

**EFFECTS OF INTERVAL TRAINING ON
HEALTH-RELATED FITNESS AMONG
SEDENTARY UNIVERSITY STUDENTS**

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(Exercise And Sports Science)**

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CERTIFICATE

This is to certify that the dissertation that the dissertation entitled EFFECTS OF INTERVAL TRAINING ON HEALTH-RELATED FITNESS AMONG SEDENTARY UNIVERSITY STUDENTS is the bona fide record of research work done by CAROL LAU KHO MING during the period from October 2016 to May 2017 under my supervision. I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfilment for the degree of Bachelor of Health Sciences, Exercise and Sports Science.

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ABSTRAK

Kajian ini berbandingkan kesan latihan interval pada kecergasan yang berkaitan dengan kesihatan dan kesannya dari masa ke masa. Respons dalam komposisi badan, daya tahan kardiorespiratori, kekuatan otot, daya tahan otot dan fleksibiliti telah diperiksa. Tiga puluh tujuh peserta wanita yang sihat dan kurang aktif dari Kampus Kesihatan Universiti Sains Malaysia terlibat dalam kajian ini. Latihan interval terdiri daripada 18 sesi sepanjang enam minggu. Hasil kajian menunjukkan peningkatan yang ketara dalam daya tahan kardiorespiratori, kekuatan otot, daya tahan otot dan fleksibiliti selepas kajian. Kesimpulannya, latihan interval boleh dijadikan sebagai alternatif untuk latihan daya tahan berterusan untuk populasi yang tidak terlatih.

ABSTRACT

The present study compared the effect of interval training on health-related fitness and its effect over time. Responses in body composition, cardiorespiratory endurance, muscular strength, muscular endurance and flexibility was examined. Thirty-seven healthy, sedentary female participants from Universiti Sains Malaysia Health Campus were recruited in this study. Interval training consisted of 18 sessions were completed over six weeks. Results indicated significantly improved cardiorespiratory endurance, muscular strength, muscular endurance and flexibility after intervention. It is concluded that interval training can be used as an alternative for endurance training for untrained population.

CHAPTER 1

INTRODUCTION

1.1 Overview

Young people are often prefigured as the leaders of tomorrow. Major segment of the young adult population is represented by college or university student and their health practices and behaviors at this stage will carry on into later life (Lee and Loke 2005). Many of the nation's undergraduate students are placing their health at risk through lifestyle choices that include insufficient physical activity and unhealthy food choices. For that reason, health professionals should target young people for health promotion.

Physical activity and health status is no longer the topic of argument. Those who are habitually physical active are healthier than those who are not (Pate, Pratt et al. 1995). In spite of the how firmly people believe the health benefits of physical activity, regular activity may be discouraged by plenty of barriers. Most rated barriers are including lack of time, lack of motivation, no facilities, low enjoyment and low of family social support (Leslie, Owen et al. 1999).

According to TheStar (2016), 3.5 million of Malaysians have diabetes, 6.1 million are tormented by hypertension; and 100, 000 people suffer from cancer annually in Malaysia. In short, Malaysia has a chronic health problem. National Health and Morbidity Survey (NHMS) 2015 mentioned that the alarming rise of these diseases can be related to the root that most families in Malaysia have poor lifestyle options leading the children to the wrong way and when they grow up, they too do not see the significance of practicing sports and this will be passed down from generations to generations; the totally wrong concepts which leads to the reasons why we have so many inactive university students here in our country. TheStar (2016)

indicated that the Healthy Ministry survey showed that 94% of the Malaysian adult students do not eat enough fresh fruits and vegetables and about one of three Malaysian adults are not physically active. Hence, it is vital to lead a healthy life style by applying sports in our daily lives.

The researcher suggested interval training to improve five health-related fitness components namely cardiorespiratory endurance, muscular endurance, muscular strength, body composition and flexibility. There are some reasons where the researcher proposed interval training rather than “steady state” exercise. It involves a combination of high and low-intensity training within a single workout session. Interval training is a simple technique suitable for both novice and experienced trainers. It is not complex and difficult as it is simply just alternating bursts of intense doings with intervals of lighter doings. An example would be; if your exercise is walking, you can actually incorporate short bursts of jogging into your regular brisk walks. You could try to walk faster between certain mailboxes, trees or other landmarks. In general, interval training helps to burn more calories and the current routine can be simply modified to achieve greater effectiveness and results. Interval training enables a person to exercise longer or with more intensity. One might be able to finish 60-minute walk in 45 minutes. Not only that, no special equipment is required for interval training too and lastly, students find that time is precious and they need to spend more time studying; thus, interval training saves their time as it combines different activities into one and it tackles more than just one part of the bodies (Staff, M.C., 2017).

1.2 Background of the Study

In Malaysia, our Youth and Sports Minister; Mr. Khairy Jamaluddin mentioned that Malaysians in general have yet to practise a healthy lifestyle (theSundaily, 2016). He also stressed that only 40% of the Malaysian students adopted a healthy lifestyle by making sports as a culture. It is not a surprising fact that other developed countries like Australia, Japan and United Kingdom do well in the Olympic Games because their people adopt a sports culture since young and they brought out the spirit into their jobs and into a habit of their lives which in Malaysia, students are lack of this virtue. Hence, when they become young adults, they too do not see the importance of having sports as parts of their lives. The significance of practising a healthy lifestyle is brought out by the minister of Youth and Sports that the ministry itself is making plans to make Malaysia as a sporting nation with at least 60% of the people involving in fitness activities with the minimum range of three times a week. This is due to the fact that more Malaysians have suffering from obesity which then after leads to heart diseases, hypertension as well as diabetes. According to the Sundaily (2016), the ministry also aims to provide channels like Fit Malaysia and National Sports Day to get more Malaysians to be involved in sport and fitness activities. Thus, to summarize from here, even the government is raising awareness among the public to change their living lifestyle to create a healthy image among the Malaysia. Therefore, the researcher aimed to conduct a research on the effects of interval training among the sedentary university students as interval training is suitable for university students as it is a type of training which involves a series of low-to-high intensity workouts combined with rest or relied periods. Interval training can also be referred to the organization of any cardiovascular workout such as cycling, running and rowing. It is noticeable in training routines for many sports, but is particularly engaged by runners (Kerr, Hamish, 2011). According to Kerr, Hamish (2011), interval training can enhance many features of human physiology. It can boost up the lactate threshold and

develop VO₂max. An increase in an athlete's VO₂max permits them to inhale more oxygen whilst exercising, improving the competency to endure larger extents of aerobic strength. An intensification in an athlete's VO₂max permits them to inhale more oxygen whilst exercising, improving the competency to endure larger extents of aerobic strength. A blend of interval training and continuous exercise enhances cardiovascular fitness and increases HDL-cholesterol, which decreases the hazard of cardiovascular disease. Interval training may profit the exercisers by letting them to burn more calories in a diminutive period, and by enhancing aerobic competency at a faster rate, when equated with constant-intensity exercise. High concentration interval training employing 4 sets of 4-minute intervals has been revealed to enhance VO₂max to a better extent than isocaloric sensible continuous training, as well as to a greater extent than with a practise using shorter, 1-minute intervals. Thus, the researcher aimed to carry out a research of the effects of interval training; to what extent it is able to bring out the effectiveness by using full body weight training.

1.3 Problem Statement

Many university students find it time consuming to exercise due to hectic study life styles where they need to tackle assignments, mid-semester examinations and final examinations as well. Many of them spend inactive lifestyles and having inappropriate diet meals due to they need to rush for their group discussions or meetings and hitting every deadline given. Thus, they cannot afford to spend time doing some sports; rather they tend to opt to release their stress in different solutions; like eating, shopping, listening to music and etc. (TheStar, 2016). According to Thiagarajan, T.(2017), Deputy Health Minister Datuk Seri Dr. Hilmi Yahya indicated that Malaysia will become the country with the highest number of kidney failure patients who are diabetic by the year of 2030 if Malaysians keep their unhealthy lifestyles regardless of age. On top of that, it was also reported that Malaysia is considered to be in the midst of an obesity epidemic, with a percentage about 45% students being overweight and obese due to prevalence of sedentary lifestyles.

1.4 Purpose of the Study

The purpose of my study was to investigate the effects of interval training on five health-related fitness components (cardiorespiratory fitness, muscular endurance, muscular strength, body composition and flexibility) among sedentary university students as interval and continuous training are always getting into subject of debate as which is more effective in improving fitness, biomechanical, physiological and performance measures.

1.5 Objectives for the Study

The objective of the study was to determine the effects of interval training on health-related fitness among female sedentary students by applying pre-test-post-test experimental study which consists of baseline testing, two post-tests and 6-week circuit training intervention. The test consisted of Height, Weight and BMI under anthropometry, Yo-Yo Intermittent Recovery Test under cardiorespiratory fitness, Push-up Test and Curl-up Test under muscular endurance, Handgrip Test and Back and Leg test under muscular strength, Sit-and-Reach Test under flexibility and lastly, Bioelectrical impedance analysis (BIA) under body composition.

1.6 Research Question

Is there any difference between the pre-test and post-test of the evaluation for cardiorespiratory endurance, muscular endurance, muscular strength, body composition and flexibility after 6-week circuit training intervention?

1.7 Research Hypotheses

H_{01} : There are no significant effects of interval training on health-related fitness among sedentary university students.

H_{A1} : There are significant effects of interval training on health-related fitness among sedentary university students.

1.8 Significance of the Study

This research study was significant as there are problems arising among the university students which are they do not practise healthy and active lifestyle due to different factors like time limitation, lack of motivation and etc. This research was conducted to cultivate and spread the awareness among the students to practise sports as a part and culture of their lives. Compare to other countries in Southeast Asia, we have about 44.2% of overweight populations for adults of both sexes (Thiagarajan, T., 2017), hence, there is a need to conduct this experimental study to educate the group of students who were being tested and making them realise within a short period of time on how effective interval training could be and they could continue to practise it despite after the study has ended.

Chapter 2

Literature Review

2.1 Physical Activity

Physical activity and exercise have similar definitions as any bodily movement results in energy expenditure through skeletal muscles (varies continuous from low to high) and positively correlated with fitness (Caspersen, Powell et al. 1985). Exercise can be defined as planned, structured and repetitive bodily movement done to enhance or preserve one or more components of physical fitness (Corbin and Noble 1980). Caspersen et al. (1985) classified physical activity into light, moderate or heavy intensity that happens while sleeping, at work and at leisure times.

According to American College of Sport Medicine, (ACSM), moderate-intensity of aerobic physical activity performed for a slightest of 30 minutes on five days per week, or dynamic-intensity aerobic activity accomplished for a minimum 3 days per week, or permutation of moderate and energetic intensity activity can be performed to meet the recommendation to enhance and retain our health. Haskell et al. (1985) proposed that young adults should take account of flexibility exercises and calisthenics or resistance exercises to preserve muscle tone and strength as part of their exercise regime, instead of durable exercise only (Haskell, Montoye et al. 1985).

Consistent participation in physical activity has always outlook as vital for healthy lifestyle that associated to physical and mental benefits (Paffenbarger Jr, Hyde et al. 1986, Powell, Thompson et al. 1987, Pate, Pratt et al. 1995). Other epidemiologic researches have shown that low levels of habitual physical activity and low level of physical fitness related with markedly increased all-cause mortality rates (Paffenbarger Jr, Hyde et al. 1986, Blair,

Kohl et al. 1989). Paffenbarger et al., 1986; Blair et al. (1989) conveyed that, sedentary individuals of all age will achieve noteworthy increases in physical fitness and associated health benefits with suitable type of exercise accomplished at appropriate intensity, duration and frequency.

2.2 Lifestyle of University Students

University scholars represent a major division of the young adult inhabitants and are also forthcoming social opinion leaders and judgment makers. As such, they are a cluster worthy of study, especially as little known about their bodily activity forms and other health-related characteristics.

While young grown-ups entering university may gain amplified control over their lifestyles, they may not obliquely develop behaviors like consistent physical activity and may have restricted admittance to physical activity amenities on campus. Preceding studies have testified that the average college student fails to encounter the contemporary physical activity commendations of the American College of Sports Medicine (Dinger and Waigandt 1997), while both students and alumni distinguish that they are turning to be less active over time (Calfas, Sallis et al. 1994).

University students equated to young adults in universal are more probable to be preoccupied with their studies, which eat up much of their time and energy, averting them from partaking in systematic exercise programs. Although health is greatly valued by university students, and a majority of them are conscious of the significance of health-promoting behaviors, but only a minor percentage of students actually enthusiastically pursue a vigorous lifestyle, participate in regular exercise, or embrace good nutritional habits (Oleckno and Blacconiere 1990, White 1999).

2.3 The Terminology of Sedentary and Sedentary Behavior among University students

According to Cambridge English Dictionary (2017), sedentary can be defined as involving minimum amount exercise or physical activity. Sedentary behavior refers to activities that do not increase energy expenditure substantially above the resting level and includes activities such as sleeping, sitting, lying down, and watching television, and other forms of screen-based entertainment (Pate, O'Neill et al. 2008). Sedentary conducts are usually demarcated by both low energy expenditure (for example; resting metabolic rate, typically ≤ 1.5 metabolic equivalents (METs)) and a sitting or reclining position (Pate, O'Neill et al. 2008, Owen, Healy et al. 2010, Tremblay, Colley et al. 2010). Common sedentary attitudes consist of TV viewing, video game playing, computer use (collective termed "screen time"), driving vehicles, and reading. The generic term sedentary behavior identifies a class of behaviors characterized primarily by sitting, with associated low levels of metabolic energy expenditure (Owen, Leslie et al. 2000, Owen, Healy et al. 2010, Hamilton and Owen 2012).

University pupils are more expected to be concerned of their studies, which take up much of time and energy, avoiding them from joining in consistent exercise programs as compared to young adults in general. In addition of pursuing their studies, they are facing obstacles of corresponding between rest and exercise, nutritional intake and psychosocial needs. They are also confronted in accomplishing their personal growth and perseverance is needed to cope with life stress in order to establish healthy interpersonal relationships.

In the study on Australian College Students by Eva Leslie et al. (1999), most of the students reacted that their capability to join in physical activity was not restricted (89% of respondents). Only a small percentage of the respondents testified that they were bounded by

a temporary illness (2%), a temporary injury (3%), a long-term illness (2%), or a long-term handicap or disability (4%) (Leslie, Owen et al. 1999).

Regina et al. (2005) described that university students had a limited logic of “health responsibility”, and relatively few are involved in “physical activity” and applied “nutritional habits”. Although health is vastly valued by university students, and most of them aware of the significance of health-stimulating behavior, in fact, actually there is only a small percentage of students practice a healthy lifestyle, affianced in physical activity and nutritional habits (Oleckno and Blacconiere 1990, White 1999).

2.4 Why Females and the Stand Behind It

The Hong Kong Federation of Youth Groups (1999) exposed that male students are more probable to “follow a planned exercise program”, “exercise vigorously for 20 minutes or more for at least three times a week”, “participate in leisure physical activities” than female students. Regina et al. (2005) also discovered that male students were more able to cope in stress management than female students, “take time to relax”, “concentrate on pleasant thoughts”, and “pace themselves to prevent tiredness” (Lee and Loke 2005). At the same time, Eva Leslie et al. (1999) stated that females were more expected to be insufficient active with a higher percentage in the sedentary and low-activity categories rather than males. Female students also described that they experienced more stress, headache and tiredness than male students did (Von Bothmer and Fridlund 2005). Few studies have shown differences in physical activity levels between men and women with more women than men being insufficiently active to achieve most of the long-term health benefits (Owen and Bauman 1992, Bauman, Bellew et al. 1996, Booth, Bauman et al. 1997). However, few studies have examined gender differences in the correlates of physical activity. One relevant finding is that social support may be more important for women than men (Sallis and Hovell

1990, Calfas, Sallis et al. 1994). Females were more likely to be insufficiently active, with a higher proportion in the sedentary and low-activity categories than males. Females who reported low social support from their family were more like to be insufficiently active than those who reported high social support. Low levels of friend and family social support were the strongest psychosocial attributes associated with being insufficiently active (Leslie, Owen et al. 1999).

2.5 Continuous Training versus Interval Training

Moderate-intensity continuous training methods and high-intensity interval training are normally recommended to increase $\text{VO}_{2\text{ max}}$. Reasonable-intensity continuous training program typically endure intensities between 60% and 75% of peak heart rate, while high-intensity interval training is generally using short intervals (around 30s) and intensities near maximum (80-100 % peak heart rate). High-intensity interval training has not only utilized with athletes but in recent times it is also used on amateur individuals with cardio metabolic disorders and cardiovascular illness (Weston, Wisløff et al. 2014).

High-intensity interval training was at the topmost of top 20 trends in global survey of fitness trends for the past two sequential years (ACSM's Health Fit J. 2013, 2014). Numerous studies had revealed that high-intensity interval training when compared to moderate intensity continuous training; it can create faster and more significant adaptations in $\text{VO}_{2\text{ max}}$ (Helgerud, Hoydal et al. 2007, Gibala and McGee 2008, Nybo, Sundstrup et al. 2010). Gorostiaga et al. reported that interval training results in higher increase in $\text{VO}_{2\text{ max}}$ and maximal exercise intensity when the work intensities of both two training modes were relative same (Gorostiaga, Walter et al. 1991).

There is another reason that high-intensity has become the top fitness trends for current years. Wisloff et al. (2007) and Tjonna et al. (2013) recommended that greater post-

exercise feelings of enjoyment are due to the varied nature of the activity profile inherent to high intensity interval training compared with the “boring” steady-state continuous method (Wisløff, Støylen et al. 2007, Tjønnå, Leinan et al. 2013). Consequently, the accessible evidence recommends that higher-intensity may suggest a more time-efficient approach to negate time from being a barricade to exercise and thus assist in increasing the physical activity levels. As little as 3 weeks of the interval training mentioned in the study has shown improvement in maximum oxygen consumption ($\text{VO}_{2\text{ max}}$) and endurance performance in recreationally active individuals (Burgomaster, Hughes et al. 2005, Gibala, Little et al. 2006, Burgomaster, Howarth et al. 2008). In addition, Rakobowchuk and colleagues (2008) also discovered that peripheral vascular structure and function were enriched after 6 weeks of sprint interval training.

2.6 Health-related Fitness

Physical fitness is a set of features that people have or accomplish. High level of physical fitness is commonly go along with beneficial to health but an enhancement in fitness does not necessary guarantee an increase in risk of disease or its consequences (Haskell, Montoye et al. 1985). According to Pate (1983), the most regularly quoted fitness components fall into two groups: one is health-related and one is skill-related (Pate 1983). Being physically fit which can be defined as the capability to bring out daily tasks with vigor and alertness made health-related fitness components more imperative to public health compared to performance- related components. Health-related fitness components are often made up of of five components which are cardiorespiratory fitness, muscular endurance, muscular strength, flexibility and body composition (Caspersen, Powell et al. 1985).

Cardiorespiratory endurance is defined as the ability of the circulatory and respiratory systems to supply fuel during sustained physical activity and to eliminate fatigue products

after supplying fuel. Muscular endurance is a health-related component that relates to the ability of muscle groups to exert external force for many repetitions or successive exertions. In the meantime, muscular strength is related to the amount of external force that a muscle can exert. Body composition is the relative amounts of muscle, fat, bone and other vital parts of the body. A health-related component that relates to the range of motion available at a joint is what we named as flexibility (Corbin and Noble 1980).

2.7 Interval training in enhancing cardiorespiratory endurance

Interval training works great to improve one's cardiovascular structure because it combines up the routine, causing the body to consistently work hard. It also avoids the alteration process or does not permit your body to get used to one type of exercise. If you think of an activity at work you're responsible for. When you were first consigned this task, your brain had to really reason hard to accomplish the job. After about a month or two, though, that task most probable became second nature to you, so your brain did not have to ponder as hard to accomplish the task. If you let this occur to your workout, your body gets use to a routine, causing the capacity of workload to not be there anymore (and thus prevents fitness improvement). Interval training combines your workout enough to keep your body reflecting about what it is doing. Interval training consists of anaerobic and aerobic activity, causing the heart and lungs to work harder, and giving out a results-oriented workout. Anaerobic refers to the high intensity point in your exercise, or when one is lacking of oxygen. This is when stored glucose and fat are burned while the heart is functioning at 85 percent peak capacity. At this intensity level, the muscles are being forced to not depend on oxygen to fuel muscle contraction, and during this period, lactic acid is formed. Lactic acid causes the muscles to break down and fatigue, making your exercise intensity to eventually

decrease. One will know that the lactic acid is forming when the burning sensation takes over the muscles (Atkins, William, 2015).

Aerobic refers to the recovery point in the cardio session, and it is when the body refuels on oxygen. This is the point in one's exercise where the heart and lungs have to work extra hard to pay back that oxygen deficiency, and break down the lactic acid that was accumulated. During the aerobic stage of your workout, one will be building the stamina. By having a recovery period throughout the workout, the body is able to exercise longer, leading to a gradual cardio improvement.

The amount of blood that is pumped throughout the body can be improved in two different ways. First of all, there is the amount of blood expelled by the heart. Secondly, heart rate, which is the rate that the heart pumps blood.

Research shows that fit individuals have a lower than average resting pulse. Interval training makes the heart stronger, making it possible for more blood to be expelled with each pump. This means that one's heart will not have to pump as often, thus reducing the resting heart rate (Gray, S., 2011).

2.8 Interval training in enhancing muscular endurance

Endurance is the ability of your muscles to perform contractions for extended periods of time. Rather than just lifting or carrying something for a few seconds, the muscles are used for minutes.

High intensity training adapts to the cellular structure of muscles which enables one to increase his or her endurance while doing any type of exercise. "Journal of Physiology," posted a study where people participated in HIIT for eight weeks and the results showed that they had doubled the length of time they could ride a bicycle while keeping the same pace (Nevill, Holmyard et al. 1996).

Muscular endurance is defined as the ability to perform a specific amount of work for an extended period of time. Exercises that build muscular endurance are designed to improve the amount of effort used and the duration a specific intensity can be held. The key to building muscle endurance is to perform high-rep workouts of several types of exercise. One of the examples which can be applied in interval training is push-ups. Push-ups build upper-body strength, but they can also improve muscular endurance. Start in the prone position with your head facing the ground and your feet and hands on the ground. Lower your chest to the ground and then press yourself back up to the starting position with your arms extended. Primary muscles worked for muscular endurance include the chest, triceps, shoulders, core and serratus anterior. Adding variations, such as raising one leg, can increase the intensity of the push-up to build additional muscular endurance. Another example would be curl up test which is widely recommended by the American College of Sports Medicine. Curl up test measures abdominal muscular strength and endurance of the abdominals and hip-flexors, important in back support and core stability. Curl up test measures the strength and endurance of the abdominals and hip-flexor muscles.

2.9 Interval training in enhancing muscular strength

Muscular strength refers to the amount of force a muscle can produce with a single maximal effort. Muscle strength is measured during muscular contraction. The size of your muscle fibers and the ability of nerves to activate muscle fibers are related to muscle strength. In addition to understanding the definition of muscular strength, it's also important to understand the benefits of strong muscles. Building muscle strength helps with body alignment, makes performing everyday actions easier, increases metabolism, and relieves stress. According to the American Council on Exercise (ACE), muscular strength is the maximal force a muscle or muscle group can exert during a contraction. Muscular strength is

usually measured with a one-rep maximum (1-RM) test. During a 1-RM, an exerciser performs one repetition of a single exercise to see how much weight he or she can lift. One of the examples of interval training which can be applied to enhance muscle strength is hand grip test. The purpose of this test is to measure the maximum isometric strength of the hand and forearm muscles. Handgrip strength is important for any sport in which the hands are used for catching, throwing or lifting (Roberts, Denison et al. 2011).

2.10 Interval training in enhancing body composition

The muscle carbohydrate reserves, glycogen, is almost exhausted thorough interval training. It may seem a little backwards to think that improved fat burning is one of the many benefits of interval training because carbohydrates are used as the main source for fuel.

On the contrary, once the glycogen reserves have been exhausted replacement is necessary through the fuel source fat. Hours after you have completed your workout, you will continue to reap the benefits of interval training because one's body will use up fat replacing the depleted glycogen (Gray, S., 2011).

Essentially, the body uses insulin to transport sugar to cells in the form of glucose to be used as energy. Exercise at a high level of intensity causes the body to produce lactate, which is a good thing. Lactate is transported to cells much easier than glucose and it does not require any insulin to do so. Lactate is then converted into pyruvate, a major chemical that is used to produce energy quickly. The benefits of interval training positively affect the lives of both diabetics and non-diabetics alike.

Body fat composition refers to the amount of fat on your body. For example, a 100-pound person with a 25% body fat composition will have a lean body mass of 75 pounds. To qualify as fit; men must have a body fat composition lower than 17 percent and women must have a body fat composition lower than 24 percent. The average man tends to have about 18