress the body so that fitness improves. In monitoring the intensity of exercises, two methods can be employed. These are target heart zones and rating of perceived exertion (Booher & Inbodeau, 2000). The target heart zone is a recommended range of exercise intensity that is based on one's maximal heart rate and this is an age-related estimate of the fastest one's heart can beat (maximum number of beats per minute) at one's maximal level of activity. Below is the formula for determining one's heart rate zone:

220 – Age = HRmax

HRmax X .65 = Bottom of heart rate range

HRmax X .85 = Top of heart rate range

According to the formula, a 40-year-old exerciser would have a Total Heart Rate of 117-153 beats per minute (220 – 40 = 180; 180 X .65 = 117; 180 X .85 = 153).

Rating of perceived exertion is an individualised rating based on one's own perception of how hard one is exerting oneself when exercising. The scale rate ones intensity level from 6 (no exertion) to 20 (maximal exertion). Any rating of perceived exertion of 12-14 is considered moderately intense and in line with the ACSM recommendations for most adults.

There are two main ways by which cardiovascular endurance can be measured or assessed. These are field and laboratory assessments. Field assessment involves a measure on something such as a piece of equipment that is done in the place where it is going to be used rather than an office or a laboratory.

Laboratory assessment is performed at the laboratory that comprise of single or multiple rooms (technical rooms, reception, offices, storage, wash room), which operate by applying scientific analytical methods to provide relevant results for a defined health-related purpose. In this study, I utilise the field assessment due to its numerous advantages, some of which are; easy access to facility and equipment, time saving, personnel available to help conduct the test, and the fitness level of the people being tested. The laboratory assessment is more expensive due to the nature of complex and sophisticated equipment used.

For the field assessment, four tests have been postulated by Fahey et al. (2002);

(a) The 1-mile run/walk test which estimates the level of cardiorespiratory fitness (VO_2 max) based on the amount of time it takes to complete 1-mile brisk walking and running.

(b) The 3-minutes step test; the rate at which the pulse returns to normal after exercise; heart rate remains lower and recovers faster in people who are more physically fit. For the step test one steps continually at a steady pace and then monitors the heart rate during recovery.

(c) The 1-mile run/walk test oxygen consumption increases with speed in distance running, so a fast time on this test indicates maximal oxygen consumption.

(d) The Astrand-rhyming cycle ergometer test estimates maximal oxygen consumption from the high heart rate after pedaling the bicycle ergometer for 6-minutes at a constant rate and resistance (power output). A low exercise heart rate after pedaling a high power output indicates high maximal oxygen consumption.

Muscular strength

Corbin et al. (2002) defined muscular strength as the amount of force that can be produced with a single maximal effort of a muscle group. Greater muscle mass makes possible a higher rate of metabolism, and faster energy use, which help to maintain a healthy body weight. Strong, powerful muscles are important for the smooth and easy performance of everyday activities,

such as carrying groceries, lifting boxes and climbing stairs, as well as for emergency situations.

Muscular strength has obvious importance in recreational activities. Strong people can hit a tennis ball harder, kick a soccer ball further, and ride a bicycle uphill more easily. Muscular strength depends on the size of muscle cells and the ability of nerves to activate muscle cells. Muscular strength can best be improved by training activities that use the progressive overload principle. By over-loading or gradually increasing the resistance (load, object, or weight), the muscles adapt to the increasing weight and subsequently increase muscular strength.

The overload principle is based on the following three types of training exercises:

(a) Isometric exercise: This means the "same measure", the resistance, is static and prevents contracting muscles from moving. Thus, the muscles contract against immovable objects (e.g., pushing a wall). Because of the difficulty of precisely evaluating the training effects, isometric exercises are not usually used as a primary means of developing muscular strength.

(b) Isotonic exercises or "same-tension", also called Progressive resistance exercises are currently the most popular type of strength-building exercises. Progressive resistance exercises utilise eccentric and concentric contractions to ensure that varieties of exercise are performed. This involves the contraction and extension of muscles over joints to aid exercise. Although during a given repetitive exercise the weight or resistance remains the same, the muscular contraction efforts required varies according to joint angles in the range of motion.

(c) Isokinetic exercises, also known as "same motion" use mechanical devices that provide resistances consistently to over-load muscles throughout the entire range of motion. Isokinetic exercises are strength training workouts, which makes one work at a constant pace or consistent weight in a range of motion. Some isokinetic exercises use bodyweight or other lightweights but need to be worked manually at a constant pace. Isokinetic exercises are mostly used for recovery and physical therapy.

For effective muscular development, the following guidelines according to Payne et al. (2003), should be followed:

(a) **Sequence**: Ideally, work large muscle groups first, ending with small muscle groups. It is difficult to adequately exercise large muscle groups if the smaller supporting ones have been fatigued already.

(b) **Form**: After progressive overload, correct exercise form is the most important factor in maximising strength gains and minimising risk of injury. Improvement is more rapid if correct technique, not just quantity of weight is emphasised.

(c) **Muscle balance**: Since muscles work in pairs, it is important to strengthen muscles on both sides of bone so that they pull evenly across joint and maintain body alignment. For example, if pectorals are stronger than upper back muscles, rounded shoulders result. When upper back muscles are strengthened, shoulders are naturally held erect.

(d) **Breathing**: Before lifting, inhale, and then exhale on the exertion. Avoid holding the breath.

(e) **Speed of movement**: Exercising in a smooth, controlled manner maximises strength gains and reduces injuries. Movement should be controlled.

Muscular strength can be assessed by usually measuring the maximum amount of weight a person can lift at one time. This single maximal movement is referred to as one-repetition maximum (IRM). One can assess the strength of the major muscle groups by taking the 1RM test for the bench press, the leg press, military press and press-ups done with heavy load or high resistance. To develop muscular strength, a frequency of 3-6 days per week with high intensity or resistance or heavy load used at the rate of sets for repetition ranging from 6-12 is required (Fahey et al., 2002). Muscular strength leads to;

(a) ***Improved performances of physical activities***. A person with moderate to high level of muscular strength can perform everyday tasks like recreational activities and daily routines without undue fatigue.

(b) ***Injury prevention***: Increased muscle strength provides protection against injury because it helps people to maintain good posture and appropriate body mechanics when carrying out everyday activities, like walking, running, lifting and carrying. Strong muscles in the abdomen, hips, lower back and leg support the back and help prevent lower back pain.

(c) ***Improved body composition***: Healthy body composition means that the body has high proportion of fat free mass (primarily composed of muscle) and relatively small portion of fat. Strength training improves body composition by increasing muscle mass, thereby tipping the body composition ratio toward fat-free mass away from fat. A high metabolic rate means that a

nutritionally sound diet coupled with regular exercise will not lead to an increase in body fat.

(d) ***Enhanced self-image and quality of life***: Strength training leads to an enhanced self-image by providing stronger, firmer-looking muscles and a toned, healthy looking body.

(e) ***Improved muscle and bone health with aging***: Good muscular strength helps people to live healthier lives. A lifelong programme of regular strength training prevents muscle and nerve degeneration that can compromise the quality of life and increase the risk of hip fracture and other potentially life-threatening injuries.

(f) ***Preventing and management of chronic diseases***: Strength training helps in the prevention and management of several major chronic diseases. Strength training improves glucose metabolism, an important factor in the prevention of the most common form of diabetes. It also modifies risk factors for cardiovascular diseases. Strength training also boosts bone mineral density, helping to prevent osteoporosis and bone fracture.

Payne et al., (2003) believe the quality of muscle in men and women are the same, endocrinological differences cannot allow women to achieve the same amount of muscle hypertrophy as in men. Men have greater muscle fibres and due to the male sex-specific hormones, each fibre has a potential for hypertrophy.

Muscular Endurance

Muscular endurance is the capability of the skeletal muscles or group of muscles to continue contracting over a long period of time. One needs both strength and muscular endurance to increase work capacity, decrease injury,

prevent low back pain, poor posture, other hypokinetic conditions, and to improve athletic performance.

Fahey et al. (2002), defined muscular endurance as the ability to sustain a given level of muscle tension-that is, to hold a muscle contraction for a long period of time, or to contract a muscle over and over again. According to Lindsey et al. (2000), muscular endurance is the capacity of the skeletal muscles or group of muscles to continue contracting over a long period of time. The authors posited that progressive resistance training exercise promotes muscular fitness that permits efficient and effective movement and contributes to ease the economy of muscular effort. It also promotes successful performance, and lowers susceptibility to some types of injuries, musculoskeletal problems and some illnesses.

Examples of muscular endurance are performing repetition of push-ups, squats or sits-ups. The development of muscular endurance is an important aspect of HRF. For endurance development, the amount of weight selected should allow the individual to perform 3-sets of 10-12 repetitions. The amount of resistance used should be changed if the individual finds it too difficult or too easy to accomplish the task. Muscular endurance tends to improve with muscular strength. To achieve improvements exercise should be done at least 8-10 consecutive weeks. Attention should be given to the development of the various muscle groups of the body. Muscles are developed with activities that stress the systems such as running, cycling and swimming.

Muscular endurance is usually measured by counting the maximum number of repetition of a muscular contraction a person can do (such as in-

push-ups) or the maximum amount of time a person can hold a muscular contraction (such as in the flexed-arm hang).

Flexibility

Corbin et al. (2002) defined flexibility as a measure of the range of motion available at a joint or group of joints. It is determined by the shape of bones and cartilage in the joint and by the length and flexibility of muscles, tendons, ligaments and fascia that cross the joint. The range of movement at a joint may vary. In some cases the joint will not bend or straighten, and is said to be tight or stiff, or to have contractures. In terms of fitness, an individual who possesses good flexibility can move through the full range of motion at a specific joint.

Flexibility is influenced by several factors. These factors include age, sex and race. As children grow older, their flexibility increases until adolescence when they become progressively less flexible. As a general rule, girls tend to be more flexible than boys. This is probably due to anatomical differences in the joints, as well as differences in the type and extent of activities the two sexes tend to choose. In adults, there is less difference between the sexes. Some races and ethnic groups have been reported to have specific joints that are hypermobile (Corbin et al., 2002).

Some people are also unusually flexible because of genetic trait that makes their joints hypermobile. In some families the trait for loose joints is passed from generation to generation. This hyper mobility is sometimes referred to as joint looseness. This fitness trait, differ from point to point within the body and among different people. Inability to move easily during

PA can be a constant reminder that aging and inactivity are the foes of flexibility.

Flexibility can be measured with sit-and-reach test. This test uses the sit- and-reach box, constructed using two pieces of wood approximately 12-inches (25 centimetres) high attached at right angles to each other. A metric rule to measure the extent of reach is attached to the box. The students fully extended both legs with the feet flat against the face of the box. The arms are extended forward over the measuring scale and the tip of the longest finger with its corresponding mark on the scale are recorded.

Factors affecting flexibility are joint structure, muscle elasticity and length, and nerve system activity (Fahey et al., 2002). Joint structure: This is the amount of flexibility in the joint determined in part by the nature and structure of the joint. Ball-and-socket joints, like the hip or shoulder enable movement in many different directions and greater range of motion. Heredity also plays a part in joint structure and flexibility.

Muscle elasticity and length: This is the soft tissue, including skin, muscle, tendons and ligaments that limit the flexibility of a joint. Muscle tissue is the key to developing flexibility because it can be lengthened if it is regularly stretched. Nerve system activity: Muscles contain stretch reporters that control their length. If a muscle is stretched suddenly, stretch receptors send signal to the spinal cord, which then send signal back to the same muscle causing it to contract. These reflexes occur frequently in active muscles.

Fahey et al. (2002) listed the following as the benefits of flexibility;

1. ***Joint health***: Good flexibility is essential to good joint health. When the muscle and other tissues that support a joint are tight, the joint is subjected

to abnormal stresses that can cause joint deterioration. For example, tight muscle causes excessive pressure on the kneecap, leading to pain in the joint. Tight shoulder muscles can compress sensitive soft tissues in the shoulder, leading to pain and disability in the joint.

2. ***Prevention of low-back pain***: Low-back pain can be related to poor spinal alignment which puts pressure on the nerves leading out on the spinal column. Strength and flexibility in the back, pelvis and thighs may help prevent this type of back pain.

3. ***Temporary reduction of post exercise muscle soreness***: Delayed onset of muscle soreness, occurring 1-2 days after exercise, is thought to be caused by damage to muscle fibres and supporting connective tissue.

4. ***Relief of aches and pains***: Flexibility exercises help relief pain that develops from stress or prolonged sitting. Studying or working in one place for a long time can make the muscles tensed. Flexibility aids athletic performance and can help to reduce injury risk. Stretching helps to relief tension.

5. ***Maintenance of good posture***: Good flexibility also contributes to body symmetry and good posture. Bad posture can gradually change the body structures. Sitting in a slumped position, for example, can lead to tightening in the muscles in front of the chest and over stretching and looseness in the upper spine, causing a rounding of the upper back.

6. ***Relaxation***: Flexibility exercises are a great way to relax. Studies have shown that flexibility exercises reduce mental tension, slows breath rate, and reduces blood pressure.

Body Composition

Corbin et al. (2002) posited that body composition refers to the relative percentage of muscles, fat, bone and other tissue of the body. There are standards to determine how much body fat an individual should possess. Everybody should possess at least a minimal amount of fat for good health. This fat is called essential fat and it is necessary for temperature regulation, shock absorption and regulation of essential body nutrients. It also includes lipids incorporated into the nerves, brain, heart, lungs, liver and mammary glands. These fat deposits, crucial for normal body function, make up approximately 3-5% of total body weight in men and 8-12% in women. For females, an exceptionally low body fat percentage (under fat) is especially of concern.

However, non-essential fat is fat above essential fat levels that accumulate when one take in more calories than one expect. Non-essential fat exists primarily within fat cells or adipose tissues often located just below the skin and around major organs. Maintaining an ideal level of body fat allows the body to function actively in an efficient manner, lending a valued boost to one's quality of life and level of wellness (Fahey et al., 2002).

The amount of storage fat varies from individual to individual based on many factors, including gender, age, heredity, metabolism, diet, and activity level. When non-essential fat accumulates in excessive amount, over-fatness or even obesity can occur. Excess storage fat is usually the result of consuming more energy than is expended (in metabolism and physical activity). In spite of uncertainty regarding the point at which excess weight becomes a medical concern, there is little debate for our image-conscious

general population about overweight being a problem related to perceived physical attractiveness (Fahey et al., 2002). This concern is caused by the media, which tells people that being overweight is undesirable because it does not conform to certain ideal body images (such as being tall, thin and cute with muscular definition).

In light of this challenge, people may become dissatisfied and concerned about their inability to resemble the ideal. The ratio between body fat-free weights is a better fatness than is body weight. The body composition of an individual is an important aspect of total fitness. People whose body composition is optimal tend to be healthier, move more efficiently, and feel better about themselves. To reach wellness, one must determine what body composition is right for them and then work to achieve and maintain it. According to WHO (2008), health experts are especially concerned about the large number of people who are overweight and obese in our society.

Health professionals over the years have linked many diseases with the risk factor of obesity. Experts in health often distinguish between two types of obesity: moderate and morbid. Moderate obesity is currently defined as 20-50% overweight according to height/weight tables, while morbid obesity is considered anything above 50% over normal weight. Once again, common definitions of obesity confuse the concepts of weight which includes lean and fat weight with the concept of over fat. Cardiorespiratory fitness trainers increasingly are recognising the importance of body composition and including strength-training exercises to help reduce body fat.

According to Corbin et al. (2002), body composition is considered a component of HRF but can also be considered a composition of metabolic

fitness. Body composition is related to health, but it is not like the other components of HRF (cardiovascular, muscular strength, muscular endurance, and flexibility). The reason being that the others are measured by performance, but body composition requires no movement. There are so many health problems associated with body overweight. WHO (2008) listed obesity (which is associated with unhealthy blood fat levels, impaired heart function, and death from cardiovascular diseases), hypertension, many kinds of cancer, impaired immune function, gall-bladder and kidney diseases, skin problems, sleep, breathing disorders and impotence.

Too much body fat makes all types of physical activity more difficult because just moving the body through everyday activities means working harder and using more energy. In general, over fat people are less fit than others and do not have the muscular strength, endurance and flexibility that make normal activity easy. Because exercise is more difficult, they do less of it, depriving them of an effective way to improve body composition. (Fahey et al., 2002). Factors that affect body composition, according to Fahey et al.(2002), are placed under 3-main headings. These are genetic, physiological and lifestyle factors.

1. ***Genetic factors***: Estimates of genetic contribution to obesity vary widely, from about 5-40%. More than 20 genes have been linked to obesity. Genes influence body size and shape, body fat distribution and metabolic rate. Genetic factors also affect the ease in which weight is gained as a result of overreacting and where on the body extra weight is added. If both parents are overweight, their children are twice as likely to be overweight as children who have only one overweight parent.

2. ***Physiological factors***: Metabolism is a key physiological factor in the regulation of body fat and body weight: Hormones also play a role. Another physiological factor that has been proposed as contributing to obesity is weight cycling.

3. ***Lifestyle factors***: Genetic and physiological factors may increase the risk for excess body fat, but they are not sufficient to explain the increasingly high rate of obesity seen in some societies. Lifestyle factors like diet and exercise can also affect body composition. The gene pool has not changed dramatically in the past 40 years, during which time the rate of obesity among Ghanaians has doubled.

There are so many techniques that can be used to measure body composition. Some are common and are routinely used by the general public. Others are expensive and of limited availability. Fahey et al. (2002) listed the following;

1. ***Height-weight tables***: Height and weight tables were originally developed to assist people in determining the relationship between their weight and desirable standards. Nearly every version of this table has come under criticism for not considering valuables such as gender, age, and frame size.

2. ***Body mass index (BMI):*** Another method for assessing healthy body weight is the BMI. BMI indicates the relationship of body weight (expressed in kilogram) to height (expressed in metres) for both men and women. The BMI does not reflect body composition (fat versus lean tissue) or consider the degree of fat accumulated in the central body cavity; nor its adjustment for age.

3. ***Skinfold measurement:*** This is a relatively precise and inexpensive indicator of body composition. In this assessment procedure, constant-pressure calipers are used to measure the thickness of the layer of fat beneath the skin's surface; the subcutaneous fat layer. These measurements are taken at key places on the body such as triceps, biceps, abdomen, iliac crest just below the scapula, the thigh and the chest.

4. ***Hydrostatic weighing***: This is another precise method of determining the relative amounts of fat and lean body mass that make up body weight. A person's percentage of body fat is seen by comparing the underwater weight with the body weight out of water. The need for expensive facilities (a tank or pool) and experienced technicians make the availability and cost of this procedure limited to small-scale application.

5. ***Body composition system***: The newest method of determining body composition involves the use of the body composition system, an egg shaped chamber in which a subject is briefly enclosed to determine how much air they displace in the chamber. Once the amount of displaced air is known, a mathematical formula is used to calculate the subject's body density. Body density can then be used to determine the percentage of the subject's body that is composed of fat.

6. ***Electrical impedance***: This is a relatively new method used to determine body composition. This computerised assessment procedure measures the electrical impedance (resistance) to a weak electrical flow directed through the body. Electrodes are attached to the arm and leg. Because adipose tissue resists the passage of the electrical current more than muscle tissue does, electrical impedance can be used to accurately calculate the

percentage of body fat. Fortunately, electrical impedance measurements are painless.

7. ***Appearance:*** Perhaps the simplest method of determining obesity may be to look in the mirror. The old saying that "mirrors don't lie" speaks for itself for most people. This method is fairly accurate and certainly inexpensive. Unless a person is very muscular or has retained an excessive amount of water, the reflection in the mirror should be a good indicator of whether one's weight is appropriate.

The benefits of healthy body composition can be physical and psychological. The physical benefits are; reduced body fat percentage, increased lean body mass and firmer, more toned muscles. The psychological benefits are enhanced sense of well-being and self-esteem, resulting in increased energy, alertness and vitality; increased sense of self-discipline due to the determination needed to stick to an exercise programme; reduced state of anxiety and mental tension, thereby increasing stress coping ability; improved quality of sleep, resulting in the ability to fall asleep faster and with less tossing and turning during sleeping time; decreased level of mild to moderate depression; increased release of endorphins (brain chemical) producing a relaxed state (Fahey et al., 2002).

Factors that affect Health-related Physical Fitness

Physical fitness is a multi-dimensional attribute. Genetic inheritance, age, morphology, nutrition, habitual physical activity, gender and general well-being are common factors. Environmental factors (such as adequate rest, proper diet, proper room ventilation, sanitation, family support and influence, facilities for training, and time), and physiological factors greatly affect one's

physical fitness status in life and affect one's lifestyle (Brabazon, 2006). Malina (2010) observed that experience in physical activity in early childhood is important because it positively influences attitudes and healthy habits in later life. As individuals get old, physical activity becomes a critical component of a healthy, happy and independent life.

Genetic inheritance influences several factors that contribute to fitness, such as body size and muscle fibre composition. Whether we are tall or short is determined by heredity. The percentage of slow-twitch and fast-twitch muscle fibres found in skeletal muscles is determined genetically and these inheritance greatly affects physical fitness.

Environmental factors such as access to public recreation space and infrastructure, access to sidewalks, neighbourhood crime, diets and exercise would affect ones physical activity level. Given active opportunities (the combination of time allowed for outdoor play, structured activity, etc.), presence of portable playground equipment and physical activity training methods in the environment would affect physical activity.

Physiological factors affecting performance, focuses on developing the learner's knowledge of the science behind physical activity. This includes the structure and function of key systems in the human body, the forces that act upon us and the adaptations we make to our bodies through diet and training regimes.

Benefits of physical activity

The health-related benefits of physical activity are clear. They include lower blood pressure and cholesterol and maintenance of a healthy weight (WHO, 2009). Some other examples of benefits include improved mental

health and well-being (Heesch & Brown, 2008), social engagement (Jewson, Spittle & Casey, 2008), enhanced sleep (de Castro Toledo Guimaraes, de Carcalho, Yanaguibashi & do Prado, 2008) and reduced risk of fractures (Stessman, Hammerman-Rozenburg, Cohen, Ein-Mor & Jacobs, 2009).

Also, Nieman (2005) opines that, people who are physically fit fall asleep faster, sleep better and are less tired during the day. Further, men who participate in regular physical activity sleep more and experience a better quality of sleep than women who are sedentary (Cesario & Hughes, 2007).There are additional benefits for women who remain physically active. Regular PA aids muscle strength, aerobic capacity, reduction of fracture risk and general wellbeing (Graco, Garrard & Jasper, 2009). Craig and Bittman (2009) state that, strength and training enables individuals to maintain their independence and ability to do day-to-day tasks and leisure activities. Additionally, physical activity is associated with maintaining independent function over time, irrespective of increasing age (Stessman et al., 2009).

PA provides essential stimuli for most organs of the human body, in order to develop and maintain their structures and functions in meeting the requirements of life. Chronic physical inactivity leads to deterioration while physical activity leads to maintenance or increase or improvement in organ function. Many of these effects are related to conditions that are classified as diseases or their precursors or risk factors.

In the musculoskeletal system, physical activity is effective in decreasing the risk of developing sarcopenia or muscle waste, osteoporosis and related fractures, and low back pain, and in secondary prevention and rehabilitation of osteoarthritis and chronic low back pain. Regarding

metabolic conditions, overweight and obesity, type 2 diabetes mellitus, hypertension and metabolic syndrome, physical inactivity increases the risk while physical activity is effective in decreasing the risk and in the management of these conditions, especially in combination with proper diet (Williams, 2001).

Physical inactivity is a modifiable risk factor for cardiovascular disease and a widening variety of other chronic diseases, including diabetes mellitus, cancer (colon and breast), obesity, hypertension, bone and joint diseases (osteoporosis and osteoarthritis), and depression (Lee & Skerrett, 2001).

Health benefits of regular participation in PA are numerous, below are but a few of some health benefits of regular participation in PA.

Williams (2001) also espoused that, the benefits of exercise extend far beyond weight management. According to them, PA can help reduce your risk for several diseases and health conditions and improve your overall health related quality of life.

Laaksonen, Lindstrom and Lakka (2005) indicated that, PA participation reduces risk of type two diabetes and metabolic syndrome: Regular PA can reduce ones risk of developing type 2 diabetes and metabolic syndrome. Metabolic syndrome is a condition in which one have some combination of too much fat around the waist, high blood pressure, low HDL cholesterol, high triglycerides, or high blood sugar. Heart diseases are the number one cause of death in the United States and studies have shown insufficient aerobic PA contributes to increased risk for CVD mortality (Katzmarzyk, Church, Craig, & Bouchard, 2009; Lee, Sui, Artero, Lee,

Church, McAuley & Stanford, 2012; Hoyert, & Xu,2012). Interestingly, studies suggest merely light to moderate levels of aerobic activity are needed to reduce CVD risk factors (Wannamethee, Shaper, &Walker, 2000; Williams, 2001).

Increasing participation in both aerobic PA and resistance training is an effective way of decreasing CVD incidence and mortality (USDHHS, 2010). Myers, Kaykha and George (2004) also espoused that PA can help reduce the risk of heart diseases and stroke. They stressed that, heart disease and stroke are two of the leading causes of death in the United States. But following the Guidelines and getting at least 150 minutes a week (2hours 30 minutes) of moderate-intensity aerobic activity can put you at a lower risk for these diseases. One can reduce ones risk even further with more PA.

According to Yaminah (2008), PA helps to reduce body fat by building or preserving muscle mass and improving the body's ability to use calories. When PA is combined with proper nutrition, it can help control weight and prevent obesity, a major risk factor for many diseases. Yaminah (2008), further explained that by increasing muscle strength and endurance and improving flexibility and posture, regular exercise helps to prevent back pain.

Pescatello and ACSM (2014) stated that, weight is gained when the calories an individual burns, including those burned during PA, are less than the calories eaten or drunk. When it comes to weight management, people vary greatly in how much PA they need. One may need to be more active than others to achieve or maintain a healthy weight. As one aged, it's important to

protect ones bones, joints and muscles, diet and PA play a critical role in controlling weight.

Dunn, Trivedi and O'Neal (2001), believes that PA improve psychological well-being of individuals. They argue that routine is also associated with improved psychological well-being (e.g., through reduced stress, anxiety and depression). Psychological well-being is particularly important for the prevention and management of cardiovascular disease, but it also has important implications for the prevention and management of other chronic diseases such as diabetes, osteoporosis, hypertension, obesity, cancer and depression.

Fartlek Training

The concept of fartlek training was developed back in the 1930s by a man named Gosta Holmer. Holmer had been a Swedish decathlete, winning a bronze medal at the 1912 Olympics, but later became the coach of the Swedish cross-country team. Fartlek means ‘speed play’ in Swedish.

Fartlek is a style of training that can be used to increase levels of overall fitness in all age groups, from beginners to elite athletes. Fartlek training is generally associated with running; however, it can be used for almost any kind of training (Kumar, 2015). The training involves variable pacing, alternating between fast and slow bouts, and allowing for the training pace to be self-selected while progressing through the workout. Fartlek is a form of fitness training that works both the aerobic and anaerobic systems to quickly improve an athlete’s fitness. It is a simple method of training that can be tailored and effectively used by individuals to specifically train for a range of different sports.

As a method based around running at varying speeds, this type of training has been claimed to improve fitness and burn fat faster than other methods of training. Fartlek can work equally well in groups, particularly if everyone is at a similar level, as the longer, slower portions of the run provide ample opportunity for everyone to catch up. Fartlek training is associated with increasing VO_2 max during running increments, although this basic format can be used for cycling and swimming by simply combining long, slow distance training, pace/tempo training, and interval training (Reuter & Dawes, 2016).

Fartlek training can be individualised for various goals, ranging from weight loss to top end speed, as well as developing high levels of fitness and well-being (Bashir & Hajam, 2017). Any individual can find a Fartlek style of training that would best enhance their fitness level. Fartlek is a great training tool and is very effective in increasing a runner's speed and endurance. A typical session lasts about 45minutes. The route is predetermined, but the pace is varied from fast bursts to jogging and walking, according to the terrain, and the disposition of the runner. A single session might consist of walking, cruising and sprinting depending on the precise composition. Fartlek training can improve both the aerobic and anaerobic capacity of the athlete. Many coaches use Fartlek training because it provides relief from highly structured types of training. This means some specific guidelines are put in place so that each session can be made as effective as possible.

The principle of fartlek practice is to run with various variations. This means one can set the desired running speed during the exercise in accordance with the desires and abilities of the athlete. The offered training programme is

expected to be an attraction for athletes to improve their cardiorespiratory capacity, so athletes can have a good level of fitness (Dwikusworo, 2010). Cardiorespiratory is the functional ability of the lungs and the heart to supply oxygen to the muscle for a long time (Djoko, 2004). Appropriate practice should apply the basic principles of exercise systematically in order to achieve maximum physical performance for a person.

In theory, fartlek exercise is said to increase the VO_2 max of the lungs so it will certainly affect the increase in endurance. Haemoglobin the blood protein, will bind the oxygen and then deliver it throughout the body tissues. This supply ensures adequate haemoglobin levels throughout the body. A person with haemoglobin range of 13-18g/dL and Ht blood volume of 40-52%, will have a better cardiorespiratory ability (Sunita, 2001). More than half the maximum aerobic power difference is due to genotype differences, and environmental factors due to the volume of oxygen supplied.

There is no exact prescribed way of doing Fartlek training, there is no strict rule on how many seconds or metres one has to run at one speed or another. A strict prescriptive type loses the 'play' element, which could take away one of the best aspects about this type of training. The ability to tailor it to one's own situation makes it so enjoyable.

Fartlek is meant to be free and differs from normal interval training. It is unstructured and the intensity or speed varies as the athlete wishes. The application of structured fartlek sessions are often aimed at achieving a specific training aim. When determining the recovery, an elevated pulse rate results in the development of the energy system needed for specific events.

These sessions are also handy when weather does not permit running on a track or when one does not have a track available to them.

Fartlek training can be done anywhere: the running track; in a park; up and down hills, or on the streets in residential areas. Also it does not require any special equipment. All one needs to do is mix periods of sprinting with jogging, walking and other speeds in between on different terrains. The idea is to play with routines, mix things up to condition both quickness and stamina. One should however, not confuse 'play' with just larking, it should still be hard work and supposed to result in training at a high speed more often and more continuously than usual interval training.

The fartlek session

An unstructured fartlek session would be according to when one feels like running harder and slower interspersed with the recovery periods. A marker can be chosen from where one would start their effort. This marker can be a lamp-post, tree or even rock. The effort is determined according to a percentage of one's maximum effort or at a set race pace for a distance, e.g., 10k pace. Runners are known to do block fartlek sessions where they run 45-60 minutes of indiscriminate accelerations at efforts with recoveries they determine during the running. Golf courses and rolling hill courses are popular routes for such sessions.

Benefits of Fartlek Training

Fartlek training has grown in popularity and has proven to be successful as it can be applied under any conditions, be it weather or terrain. The benefits achieved mentally, plus the fitness benefits have made Fartlek training a popular addition to an athlete's routine. The speed, intensity and

duration of the training will determine the status of the session. The status is in reference to how tough the session will be, while still achieving the mental benefits. Clearly Fartlek training is not the only type of fitness training one can do, but it is certainly a very good one to consider adding to one's routine. The following benefits have been documented by Kumar (2015):

1. ***In tune with body***

   It encourages one to vary the motion speed and helps one improve their aerobic and anaerobic levels of fitness. The continuous change between effort and recovery increases endurance when ones heart rate is in the upper range. The body is forced to push itself harder for longer periods. This boosts the overall endurance level.

2. ***It is fun***

   Fartleks are fun as it breaks the monotony of the oval track or football ground. In this, one can challenge oneself to run all out till the next light post and walk thereafter. Or have fun with the run mates playing catch or taking turns to become the leader of the pack and controlling the speed. With fartlek training one can learn about one's own limits in a playful way. By changing ones speed so often, one practices passing other runners. This can be helpful during a race or final sprint to the finish line.

3. ***Flexibility***

   Fartleks are done on terrains such as plains, hills, beaches or trails. Running downhill on different surfaces trains balance, coordination, and flexibility. It can be done for as much time as is comfortable for the runner. The schedule is not as rigid like interval sessions. There is a lot of flexibility within the workout, for example, a high intensity session where the body is

pushed to its limits, or a low intensity session if one is tapering for a race, or easing back into running post-injury. Changing pace and surface also works on the tendons and muscles. The muscles get stronger, and are able to prevent injuries.

4. ***Mental strength***

Fartleks are helpful in building up mental robustness as it prepares the mind to catch up with fellow runners when they are surging past them. The sudden accelerating competition given is mimicked in this type of workout. It is great for getting into the racing mindset as a fartlek session mimics the surges of speed one may put on in a race. For example, to pass other runners, one has to sprint for the line, or reach a check point on time. Incorporating these surges of speed helps runners to gauge and learn how much they can push their body over shorter segments while at the same time keeping enough physical and mental energy in reserve to go the whole distance and complete a race. Mental strength improves one's ability to put on a spurt in races and overtake a competitor when tired, or knock seconds off the finish time.

5. ***Better runner***

Fartleks put stress on anaerobic system because of the high running speed thus improving base speed. According to Kumar (2015), to run faster, one needs to practice running faster. Fartleks help in building a stronger, efficient and faster runner with enhanced cardiovascular system. It mimics the stop-start rhythm of most sports, including soccer/football, allowing one to develop the specific type of fitness needed for their chosen sport.

6. ***In tune with pace***

Running fast frequently as in fartleks, help in understanding the capabilities of the body. They help in understanding the speed the body can handle or time taken to recover from hard running or sustaining a speed. Mixing low and high-intensity exercise may help reduce injury. This sort of training, using periods of high intensity, helps the body burn calories even after the workout ends.

Chapter Summary

In this chapter, relevant literatures were reviewed regarding the different sub-topics. Literature was reviewed on the theoretical framework based on Bandura's self-determination theory and social cognitive theory, conceptual framework, concept of HRPF, factors that affect HRPF, fartlek training and its benefits and effects of fartlek training on HRF. The chapter reviewed literature generally on the five components of HRF (namely, the cardio-respiratory endurance, muscle strength, muscle endurance, flexibility and body composition), and the effects of fartlek training sessions.

CHAPTER THREE

RESEARCH METHODS

The purpose of this study was to examine the effects of nine-week Fartlek training on health-related fitness (HRF) of Adidome Senior High School (SHS) students. This chapter describes the methods used to conduct the study. It comprises research design, study area, population, sampling procedure, data collection instruments, data collection procedures, and data processing and analysis procedures.

Research Design

This study employed the one-group pre-test post-test repeated measures experimental research design. The one-group pre-test post-test repeated measures experimental research design is used when a researcher wants to examine the effectiveness of an intervention (Kothari, 2004) conducted at different times and where it is impossible to randomly assign participants into distinct groups (Babbie, 2008). In this study only one group was used, hence the participants were not assigned to any special group. This design allows the effect of the treatment to be measured over time, and at multiple different times, using the same subjects (Creswell, 2012).

A demerit of one group pre-test post-test design however, is the probability that the conclusions that may be derived from the study may not be a true reflection of the intervention (internal invalidity) and the fact that the findings cannot be generalised to other populations (Babbie, 2008; Ogah, 2013). Babbie and Ogah stated that pre-test may alert participants about the experimental treatment which might as well influence the post-test scores.

Study Area

Adidome SHS is one of the second cycle schools in the Central Tongu District in the Volta Region of Ghana. The town is on the major road between Sogakofe and Ho. The town shares boundaries with South Tongu District to the South, North Tongu District to the North and Adaklu/Ziope District to the Western part. The vegetation lies in the tropical savannah grassland zone. The Volta River cuts the district into two equal halves from the North to the South. The major communities lie along the Volta River. Accessibility to most of the communities is very difficult, especially during the rainy season. This is due to the bad nature of the road network in the district. The inhabitants of Adidome are noted for fishing, farming and cattle rearing.

Adidome SHS shares boundaries with G.E.S office to the South and the District Assembly office to the East. Adidome SHS is the only community SHS in the district with her sister school also the only Senior High Technical School (SHTS) in the district. The school is closer to the Central Tongu District Assembly and about 200metres away from the Central Tongu Education Office.

Adidome SHS is an inclusive school made up of visually impaired and the regular students. According to the report from Adidome SHS enrolment list 2021/2022 academic year, the total number of students stands at 2,853. Out of the population 854 students are third years, 491 students are second year green track, 490 students are second year gold track, 510 are first year green track, and 508 students are first year gold track students. (Adidome SHS Administration, 2022).

Population

The population for this study consists of all second and first year gold track students in the boarding house. According to Adidome SHS Administration (2022), the total number of boarders for 2021/2022 in the gold track stands at 620 broken into 390 girls and 230 boys. Only students in the boarding house were considered in the study, because a report from the school's clinic 2019 indicates that 70% of the boarders that visited the clinic with physical fitness-related problems are due to inactive lifestyle including physical inactivity and insufficient rest. The day students at home help with household chores, work on farms, run a lot of errands and sell foodstuffs and other items as well. All these activities go a long way to positively affect the health of the day students. This cannot be said of the boarders who live a predominantly inactive lifestyle.

Sampling Procedures

In all 48 students were selected, 24 boys and 24 girls, for the study. This sample size is deemed appropriate since it is in line with Ogah's (2013) recommendation that for experimental research, it is appropriate to use sample sizes of not less than 30. This, according to Ogah, is because most statistical computations or analyses are based on a minimum sample size of 30. Also, the choice of this sample size is to make room for any future experimental mortality that may arise as a result of the duration, or other unforeseen factors (Babbie, 2010).

A multistage sampling technique made up of stratified sampling and simple random sampling without replacement techniques were used to select

the sample for the study. Creswell (2012) agrees that stratified random sampling is an appropriate methodology to make proportionate, and meaningful, comparisons of sub-groups in the population. The list of all second and first year gold track students in the boarding house was obtained from the management of the school.

The students were put into two strata according to their gender; the boys were separated from the girls. In each stratum, the simple random sampling without replacement was used to select boys and girls who are in the boarding house for the study. This was to ensure that students from all the departments have equal chance of being included in the study (Cohen et al., 2007; Neuman, 2014).

In each stratum, "Yes" was written on four pieces of paper and mixed with other blank papers for both boys and girls separately. Each student was asked to pick a piece of paper. All those who picked "Yes" were selected for the study. In all 48 students were selected, 24 boys and 24 girls. I consider this sample size to be appropriate since it could help eliminate the violation of assumptions for statistical analysis as a result of experimental mortality (Babbie, 2010).

Data Collection Instruments

This study employed the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD, 2013) functional fitness testing for HRF (see Appendix A). A researcher-generated data collection summary sheet (see Appendix B) was also used to gather the required data. The AAHPERD functional fitness test was designed for the youth. This test

measures body composition, flexibility, agility, coordination, muscular strength and cardiovascular endurance.

The data summary sheet comprised eight columns. The first column captioned "ID" was used to record participants' identity numbers. Participants' ages were recorded under the second column captioned "Age", whilst their gender was recorded under the third column dubbed "Gender." Columns 4-8 were further divided into five subdivisions which were used to record the five HRF test components of the participants (see Appendix C).

1. For Cardiorespiratory Endurance, 12 minutes-run/walk test was used.

Purpose: To measure the cardiorespiratory endurance of the student.

Equipment: Stop watches, whistles, pens, and note books.

Description: The students used a standing start. At the signals "Ready" and "Go" the students start running the 12 minute race. The running were interspersed with walking. The timer merely called out the times as the students crossed the finish line.

Scoring: The distances the students covered were recorded and compared with the standard Cooper test format.

2. For Muscular Endurance, modified pushups was used.

Purpose: To measure the muscular endurance of the students.

Equipment: Modified push up bar, pens, note books, and whistles.

Description: The students start from prone falling position with the hands or palms down under the shoulders, the balls of the feet on the ground, and the back straight. They then push the body up and down by an alternate straightening and bending of the elbows. The students maintain straight posture throughout the push up.

Scoring: The number of repetitions will be credited to the student.

3. For Muscular Strength, standing broad jump was used.

Purpose: To measure the maximum force that can be generated by the muscles of the legs.

Equipment: Tape measure, pens, notebooks, and whistles.

Description: The students stand behind a line marked on the ground with feet slightly apart. Two feet take-off and landing technique was used, with swinging of the arms and bending of the knees to provide a forward drive. The subject jumped as far as possible, landing on both feet without falling backwards.

Scoring: The measurement was taken from the take-off line to the nearest point of contact on the landing heels. Three attempts was allowed and the participant credited with the longest distance.

4. For Flexibility, back saver sit and reach was used.

Purpose: To measure the range of movement (ROM) at the joints of the students.

Equipment: Sit and reach box, pens, whistles and note books.

Description: From long sitting, participants placed the soles of their feet flat against the sit and reach box. They placed the head, back of the upper part of the body and hip against a wall. They placed one hand over the other and slowly reached forward as far as they can with the arm fully extended, head and back in contact with the wall. A partner slided the measuring stick on the bench until it touched the fingertips of the performer.

Scoring: The longest finger with its corresponding mark on the scale was recorded.

5. For Body Composition, BMI was used.

Purpose: To measure the body composition of the students.

Equipment: Weighing scale, tape measure, calculator, notebook and pens.

Description: The BMI is a measure of body fat based on height and weight. The BMI calculation divides ones weight in kilograms by ones height in metres squared. The students' heights were taken as well as the weight. The measured weights were divided by the height to get the BMI.

Scoring: Weight(kg)/Height(m^2) were compared to the standard BMI categories as stated in Table 1.

Table 1: Standard BMI

BMI range	BMI categories
Below 18.5	Underweight
Between 18.5 - 24.9	Healthy weight/ Normal
From 25 - 29.9	Overweight
30 and above	Obese

Source: US Department of Health and Human Services (2018)

From Table 1, a BMI below 18.5 means that the participant is underweight, between 18.5-24.9 means that the participant is normal and have a healthy weight, From 25-29.9 means the participant is overweight (that is above ideal range), and 30 and above means the participant is obese.

Validity and reliability of the instrument

The tests for the respondents have already been designed and carefully tested by the AAHPERD and implemented worldwide. The instruments were valid because the AAHPERD fitness test evaluated both the extent to which an individual is achieving or maintaining physical fitness and the extent to

which the PA is helping them. The tests have widely been used in the USA and Europe and have proved to be a reliable instrument in the evaluation of students' status relative to the different HRF components. The validity indexes for the HRF components as noted by Welk, Morrow and Falls (2002) are as follows;

a. For cardiorespiratory endurance, 12 minutes-run/walk test, Validity: $.60 \leq r \leq .80$

b. For muscular endurance modified pushups, Validity: $.31 \leq r \leq .81$

c. For muscular strength, standing broad jump, Validity: $.91 \leq r \leq .92$

d. For flexibility, back saver sit and reach, Validity: $.15\% \leq r \leq .20\%$

Data Collection Procedures

Ethical clearance for the research protocol was obtained from the Institutional Review Board (IRB) of University of Cape Coast (UCC) (see Appendix D). In addition, an introductory letter was obtained from the Head, Department of Health, Physical Education and Recreation (HPER), which introduced me to the authorities of Adidome SHS and provided an access to the participants for data collection (see Appendix E). This is in line with the proposition of Ogah (2013), that in order to prevent the violation of the rights of human research participants, it is incumbent on the researcher to obtain the approval of a well instituted research ethical committee to ascertain that the research protocol and data collection procedures conformed to that of the committee.

Dates were arranged to start the study with the students. The time was 4:00pm-5:00pm on week days and 7:00am-8:00am on Saturdays for the

nine weeks. The school handball and volleyball courts were used as venues for data collection. I demonstrated each test to participants.

The Health-Related Fitness components were tested using the test battery on the first day and results were recorded as baseline data and further tests were conducted at 3-week intervals. Data was collected with the help of 10 trained research assistants from Adidome branch of Red Cross Society of Ghana. The entire data collection lasted for nine weeks in which each session was made of a maximum of 60 minutes. The training sessions were conducted three times in a week; that is Wednesday, Friday and Saturday. Training guidelines were adhered to throughout the 9-week period.

Guidelines for training

The following guidelines were adhered to in each session or training day throughout the nine-week training period:

1. Each participant was screened to be sure that they were physically fit to be able to participate in each session. Their heart rate, BP and body temperature were taken.
2. All participants were instructed to wear the appropriate attire (PE kit) and a non-slip sports shoe with socks.
3. All participants were instructed to properly lace their shoes to avoid any injury.
4. All participants were taken through warm-up and stretching before the main activity.
5. Participants were instructed to come along with small towels to wipe their sweat.

6. Sachets of water were provided for drinking during each resting periods.
7. Resting mats were provided to help surmount all emergency situations.
8. A first aider with a first aid kit and medicaments were present during each session of the training.
9. The working area was well ventilated and illuminated.
10. Hand washing equipment was provided for participants to wash their hands before and after every session.
11. All participants were provided with nose masks to wear during the activities.

Intervention

This aspect of the study highlights the weekly physical activities designed for the participants over the nine weeks period to ascertain the effectiveness of the fartlek training on their HRF. Participants were taken through carefully designed activities in each of the training sessions throughout the entire nine weeks. Participants were tested on the first day of the training programme (Pre-test), week three (Post-test1), week six (Post-test2) and finally in week nine (Post-test3).

Week One

Materials required: stop watch, whistle, cones, pens, notebook, tape measure, weighing scale and gym mats.

Test 1 (Pre-test/baseline testing)

The BMI test was taken first (10 minutes)

Warm up: Jogging and neck side flexion (5 minutes)

Specific warm up activities: (6 minutes)

1. Brisk walking over 10m
2. Jumping jacks
3. Galloping with left leg in front over 20m
4. Galloping with right leg in front over 20m

Main activity: (30 minutes)

1. 12 minutes run interspersed with walking
2. Push-ups
3. Standing broad jump (3 reps)
4. Sit and reach test (3 reps)

Cool down: Steady walking around the court (4 minutes)

Week Two

Materials required: Stop watch, whistle, cones, and gym mats.

Warm up: "Here, there, where" and triceps stretch (5 minutes)

Specific warm up activities: (6 minutes)

1. Steady jog
2. Vertical jumps
3. Standing long jumps forward/backwards over 10m
4. Hopping from side to side forward/backwards over 10m

Main activity: (30 minutes)

1. Brisk walking around the handball court (3 reps)
2. Slow jogging around the handball court (3 reps)
3. Sprinting 40m dash (3 reps)
4. 6 minutes running/walking (2 reps)

Cool down: Slow jogging and high knee picking (4 minutes)

Week Three

Materials required: stop watch, whistle, cones, pens, notebook, tape measure, weighing scale and gym mats.

Test 2 (Post-test 1 was conducted during the last training session)

The BMI test was taken first. (10 minutes)

Warm up: Jogging and neck side flexion (5 minutes)

Specific warm up activities: (6 minutes)

1. Brisk walking over 10m
2. Jumping jacks
3. Galloping with left leg in front over 20m
4. Galloping with right leg in front over 20m

Main activity: (30 minutes)

1. 12 minutes run interspersed with walking
2. Push-ups
3. Standing broad jump (3 reps)
4. Sit and reach test (3 reps)

Cool down: Steady walking (4 minutes)

Week Four

Materials required: stop watch, whistle, cones and gym mats.

Warm up: Picking tails and shoulder stretch (5 minutes)

Specific warm up activities: (6 minutes)

1. Jumping over an obstacle
2. Jumping front and back to the right side/left side
3. Standing long jumps forward/backwards

Main activity: (30 minutes)

1. Normal pace run over 2km (2 reps)
2. Slow jogging over 800m (2 reps)
3. Normal walking around the court (3 reps)
4. 30m dash (2 reps)

Cool down: Arm raises, lower back extension and abdominal stretch (4 minutes)

Week Five

Materials required: stop watch, whistle, cones and gym mats.

Warm up: shuttle runs and upper back extension (5 minutes)

Specific warm up activities: (6 minutes)

1. Duck fight (3 reps)
2. Short jumps forwards/backwards (5 reps)
3. Hopping side to side on one foot (alternatively) (3 reps)

Main activity: (30 minutes)

1. 40m dash (3 reps)
2. Slow jogging over 100m (3 reps)
3. Brisk walking around the court (3 reps)
4. Jumping over an obstacle (4 reps)

Cool down: Body shakes, marching, arm circles and quadriceps stretch (4 minutes)

Week Six

Test 3 (Post-test 2 was conducted during the last training session)

Materials required: stop watch, whistle, cones, pens, notebook, tape measure, weighing scale and gym mats.

The BMI test was taken first. (10 minutes)

Warm up: Jogging and neck side flexion (5 minutes)

Specific warm up activities: (6 minutes)

1. Brisk walking over 10m (3 reps)
2. Galloping with left leg in front over 20m (3 reps)
3. Galloping with right leg in front over 20m (3 reps)

Main activity: (30 minutes)

1. 12 minutes run interspersed with walking
2. Push-ups
3. Standing broad jump (3 reps)
4. Sit and reach test (3 reps)

Cool down: Walking around using own pace (5 minutes)

Week Seven

Materials required: stop watch, whistle, cones and gym mats.

Warm up: "Here, there, where" and quadriceps stretch (5 minutes)

Specific warm up activities: (6 minutes)

1. Standing long jump forward/backwards (3 reps)
2. Jumping lunges to the right side/left side (3 reps)
3. Jogging on the spot
4. High knee picking

Main activity: (30 minutes)

1. Slow jogging with song and clapping of hands over 1km (3 reps)
2. Brisk walking around the court (3 reps)
3. 40m dash (3 reps)
4. 6 minutes running/walking (2 reps)

Cool down: Walking around and upper back extension (4 minutes)

Week Eight

Materials required: stop watch, whistle, cones and gym mats.

Warm up: Shuttle runs and hip flexor stretch (5 minutes)

Specific warm up activities: (6 minutes)

1. Galloping with alternative legs over 20m (3 reps)
2. High knee picking (3 reps)
3. Astride jumping (3 reps)

Main activity: (30 minutes)

1. Jogging with clapping of hands over 1km (3 reps)
2. Normal walking (3 reps)
3. Slow jogging (3 reps)
4. 8 minutes running interspersed with walking (3 reps)

Cool down: Side stretch with music (4 minutes).

Week Nine

Test 4 (Post-test 3 was conducted during the last training session).

Materials required: stop watch, whistle, cones, pens, notebook, tape measure, weighing scale and gym mats.

The BMI test was taken first. (10 minutes)

Warm up: Jogging and neck side flexion (5 minutes)

Specific warm up activities: (6 minutes)

1. Brisk walking over 10m (3 reps)
2. Jumping jacks
3. Galloping with left leg in front over 20m (3 reps)
4. Galloping with right leg in front over 20m (3 reps)

Main activity: (30 minutes)

1. 12 minutes run interspersed with walking
2. Push-ups
3. Standing broad jump (3 reps)
4. Sit and reach test (3 reps)

Cool down: Walking around the court using own pace (5 minutes)

Description of exercises

***Jumping jacks*:** Participants stand shoulder-width apart with the hands beside their body. Upon hearing the whistle, they jump with the legs spread sideways and hands moving from the side over the head. The action is repeated continuously.

***Galloping*:** This is a forward-facing locomotor movement in which the lead leg moves ahead of the trail leg, without the legs crossing at any point in time. The participants jump forward using a "springing" action with a push from the heel of the trail leg.

***Shuttle runs*:** Participants stand in a ready position behind a cone or line. Upon hearing the whistle, they run to two cones placed about 10m away from the starting point, and about 5m apart. Participants run to the first cone and back to the starting point, and then run to the second cone and back to the starting position.

***Short jumps*:** Participants stand shoulder-width apart. Upon hearing the whistle, they take off from both feet with the hand moving forwards and backwards to propel the body forwards. They land on both feet (on balls of feet) with a slightly bent knee. The action is repeated.

***Standing long jumps*:** Participants bend slightly behind the starting line with the hands drawn to the back for a forward drive. Upon hearing the whistle,

they take off from both feet and land on both feet with a slightly bent knee. The action is repeated.

***Hopping*:** Participants slightly raise one foot from the ground and take off from the other foot with the hands drawn to the back to generate the force for the body to move forward.

***Jumping lunges*:** Participants stand in ready position with one foot forward. Upon hearing the whistle, they jump and slightly "sit in" after landing. The activity is then repeated by switching to the other leg.

***Press ups*:** From a prone falling position, participants slightly bend and straighten the elbow to bring the entire body down and up respectively, whilst resting on the toe (for boys) or knee (for girls). The action is repeated.

***Sit ups*:** From supine lying position with bent knees and feet on the ground, participants lift the upper body to a sitting position and return to the supine position with the hands relaxed on the thigh. The action is repeated.

***High knee picking*:** From a shoulder-width apart standing position, participants run on the spot with the knee raised to the hip level with a well-coordinated arm and foot movement (alternate action).

***Heel kick ups*:** Participants stand shoulder-width apart and run on the spot with the arm and foot action, whilst kicking the buttocks with the heels.

***Picking tails*:** Participants fix palm leaves at the back of their shorts and jog around the working area trying to remove the tails of others, and at the same time protecting their tails from being picked by others.

***Here, there, where*:** Participants stand anywhere in the working area. They run to the position of the instructor upon hearing "here" command. Upon hearing "there" command, they run to the location that the instructor points at.

Participants run to their desired location in the working area upon hearing "where" command.

Description of stretching activities

***Neck side flexion*:** From a shoulder-width apart standing position, participants lower their ear towards their shoulder while keeping their face forwards. Participants hold the position for 30 seconds and repeat the activity at the other side.

***Triceps stretch*:** From a shoulder-width apart standing position, participants raise both arms over their head and bend their elbows such that the forearms are behind their head. They then grasp one elbow with the other hand and push the elbow down or towards the other shoulder so that the forearm drops towards the middle of the shoulder blade. The activity is repeated at the other arm.

***Shoulder stretch*:** From a shoulder-width apart standing position, participants hold a skipping rope between both hands at their back. They then gently pull the rope upwards with one hand and at the same time pull the rope downwards with the other hand. Participants repeat the activity at the opposite shoulder.

***Side stretch*:** From a shoulder-width apart standing position, participants bend their upper body to the right while still looking forward. They then use their right hand to gently push their right hip in the opposite direction. The same activity is repeated at the opposite side.

***Biceps stretch*:** Participants sit on a floor mat, place their feet flat on the floor and bend their knees. They then place their hands flat on the floor (fairly close together) with their fingers pointing away and walk their hands away from their buttocks. The activity is repeated.

***Quadriceps stretch*:** Participants raise their right foot at the ankle with the right hand. They then pull up their ankle gently to feel the stretch at the quadriceps whilst the left leg is slightly bent. The same activity is repeated on the other side.

***Adductor (groin) stretch*:** From a shoulder-width apart standing position, participants widen their feet whilst holding their hips for balance. They then lunge sideways such that the weight of the body rest on the left foot as they bend the knee to feel the stretch at the right groin. The same activity is then repeated on the other side.

***Hip flexor stretch*:** From a shoulder-width apart standing position, participants kneel by placing their right knee on a mat with the left foot placed flat on the floor in front of them. They then rest on their left knee with their hands, keep their body erect and hold the position for 30 seconds. The activity is repeated on the other foot.

***Lower back extension and abdominal stretch*:** Participants lie prone on a mat. They then lift the upper body off the floor by straightening the elbow to feel the stretch along the front of the abdomen. The activity is repeated.

***Upper back extension*:** Participants go on their knees and place their palms on the floor. They stretch their arms in front of them along the floor, while allowing their head to drop towards the floor with the buttocks moving towards their heel. The stretch is felt at the upper back between the shoulder blades.

Cardiovascular endurance

The data collected after the 12 minutes run interspersed with walk to test for cardiovascular endurance were converted to VO2max. The VO2max

was determined by converting the number of laps that the student was able to finish. The following equation was carried out to find the VO2max:

VO2max = 0.0268 x Distance (m) - 11.3 (Fahey, Insel & Walton. 2002). The answers, recorded in ml/kg/min. were fed into the computer programme as data, distinguishing the pre-test from the post-tests. These data were then processed to get the group statistics and results. The VO2max values were compared with the standard cooper test figures.

Muscular endurance

The raw scores obtained after the modified push-up tests were fed into the computer programme as data. The data were processed using the computer to obtain the statistics and results on the participants. The raw scores of the pre-test and post-tests were put into the Prudential Fitnessgram (Fahey et al., 2002) rating scale individually, to ascertain the Health Fitness Zone (HFZ) of participants. The independent samples t-test and the paired t-test results were finally used to ascertain if there were differences in the muscular endurance fitness level at pre-test, post-test1, post-test2 and post-test3.

Muscular strength

The raw scores obtained after the standing broad jumps test were fed into the computer programme as data, to obtain the group statistics and the results. The raw scores were rated using a Prudential Fitnessgram (2002) rating scale for standing broad jumps. The results of the independent samples t-test and the paired t-test were used to find out whether there were differences in the muscular strength levels.

Flexibility

After the sit-and-reach test, the scores were fed into the computer as data. The data was then processed to get results for the paired t-test and independent samples t-test. The flexibility rating scale to group the raw scores of the participants into zones of "high performance" (60cm and above), "good" (40-59cm), "fairly good" (20-39cm), and "need improvement" (19cm and below). The independent samples t-test results and the paired t-test results were finally used to compare the flexibility levels of the participants.

Body composition

After taking the height and weight measurements, the BMI for each participant was calculated as follows; the recorded height was squared (expressed in metres), and then used to divide the weight (expressed in kilograms). The answer, expressed in kilograms per metre squared (kg/m^2) was recorded as the BMI of the participants. The BMI of the students were fed into the computer programme as data which were then processed to get results. The calculated BMI for each participant were also referred to the AAHPERD functional fitness test (2002) rating table for body composition classification. The independent samples t-test and the paired t-test results were used separately to compare the body composition levels. The paired sample t-test statistical tool was used to compare the Health-Related Fitness pre-test as against post-tests 1-3. The choice of this statistical tool was influenced by the submission of Huck (2012) that when comparing more than two group means of measurements of participants at different times, the appropriate statistical tool to use is the paired sample t-test.

Data Processing and Analysis

Data analysis was done based on the research hypothesis. Statistical Package for the Social Sciences (SPSS) version 20.0 was used for the analysis. The data for pre-test was collected in week 1. The BMI test for body composition and flexibility were done on Wednesday with the help of the research assistants to record the results. On Friday of week 1, the data for muscular strength and muscular endurance were done and recorded by the help of the research assistants. On Saturday the data on cardiovascular endurance were collected and recorded. The same procedure were done on weeks 3, 6 and 9.

Research hypothesis 1

There will be statistically significant effect of fartlek training on HRF among students of Adidome SHS after 9-week intervention. Hypothesis 1 was analysed with paired t-test statistical tool. This tool compares the means of two variables for a single group. The choice of this statistical tool was influenced by the submission of Huck (2012) that when comparing more than two group means of measurements of participants at different times, the appropriate statistical tool is the paired t-test statistical tool. The data collected during the pre-test was compared with the post-tests 1-3. This analysis enabled me to determine whether or not any statistically significant difference existed in the two variables. The alpha level was set at .05.

Research hypothesis 2

There will be significant difference in HRF levels between boys and girls of Adidome SHS. This hypothesis was analysed with the independent sample t-test. Independent sample t-test is used to determine whether the

difference between means of two groups or conditions is due to the independent variable, or if the difference is simply due to chance. Thus, this procedure establishes the probability of the outcome of an experiment, and in doing so enables the researcher to reject or retain the null hypothesis. Gay (2002) opined that the t-test for independent sample is used to determine whether there is probably a significant difference between the means of two independent samples. The data collected on the HRF was compared with the data collected during the pre-test and post-test1-3.

Chapter Summary

In this chapter, the research design, study area, population, and sampling procedures were discussed. Also, the data collection instruments, data collection procedures, and data processing and analysis procedures were discussed. The one-group pre-test post-test repeated measures experimental design was adopted to conduct the study at Adidome SHS in the Central Tongu District of the Volta Region of Ghana. The sample covered all second and first year gold track students.

The multistage sampling technique made up of stratified sampling and simple random sampling without replacement were used to select 48 students. The AAHPERD functional fitness testing for HRF and a researcher-generated data summary sheet were used to collect data. Ethical protocols were sought to conduct the study. Clearance from IRB of UCC and an introductory letter from the Head of Department of HPER were obtained. The data was collected over nine weeks. Data collected were processed and analysed using paired t-test and independent sample t-test.

CHAPTER FOUR

RESULTS AND DISCUSSION

The purpose of this study was to examine the effects of nine-week Fartlek training on health-related fitness (HRF) of Adidome Senior High School (SHS) students. This chapter presents the results and discussions of the findings of the study. The paired sample t-test was used to compare the means of pre-test and post-test of HRF for a single group. Also the independent sample t-test was used to test for significant differences between the boys and girls in the five components of HRF levels. The results are presented and the findings on each hypotheses stated.

Hypothesis 1: There will be Statistically Significant Effect of Fartlek Training on HRF among Students of Adidome SHS after 9-week Intervention

This hypothesis sought to find out if any significant effect of fartlek training existed on the Health-Related Fitness levels among students of Adidome SHS after 9-week intervention activities. Table 2 presents the ensuing statistics of pre-and-post tests on cardiovascular endurance.

From Table 2, there was statistical significant difference in the results of pre-test (M = 2.23, SD = 0.78), and post-test 1 (M = 3.71, SD = 0.88), t (47) = 17.85 $p < .05$. Post-test 1 (M = 3.71, SD = 0.88), and post-test 2 (M = 4.88, SD = 0.91), t (47) $p < .05$ was also statistically significant. Further, post-test2 (M = 4.88, SD = 0.91), and post-test3 (M = 6.18, SD = 0.97), t (47) $p < .05$ were statistically significant. These results mean that there were steady improvements in cardiovascular endurance along the 9-week fartlek training

programme considering the increment of the means from 2.23 to 3.71, 4.88 and then 6.18.

The students got stronger and healthier in their cardiovascular endurance fitness levels after going through the fartlek training for the 9-week.

Cardiovascular Endurance

Table 2: Pre-Test and Post-Tests, 1- 3 on Cardiovascular Endurance

Paired	Number	Mean	SD	t(47)	sig.
Pre-test	48	2.23	0.78		
				17.85	0.000
Post-test1	48	3.71	0.88		
				17.37	0.000
Post-test2	48	4.88	0.91		
				20.74	0.000
Post-test3	48	6.18	0.97		

Source: Field data (2023) Significant $p < .05$

The reason for the higher cardiovascular endurance level of the students may be due to the 9-week fartlek training intervention that they went through. At the end of the 9-weeks, their VO_2max had increased while their heart rates diseased. The higher VO_2max mean may be as a result of a better engagement in the fartlek training method. The higher cardiovascular endurance could also be explained by the statistically significant difference in muscular endurance. According to experts, weight training for strength can stimulate the cardiovascular system (Cesario & Hughes, 2007).

Physical activity (PA) and health report of the American Surgeon General (2000) emphatically states that regular PA performed daily will reduce one's risk of developing or dying from heart-related disease. The activity positively develops cardiovascular fitness that produces the quality of physical reserve, power and stamina-endurance. These attributes are in line with the findings of Cesario and Hughes (2007) who gave credence to aerobic capacity.

Inadequate PA in SHS campuses are putting the students in a sedentary state. A sedentary lifestyle is one of the six major risk factors for cardiovascular endurance diseases (CVD). Cardiovascular diseases usually begin to develop in childhood and adolescence; it progresses slowly over time before producing any symptoms. Adopting healthy habits while young can help many people prevent or delay a heart attack or other serious forms of CVD (Insel & Roth, 2002).

As students of Adidome SHS do not engage in major physical and other related activities, their aerobics capacity, which is considered to be the best indicator of cardiovascular fitness, diminished, but after the fartlek training intervention, the results shows much improvement in their aerobic capacity.

The details of the intervention programme on muscular strength is presented in Table 3. From Table 3, there was statistical significant difference in the results of pre-test ($M = 0.99$, $SD = 0.20$), and post-test1 ($M = 1.57$, $SD = 0.27$), $t(47) = 22.26$, $p < .05$. There was statistical significant difference in the results of post-test1 ($M = 1.57$, $SD = 0.27$), and post-test2 ($M = 1.95$, $SD = 0.29$), $t(47) = 15.94$, $p < .05$. Again, there was statistical significant difference

in the results of post-test2 (M = 1.95, SD = 0.29), and post-test3 (M = 6.18, SD = 0.97), t (47) = 34.96, p < .05.

Muscular Strength

Table 3: Pre-Test and Post-Test1-3 on Muscular Strength

Paired	Number	Mean	SD	t(47)	sig.
Pre-test	48	0.99	0.20		
				22.26	0.000
Post-test1	48	1.57	0.27		
				15.94	0.000
Post-test2	48	1.95	0.29		
				34.96	0.000
Post-test3	48	6.18	0.97		

Source: Field data (2023) Significant p < .05

These results show that there was statistical significant difference or improvement in muscular strength through the intervention programme. This is evidence in the gradual increase of means from 0.99 through 1.57, 1.95 and to 6.18. The paired sample t-test results showed that there was a significant difference between the muscular strength fitness levels of the students of Adidome SHS after every test. This means the students improved in their muscular strength fitness levels after the fartlek intervention programme for the 9-weeks.

The high performance of the students at the marginal zone could be explained by the fartlek training activities that they went through. According to the United States Department of Health and Human Services (2010),

strength training will increase one's lean muscle mass, which results in an accelerated metabolism.

The detailed statistics of pre-test and post-tests 1-3 on muscular endurance is presented in Table 4. From Table 4, there was statistical significant difference in the results of pre-test (M = 3.04, SD = 1.55), and post-test1 (M = 5.18, SD = 2.41), t (47) = 9.54, p < .05. Post-test1 (M = 5.18, SD = 2.41), and post-test2 (M = 6.83, SD = 2.97), t (47) = 12.52, p < .05 was also statistically significant. Further post-test2 (M = 6.83, SD = 2.97), and post-test3 (M = 11.04, SD = 3.65), t(47) = 18.89 p < .05 was statistically significant.

Muscular Endurance

Table 4: Pre-Test and Post-Test1-3 on Muscular Endurance

Paired	Number	Mean	SD	t(47)	sig.
Pre-test	48	3.04	1.55		
				9.54	0.000
Post-test1	48	5.18	2.41		
				12.52	0.000
Post-test2	48	6.83	2.97		
				18.89	0.000
Post-test3	48	11.04	3.65		

Source: Field data (2023) Significant p < .05

These results mean that there were steady improvement in muscular endurance along the 9-week fartlek training programme considering the increment of the means from 3.04 to 5.18, 6.83 and then 11.04. The reason for the higher muscular endurance level of the students may be due to the 9-

week fartlek training intervention that the students went through. According to Fahey

et al. (2002), a person with a moderate-to-high level of muscular endurance can perform everyday task imposed on him.

The detailed statistics of pre-test and post-tests 1-3 on flexibility is presented in Table 5. From Table 5, there was statistical significant difference in the results of pre-test (M = 12.75, SD = 1.86), and post-test1 (M = 14.27, SD = 1.60), t (47) = 18.07, p < .05. There was statistical significant difference in the results of post-test1 (M = 14.27, SD = 1.60), and post-test2 (M = 15.66, SD = 1.70), t (47) = 19.56, p < .05. Again, there was statistical significant difference in the results of post-test2 (M = 15.66, SD = 1.70), and post-test3 (M = 17.29, SD = 2.29), t (47) = 13.00, p < .05. The results show that there was statistically significant difference in the flexibility of the students through the intervention programme. This is evidenced in the gradual increase of the means from 12.75 through 14.27, 15.66 and to 17.29.

Flexibility

Table 5: Pre-Test and Post-Tests 1-3 on Flexibility

Paired	Number	Mean	SD	t (47)	sig.
Pre-test	48	12.75	1.86		
				18.07	0.000
Post-test1	48	14.27	1.60		
				19.56	0.000
Post-test2	48	15.66	1.70		
				13.00	0.000
Post-test3	48	17.29	2.29		

Source: Field data (2023) Significant p < .05

The high flexibility levels of the students could be explained by the fartlek training activities that the students went through as part of the intervention. This result is in line with the previous findings of Fahey et al. (2004), that active people are more flexible than inactive individuals.

The details of the intervention programme on body composition is presented in Table 6. From Table 6, there was statistical significant difference in the results of pre-test (M = 29.42, SD = 6.46), and post-test1 (M = 26.10, SD = 5.37), t (47) = 12.44, p < .05. Post-test1 (M = 26.10, SD = 5.37), and post-test2 (M = 22.78, SD = 3.83), t (47) = 9.52, p < .05 was also statistically significant. Further, there was statistical significant difference in the results of post-test2 (M = 22.78, SD = 3.83), and post-test3 (M = 19.67, SD = 1.78), t (47) = 7.59 p < .05.

Body Composition

Table 6: Pre-Test and Post-Tests 1-3 on Body Composition

Paired	Number	Mean	SD	t (47)	sig.
Pre-test	48	29.42	6.46		
				12.44	0.000
Posttest1	48	26.10	5.37		
				9.52	0.000
Post-test2	48	22.78	3.83		
				7.59	0.000
Post-test3	48	19.67	1.78		

Source: Field data (2023) Significant p < .05

The results means that there were steady improvements in body composition along the 9-week fartlek intervention considering the mean from

29.42, through 26.10, 22.78, to 19.67. This is because a higher mean in this means a higher percentage of body fat deposits, which is a warning or basis for the contraction of many diseases.

Taking the entire test into consideration it shows that day-in-day-out the students reduced in weight which is good for their health. This condition could be attributed to the fartlek training activities that the students were taken through which burned out most of the fats they consumed. According to Nieman (2005), numerous studies have shown that walking can be a very effective component of a weight loss programme. It is beneficial and ranks high compared to other popular forms of exercise.

The Health-Related Fitness benefits of PA are clear. They include lower blood pressure and cholesterol and maintenance of a healthy weight (WHO, 2009). Some other benefits include improved mental health and well-being (Heesch & Brown, 2008), social engagement (Jewson, Spittle & Casey, 2008), enhanced sleep (de Castro Toledo Guimaraes, et al., 2008), and reduced risk of fractures (Stessman, et al., 2009).

Since there was a statistically significant effect in the Health-Related Fitness levels after the nine weeks of the fartlek training intervention programme for students of Adidome SHS, it can be said that the fartlek training intervention programme conducted over nine weeks was effective. This hypothesis was purposed to examine the efficacy of fartlek training intervention conducted three times in a week over a 9-week period on the HRF of the students of Adidome SHS. The study found that there was a statistically significant effect of fartlek training on the students Health-Related Fitness levels.

After comparing the pre-test and post-tests 1-3, it was indicated that there was a statistically significant increase in the Health-Related Fitness level for the students after the 9-weeks fartlek intervention programme. This implies that the 9-weeks fartlek training intervention programme was effective. It led to an improvement of the Health-Related Fitness levels of the students. This finding has some similarities with the findings of other investigations (Arazi et al., 2016; Chen, 2010; Ghorbani et al., 2014; Jahromi & Gholami, 2015; Kim et al., 2007; Lee, 2010; Lee & In, 2017; Mullur & Jyoti, 2019).

Mullur and Jyoti (2019) studied the impact of circuit training on the Health-Related Fitness level of 12-16 years in-school children. The study revealed that the circuit training conducted over eight weeks significantly improved the Health-Related Fitness of the children in the experimental group as against their colleagues in the control group. The commonality between the current study and Mullur and Jyoti's study is that Physical Activities when performed for some weeks improves Health-Related Fitness of school children. However, while the current study used nine weeks to realise the marked improvement, Mullur and Jyoti used eight weeks to record this same effect. This difference could be the result of the difference in training intensity. And also, while this study used fartlek training programme, Mullur and Jyoti used circuit training.

Similarly, Kumar (2015) conducted a study to investigate the effect of fartlek training programme on the fitness level of college athletes over a period of 6-weeks. The study yielded a statistically significant results in the fitness level of the participants following the 6-weeks fartlek training

programme. The finding that fartlek training performed after some weeks improved Health-Related Fitness as reported by Kumar is similar with the current study. However, while Kumar used only 6-weeks to note this effect, the current study used 9-weeks. A possible reason could be as a result of the differences in the sample used. Using only athletes in Kumar's study might have accounted for an improvement in Health-Related Fitness just after 6-weeks which could be linked to the students in this study not having improved fitness compared to the athletes in Kumar's study.

Jahromi and Gholami (2015) also examined the effectiveness of jump rope training on the physical fitness of 9-10 years old female students over 15 weeks. The study revealed that the 15 weeks jump rope training intervention elicited a statistically significant improvement in the Health-Related Fitness of the training group as against their counterparts in the control group. The similarity between Jahromi and Gholami's study and the present study is that improvement in Health-Related Fitness is realised after continuous participation in PA. However, while Jahromi and Gholami used 15 weeks, the current study used nine weeks and this could be due to the differences in the training intensity. Since the current study used SHS students a slightly higher intensity was used compared to the intensity that would be used for children aged 9-10 years.

In another study, Kim et al. (2007) examined the effect of six weeks skipping training programme on body composition of 26 and 14 obese and lean male adolescents respectively in Korea. Kim et al.'s study discovered a statistically significant change or improvement in the body composition of the participants in the obese exercise group after six weeks of skipping training.

Kim et al. had a similar finding with the current study. Their results re-echoed the improvement of Health-Related Fitness after 9-weeks of fartlek training. This notwithstanding, Kim et al. used skipping training for six weeks to realise the significant effect while the current study used fartlek training for nine weeks. A likely reason for these discrepancies may be because this study used normal weight students while Kim et al. used obese adolescents.

In Taiwan, Chen (2010) also conducted a case study on a student with mild intellectual disability to ascertain the effectiveness of exercise on his Health-Related Fitness for seven weeks. The result indicated that the seven-week training programme accounted for a significant improvement, supporting the evidence from the current study that fartlek training performed for 9-weeks improved the HRF of the participants. However, Chen used seven weeks to note the significant improvement in the HRF of the student. With a similar intention, Ogunleye (2014) investigated the effect of 8-weeks fartlek training programme on physical fitness level of sixth grade boys aged 11-12 years. Ogunleye's study discovered a statistically significant improvement in the Health-Related Fitness following the 8-weeks skipping training programme. While the current study used nine weeks to detect a marked improvement in Health-Related Fitness, Ogunleye used only 8-weeks. Differences in training intensity might have accounted for this differences.

Arazi et al. (2016) compared the effects of fartlek training methods on Health-Related Fitness in 10-12-year-old boys. The study revealed that the fartlek training methods significantly improved Health-Related Fitness as against the control group. This finding also confirms the improvement of Health-Related Fitness after weeks of fartlek training which is similar to the

finding of the current study. Hence, fartlek training could be used as a perfect alternative to running for the improvement of Health-Related Fitness for school going children as indicated in the current study.

Similarly, Ghorbani, et al. (2014) investigated the effects of aerobic training comprising running and rope skipping performed for six weeks on cardiovascular fitness, BMI and mental health of female students. An incredible improvement in cardiovascular fitness, BMI and mental health indices of participants in the experimental group was reported. Ghorbani et al.'s study also confirms the effectiveness of the training performed over some weeks on some fitness component, which is similar to the current study. However, Ghorbani et al. used six weeks to confirm the efficacy of aerobic training in improving CVD and BMI while the current study used nine weeks. A likely reason could be because, Ghorbani et al. used only females whose fitness level may be relatively lower. Despite the fact that this study used only one group, there was still a marked improvement in the HRF of the students after the nine-week fartlek intervention programme even though not entirely conclusive.

An acceptable reason for the finding of this study could be attributed to the high intensity nature of the fartlek training causing high degree of the breakdown of accumulated fat in the body (Styner et al., 2014). Another reason accounting for this finding could be the direct positive linkage between regular participation in vigorous PA and positive health outcomes irrespective of body size and age (Lazaar et al., 2007; Nagai & Moritani, 2004). It could also be that the long-term suspension of sporting activities in schools as a result of COVID-19 which rendered the students inactive for long, played a

role in the improvement of their HRF after the nine weeks of engaging in the fartlek training intervention programme (Genin et al., 2021; Hudson & Sprow, 2020).

In Africa's metropolitan centres, overweight and obesity are now becoming a health issue, especially for the lower and middle classes (Kumah, Akuffo, Abaka-Cann, Affram & Osae, 2015). This calls for increase in PA participation. Maintaining a healthy body composition is made easier by cardiovascular exercise (Chiu et al., 2017). Additionally, by putting the cardiovascular system through high-intensity interval training, certain hormones that stimulate fat burning (such as growth hormone and testosterone) become more active. Additionally, high-intensity exercise burns more calories overall and accelerates the fat-burning enzymes, whereas low-intensity, steady-state cardio routines burn a greater percentage of fat. (Longland, Oikawa, Mitchell, Devries & Phillips, 2016).

Studies suggest that individuals with poor body composition (overweight or obese) are more likely to have cardiovascular problems. This is primarily due to the increasing efforts required to perform PA or exercise. These substances have a high tendency to build up and block the flow of blood to the brain, to-and-from the heart and other organs resulting in a compromised cardiovascular system (Eler & Acar, 2018). Therefore, an individual with an improved body composition through aerobic muscular strength and endurance training is likely to carry out activities of daily living without undue fatigue (Seiler, 2010). Hence, an improved cardiovascular system has a significant positive effect on body composition (Hoeger, & Hoeger, 2007).

Essentially, this study has demonstrated that regular participation in vigorous PA, such as fartlek training intervention over a period of nine weeks could act as an efficacious means of promoting healthy lifestyles of the students. This findings have implications for the inclusion of fartlek training in the school life of students to help manage their Health-Related Fitness levels.

Research Hypothesis 2: There will be Significant difference in HRF levels between Boys and Girls of Adidome SHS after a 9-week Fartlek Training Programme

This hypothesis sought to find out the difference between males and females in Adidome SHS in terms of their Health-Related Fitness after the 9-week fartlek intervention programme. Independent sample t-test was used to determine whether the difference between means of two groups or conditions is due to the independent variable, or if the difference is simply due to chance (Gay, 2002). Thus, this procedure establishes the probability of the outcome of an experiment, and in doing so enables the researcher to reject or fail to reject the null hypothesis. In accomplishing this task, independent samples t-test analysis was conducted. Table 7 presents the details of the analysis.

Table 7: Gender differences on Cardiovascular Endurance

Test	Group	Number	Mean	SD	t (46)	sig.
Pre-test	Males	24	2.72	0.65	5.50	0.000
	Females	24	1.75	0.57		
Post-test 1	Males	24	4.37	0.57	7.76	0.000
	Females	24	3.00	0.59		
Post-test 2	Males	24	5.54	0.64		

	Females	24	4.22	0.59	7.08	0.000
Post-test 3	Males	24	6.98	0.53		
	Females	24	5.39	0.57	9.91	0.000

Source: Field data (2023) Significant at $p < .05$

From Table 7, there was a statistically significant difference in the results of pre-test for males (M = 2.72, SD = 0.65), and females (M = 1.75, SD = 0.57), t (46) = 5.50 $p < 0.05$. Post-test1 for males (M = 4.37, SD = 0.57), as against their female counterparts (M = 3.00, SD = 0.59), t (46) = 7.76 $p < 0.05$ was also statistically significant. Results for post-test2 for males (M = 5.54, SD = 0.64) and females (M = 4.22, SD = 0.59), t (46) = 7.08 $p < 0.05$ was statistically significant. Likewise, that of post-test3 males (M = 6.98, SD = 0.53) and females (M = 5.39, SD = 0.57), t (46) = 9.91 $p < 0.05$ was statistically significant. The mean differences revealed that the male students were better in their cardiovascular endurance fitness level along the 9-week fartlek training programme considering the means from 2.72 to 4.37, 5.54 and then 6.98 as against the means of their female counterpart from 1.75 to 3.00, 4.22 and then 5.39.

The males were stronger and healthier in the cardiovascular endurance fitness levels more than their female counterparts. This result confirms what Corbin et al. (2002) proffered that boys are naturally stronger than girls. It showed that more girls showed more weakness in cardiovascular endurance and needed to involve themselves in more physical activities to improve their cardiovascular endurance level. Physical activity and health report of the WHO, (2009) emphatically states that regular physical activity preferably performed daily will reduce one's risk of developing or dying from heart-

related disease. Regular and vigorous physical activity increases muscle size, strength and power and develop endurance for sustaining work, and taxes the circulatory and respiratory systems. Vigorous daily activity positively develops cardiovascular fitness that produces the quality of physical reserve, power and stamina-endurance.

The higher VO2max mean may also be as a result of better engagement in vigorous physical activities like aerobics. This explanation is in line with the findings of Laliberte (2001) who observed that the better the running times, the better the aerobic capacity. The higher cardiovascular endurance could also be explained by the statistically significant difference in muscular endurance to the advantage of the females. Although there were steady improvement in the females cardiovascular endurance levels day-by-day it could not match their male counterpart fitness level.

The details of the results on gender differences on muscular strength is presented in Table 8.

From Table 8, there was a statistical significant difference in the results of pre-test for males (M = 1.11, SD = 0.12), and females (M = 0.87, SD = 0.19), t (46) = 5.04 $p < 0.05$. Post-test1 for males (M = 1.76, SD = 0.20), as against their females counterparts (M = 1.37, SD = 0.17), t (46) = 7.08 $p < 0.05$ was also statistically significant. In post-test2, the results for males (M = 2.15, SD = 0.26) and females (M = 1.75, SD = 0.59), t (46) = 6.69 $p < 0.05$ was statistically significant. Also, in post-test3, the results for males (M = 2.64, SD = 0.24) and females (M = 2.13, SD = 0.15), t (46) = 8.47 $p < 0.05$ were statistically significant. This result means that the male students had better muscular strength than their females along the 9-week fartlek training

programme. This is evident in the means for the males increasing from 1.11 to 1.76, 2.15 and then 2.64 as against the means of their female counterparts from 0.87 to 1.37, 1.75 and then 2.13.

Table 8: Gender differences on Muscular Strength

Test	Group	Number	Mean	SD	t (46)	sig.
Pre-test	Males	24	1.11	0.12	5.04	0.000
	Females	24	0.87	0.19		
Post-test 1	Males	24	1.76	0.20	7.08	0.000
	Females	24	1.37	0.17		
Post-test 2	Males	24	2.15	0.26	6.69	0.000
	Females	24	1.75	0.14		
Post-test 3	Males	24	2.64	0.24	8.47	0.000
	Females	24	2.13	0.15		

Source: Field data (2023) Significant at $p < .05$

The results show that the male students had an improved muscular strength than their female counterparts. This difference may be due to the weight of the girls. According to Cesario and Hughes (2007), overweight, underweight and weak individuals will have below average strength fitness levels. Table 9 shows the results of the analysis for muscular endurance.

From Table 9, there was a statistically significant difference in the results of pre-test for males (M = 4.29, SD = 1.04), and females (M = 1.79, SD = 0.77), t (46) = 9.41 $p < 0.05$ for muscular endurance. Post-test1 for males (M = 7.45, SD = 0.83), as against females (M = 2.91, SD = 0.65), t (46) = 21.01 $p < 0.05$ was also statistically significant. In post-test2, the results for males (M = 9.66, SD = 1.00) and females (M = 4.00, SD = 0.51), t (46) = 24.58 $p < 0.05$ was also statistically significant. Also, in post-test3 results for

muscular endurance for males (M = 14.41, SD = 1.38) and females (M = 7.66, SD = 1.27), t (46) = 17.60 p < 0.05 was statistically significant.

Table 9: Gender differences on Muscular Endurance

Test	Group	Number	Mean	SD	t (46)	sig.
Pre-test	Males	24	4.29	1.04	9.41	0.000
	Females	24	1.79	0.77		
Post-test 1	Males	24	7.45	0.83	21.01	0.000
	Females	24	2.91	0.65		
Post-test 2	Males	24	9.66	1.00	24.58	0.000
	Females	24	4.00	0.51		
Post-test 3	Males	24	14.41	1.38	17.60	0.000
	Females	24	7.66	1.27		

Source: Field data (2023) Significant at p < 0.05

This result means that the male students are healthier in terms of their muscular endurance after the 9-week fartlek training programme considering the means from 4.29 to 7.45, 9.66 and then 14.41 as against their female counterparts from 1.79 to 2.91, 4.00 and then 7.66. The findings on the muscular endurance proved that there was statistically significant difference between the males and the females.

Table 10 shows the results of the analysis for flexibility.

From Table 10, there was statistically significant difference in the results of the pre-test for males (M = 14.33, SD = 1.04), and females (M = 11.16, SD = 0.86), t (47) = 11.39, p < .05. There was statistically significant difference in the results of post-test1 for males (M = 15.62, SD = 0.76), and females (M =

12.91, SD = 0.92), t (47) = 11.00, p < .05. Again, there was statistically significant difference in the results of post-test2 for males (M = 17.16, SD = 0.63), and females (M = 14.16, SD = 0.91), t (47) = 13.16, p < .05. Further, post-test3 followed the same trend for males (M = 19.29, SD = 0.90,) and females (M = 15.29, SD = 1.26), t (46) = 12.56 p < 0.05.

Table 10: Gender differences on Flexibility

Test	Group	Number	Mean	SD	t (46)	sig.
Pre-test	Males	24	14.33	1.04		
	Females	24	11.16	0.86	11.39	0.000
Post-test 1	Males	24	15.62	0.76		
	Females	24	12.91	0.92	11.00	0.000
Post-test 2	Males	24	17.16	0.63		
	Females	24	14.16	0.91	13.16	0.000
Post-test 3	Males	24	19.29	0.90		
	Females	24	15.29	1.26	12.56	0.000

Source: Field data (2023) Significant at p < 0.05

This result shows that there was statistically significant difference in the flexibility levels of the males and females students through the 9-week fartlek intervention programme. This is evidenced in the means of the males

from 14.33 through 15.62, 17.16 to 19.29 to that of the females from 11.16 through 12.91, 14.16 to 15.29.

This means the males had better flexibility than their female counterparts. This result is in support of Fahey et al. (2002) that boys are more flexible than girls in most cases. Table 11 shows the results for body composition.

Table 11: Gender differences on Body Composition

Test	Group	Number	Mean	SD	t (46)	sig.
Pre-test	Males	24	24.98	4.47		
					6.53	0.000
	Females	24	33.85	4.91		
Post-test 1	Males	24	27.60	3.58		
					5.90	0.000
	Females	24	29.59	4.55		
Post-test 2	Males	24	20.90	2.41		
					3.85	0.000
	Females	24	24.66	4.10		
Post-test 3	Males	24	18.83	0.43		
					3.64	0.000
	Females	24	20.50	2.21		

Source: Field data (2023) Significant at $p < 0.05$

From Table 11, there was statistically significant difference between males pre-test (M = 24.98, SD = 4.47), and females pre-test (M = 33.85, SD = 4.91), t (47) = 6.53, p < .05. There was statistically significant difference between the males post-test1 (M = 27.60, SD = 3.58), and females post-test1

(M = 29.59, SD = 4.55), t (47) = 5.90, p < .05. Again, there was statistically significant difference between males post-test2 (M = 20.90, SD = 2.41), and females post-test2 (M = 24.66, SD = 4.10), t (47) = 3.85, p < .05. Further, there was statistically significant difference between males post-test3 (M = 18.83, SD = 0.43,) and females post-test3 (M = 20.50, SD = 2.21), t (46) = 3.64 p < 0.05.

This result shows that there was statistically significant difference in the body composition levels of the male and female students through the 9-week fartlek intervention programme. This is evidenced in the means of the males from 24.98 through 27.60, 20.90 to 18.83 to that of the females from 33.85 through 29.59, 24.66 to 20.50. This is because a higher mean in this wise means a higher percentage of body fats deposits which is a warning or basis for the contraction of many CVD diseases.

The evidence affirms that the body composition level pertaining to the males is better than that of the females. Nieman (2005) opines that people who are physically fit fall asleep faster, sleep better and are less tired during the day. Further, women who participate in regular PA sleep more and experience a better quality of sleep than women who are sedentary (Cesario & Hughes, 2007).

This hypothesis was purposed to examine whether any substantial difference existed in the Health-Related Fitness between male and female students after the 9-week fartlek intervention programme. The study found that there was statistically significant difference in Health-Related Fitness components between male and female students after the nine-week fartlek training intervention programme. This implies that male and female students

did differ in terms of their Health-Related Fitness scores after the nine-week fartlek training intervention programme, with an incredible magnitude. In other words, gender is to be considered as a factor for having high or low Health-Related Fitness levels after the nine weeks fartlek training intervention programme.

The finding derived from this study is similar to that of other prior studies (Bashir & Hajam, 2017; Ham, Sung, Lee, Choi & Im, 2016; McKenzie, Marshall, Sallis & Conway, 2000; Vizcaíno et al., 2008). Huxley (2007) observed that historically there has been a failure to acknowledge the physiological differences between males and females and how these might impact on sex specific pathophysiology and implementation of appropriate cardiovascular disease treatments. However, differences between males and females emerge when PA increases beyond low intensity. Whereas males gain health benefits from vigorous PA, females do not. Huxley revealed how males and females are predisposed to engage in different levels of intensity and type of PA.

Similarly, Bashir et al. (2017) suggested that males need to be strong, fit and courageous to compete with other males to attract a suitable mating partner. This assertion indicates that males are biologically predisposed to be more active than females. A valid explanation that could be ascribed to this finding of having a statistically significant difference in HRF level after the 9-week programme may be due to the consistency in the training protocol for both the male and female students. The finding could also be as a consequence of the methodological approach employed in this study. That is the use of only one group as opposed to more than one group. In

the near future, studies could adopt different methodological designs to test this same hypothesis for a better understanding of the situation (i.e., gender difference in HRF after participating in a fartlek training programme for students).

The implication of this result is that the same PA interventions such as fartlek training method can be used for both male and female students who intend to improve their fitness status. In other words, fartlek training could be appropriate exercise intervention for both male and female students.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to examine the effects of nine-week Fartlek training on health-related fitness (HRF) of Adidome Senior High School (SHS) students. The summary, conclusions and recommendations emanating from the study are presented in this chapter. Suggestions for further research are also covered.

Summary

The broad goal of health service delivery is to improve the health of all people living in a country regardless of age, gender, ethnicity, religious conviction, political affiliation or socio-economic standing. This broad goal encompasses many specific objectives, among them, an increase in life expectancy, reduction in morbidity and fertility rates, and improvement in quality of life (WHO, 2009). The problem of deteriorating health status of Ghanaians has raised a lot of concerns in recent times.

The health sector is constantly plagued with cardiovascular related cases (e.g., obesity) and premature deaths. Students and for that matter the Ghanaian youth are admitted into second cycle institutions under the same broad computerised criteria or system which places students into their preferred schools so long as they qualify per the grading system. It follows that irrespective of one's educational, religious conviction, ethnicity, age, political affiliation, socio-economic standing, mental, or health-related physical fitness levels, these students are all admitted into various schools.

The Ghana Education Service (GES) have, as one of their functional pillars of responsibilities, to ensure, promote and sustain the good health of all

pupils or students in and out of educational institutions in the country. This broad focus is far from being achieved because these institutions are situated and function under different administrative, operational and environmental conditions. The different conditions existing among the various schools could influence HRF levels of the students. Craig and Bittman (2009) state that strength and training enables individuals to maintain their independence and ability to do day-to-day tasks and leisure activities. Additionally, physical activity is associated with maintaining independent function over time, irrespective of increasing age (Stessman et al., 2009).

The purpose of this study was to examine the effects of nine-week Fartlek training on Health-Related Fitness of Adidome SHS students. The study employed the one-group pre-test post-test repeated measures experimental research design. The American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD, 2013) functional fitness testing for Health-Related Fitness and a researcher-generated data collection summary sheet was used to collect data. Dates were arranged with the school authorities and students for data collection. The time was from 4:00pm-5:00pm on week days (twice) and 7:00am-8:00am on Saturdays for the nine weeks. Regarding the significant differences in Health-Related Fitness levels of the students, the paired sample t-test was adopted. Also, to determine the significant differences in Health-Related Fitness levels between males and females, the independent sample t-test statistic was adopted.

Key Findings

The summary of findings of the study are presented in accordance with the hypotheses:

1. There was statistically significant difference in all the Health-Related Fitness components of the students of Adidome SHS after the 9-week fartlek training programme. This reflected in the t-test values obtained and interpreted. This implies that the 9-week fartlek intervention programme contributed to the improvement of the Health-Related Fitness levels of Adidome SHS students.
2. There was statistically significant difference in all the Health-Related Fitness components between the male and female students of Adidome SHS after the 9-week fartlek training activities. The mean difference indicated that the male students had improved Health-Related Fitness levels than the female students.

Conclusion

From the findings, it is concluded that;

1. Training programmes such as fartlek is able to lead to a significant improvement in all Health-Related Fitness of Adidome SHS students.
2. Male students improve in all Health-Related Fitness levels from fartlek training than female students at Adidome SHS.

Recommendations

From the research findings and conclusions the following recommendations are made:

1. Physical education and sports teachers should adopt the fartlek training protocols used in this study to train their students. This will lead to

noticeable improvement in their HRF and subsequently their general health and fitness.

2. Since males recorded significant improvements in Health-Related Fitness than females, school authorities and physical education teachers should put measures in place to encourage female students to participate fully in training programmes to also improve their Health-Related Fitness components.

Suggestions for Further Research

Even though the participants were advised to engage in Fartlek training if they would want to exercise, the guarantee that they followed such instructions and that they did not do any other PA except fartlek training, which might have influenced the findings, could not be established. Also, the dietary patterns and behaviours of participants was not controlled for, subjecting the results of the study to interrogations. Future research work on Health-Related Fitness levels in any educational institution, should consider adopting other research designs such as a quasi-experimental research design where participants will be accidentally allocated to either a control or experimental group in order to rule out other possible confounding effects.

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APPENDICES

APPENDIX A

AAHPERD FUNCTIONAL TEST BATTERY

Health-related fitness	Test battery
Cardiovascular Endurance	12minutes-run/walk
Muscular Endurance	Modified push-ups
Muscular Strength	Standing broad jump
Flexibility	Sit and reach
Body Composition	BMI (weight /height

APPENDIX B

DATA SUMMARY SHEET

ID	Age	Gender	Musc. strength	Body comp.	Flex.	Musc. end.	Cardio. end.
001							
002							
003							
004							
005							
006							
007							
008							
009							
010							
011							
012							
013							
014							
015							
016							
017							
018							
019							

APPENDIX C

HRF TEST COMPONENTS SUMMARY SHEET

ID	Pre-test					Post-test1					Post-test2					Post-test3				
	F	E	C	B	S	F	E	C	B	S	F	E	C	B	S	F	E	C	B	S
001																				
002																				
003																				
004																				
005																				
006																				
007																				
008																				
009																				
010																				
011																				
012																				
013																				
014																				
015																				
016																				
017																				
018																				
019																				

APPENDIX D

ETHICAL CLEARANCE

UNIVERSITY OF CAPE COAST
INSTITUTIONAL REVIEW BOARD SECRETARIAT
TEL: 0558093143 / 0508878309
E-MAIL: irb@ucc.edu.gh
OUR REF: UCC/IRB/A/2016/1455
YOUR REF:
OMB NO: 0990-0279
IORG #: IORG0009096

2ND AUGUST, 2022

Mr. Selorm Junior Dusu
Department of Health, Physical Education and Recreation
University of Cape Coast

Dear Mr. Dusu,

ETHICAL CLEARANCE – ID (UCCIRB/CES/2022/15)

The University of Cape Coast Institutional Review Board (UCCIRB) has granted Provisional Approval for the implementation of your research **Effects of Nine-Week Fartlek Training on Health–Related Fitness of Adidome Senior High School Students.** This approval is valid from 2nd August, 2022 to 3rd August, 2023. You may apply for a renewal subject to submission of all the required documents that will be prescribed by the UCCIRB.

Please note that any modification to the project must be submitted to the UCCIRB for review and approval before its implementation. You are required to submit periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation.

You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours faithfully,

Samuel Asiedu Owusu, PhD

UCCIRB Administrator

ADMINISTRATOR
INSTITUTIONAL REVIEW BOARD
UNIVERSITY OF CAPE COAST

APPENDIX E

INTRODUCTORY LETTER

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF HEALTH, PHYSICAL EDUCATION & RECREATION

TELEPHONE: +233 - (0)206610931 / (0)543021384 / (0)268392819

TELEX: 2552, UCC, GH.

Our Ref: **ET/MPE/19/0002**

EMAIL: hper@ucc.edu.gh

Cables & Telegrams:
UNIVERSITY, CAPE COAST

5th January, 2022

The Chairman
Institutional Review Board
University of Cape Coast
Cape Coast

INTRODUCTORY LETTER: SELORM JUNIOR DUSU (ET/MPE/19/0001)

The above named person is a student of the Department of Health, Physical Education and Recreation of the University of Cape Coast. He is pursuing a Master of Philosophy degree in Physical Education. In partial fulfilment of the requirements for the programme, he is conducting a research for his thesis titled **"Effects of Nine-Week Fartlek Training on Health-Related Fitness of Adidome Senior High School Student".**

He has defended his thesis proposal and has passed. I therefore kindly request that he is granted ethical clearance to enable him continue with the research.

Counting on your usual co-operation.

Thank you.

Dr. Edward Wilson Ansah
HEAD