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Physical Fitness in College Students

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Obesity is a major problem facing the United States today. Physical inactivity can lead to obesity resulting in a variety of health problems, including premature death. Therefore the objective of the study was to identify physical fitness differences between gender, age, and physical activity level in college students. A fitness assessment test consisting of cardiorespiratory endurance, flexibility, muscular strength, and muscular endurance was performed in seventy-nine (43 male, 36 female) subjects ranging in age from 18 to 22 years old. Results indicate greater physical fitness in upper classmen when compared to lower classmen. Also, our data indicate that students that exercise 150 or more minutes per week are more physically fit when compared to students that exercise less than 150 minutes per week. In conclusion, physical activity interventions should be offered to college students and especially underclassmen to decrease the incidence of inactivity and obesity.

DEDICATION

This research is dedicated to my parents, Bill and Risa Grimme, who have always believed in me and pushed me to my limits.

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CHAPTER I

INTRODUCTION

Merriam-Webster defines obesity as "a condition characterized by the excessive accumulation and storage of fat in the body", and obesity is a major problem facing the United States today. In the past 30 years, the obesity rate in the United States has increased drastically according to the Centers for Disease Control, causing a variety of health problems, including premature death. The obesity epidemic affects every aspect of culture, from building codes to manufacturing of textiles, and everything in between. Although each individual case is different, general causes of obesity include a number of factors, and according to studies by Liou et al. (2010) and Voorhees (2009), sedentary lifestyle appears one of the main factors. As obesity has started to affect younger individuals today than ever before, it is unclear what the long-term effects will be on those individuals. It appears that these individuals will spend more time in the obese category than any group of individuals in the past. Because of this, the healthcare field is still learning what to do with these patients and what problems they will face with the long-term effects of excessive body fat.

For example, many studies show that obesity is a leading cause of cancer. Teucher et al. (2010) and Abdullah et al. (2011) are among these. It is unclear at this time how the extended amount of time spent in the overweight or obese category will affect the affinity of any cancer cells that may appear in individuals in the future. Some other

adverse health effects associated with obesity include diabetes mellitus and its complications, as discussed by Nguyen et al. (2011), and cardiovascular diseases. Although these diseases can also affect healthy people, risk for the diseases increases dramatically as physical fitness decreases. Along with cardiovascular disease, the risk of stroke and heart attack increase, as does hypertension and tachycardia.

Since obesity can lead to numerous health problems, the Healthy People campaign was established by the United States government in 1990 to evaluate ways to successfully encourage Americans to be healthier. Since then, it has been re-evaluated each decade and the goals have changed as the population has changed. Riegelman and Garr (2011) discussed some of the objectives of Healthy People 2020. As part of the campaign, the U.S. government is trying to educate Americans on the dangers of unhealthy lifestyles and obesity. Originally, the program was designed to focus on educating the young adult age group, however since the obesity problem is affecting the younger population, it has shifted to start focusing on younger children. It appears the best way to help prevent the problems associated with obesity is to start educating children about healthy eating and exercise from walking age. The 2020 program contains over 1200 objectives and focuses on every aspect of health, from tobacco cessation to sleep health. A large part of the campaign focuses on diabetes and cardiovascular health, emphasizing the importance of physical activity.

One of the most well known phenomena about college students is the “freshman fifteen”. Gropper et al. (2009) explain that the concept may be caused by students leaving home for the first time and being overwhelmed by newfound freedom. These students often reduce or altogether stop the exercising habits they had when living under adult

supervision. Accompanying the lack of exercise is often an increase in eating habits. Also, there is a high rate of participation in high school athletics, but once those students enroll in a university, most of them no longer participate in athletics at a competitive level. When suddenly these individuals are no longer required to exercise and participate in physical activity at practices and competitions, along with no supervision of their diets, they often gain weight. Aside from the issue of gaining weight, these students often become less physically fit. It is unfortunate that some of these students never gain the motivation to become physically fit again. However, as many students progress through their college career, the importance of fitness and self-motivation becomes clearer and these students begin to increase physical activity levels and develop more healthy eating habits with the hopes of increasing cardiovascular and muscular endurance.

When all the concepts join together, it is apparent that there is a problem, but not apparent where it begins. The idea that students may not pay attention to their health as freshmen but learn more about the importance of it as they progress through college seems to be overwhelming. Therefore, this study was designed to test the physical fitness levels of college students. The objective of the study was to identify physical fitness differences between gender, age, and physical activity level.

CHAPTER II

REVIEW OF LITERATURE

Physical Education

Physical Education classes have been part of curricula in schools for many decades. These classes are offered or required under the pretense they promote physical fitness. Some schools require Physical Education classes while others offer them as electives. While some students are physically active outside of school, there are many students who get no physical activity outside of these classes.

Rural areas, suburban areas, and metropolitan areas offer vastly different perspectives on what levels of physical activity students maintain outside of school. Generally, socioeconomic status is inversely related to physical fitness, and therefore physical activity. A study by Voorhees et al. (2009) indicates that children in largely suburban areas generally participate in more physical activity. This may be due to a number of factors. Generally, suburban neighborhoods are considered safer than metropolitan neighborhoods. This may allow children to play outside during after-school hours in a safe environment, which may encourage more activity. These families also have more disposable income and may be more able to spare the time and money associated with enrolling the children in more sports leagues, both scholastic and non-scholastic leagues. Although children in rural areas may not be enrolled in sports leagues and may not play in the neighborhood as often as those in suburban areas, these children

often have more chores than other children, which may play a role in helping maintain physical fitness. This leaves the metropolitan areas to fall between the cracks. Many of these children come from lower socioeconomic status, and do not have access to recreational sports leagues or safe environments for physical activity outside of school. Therefore, the gap in physical fitness between regions continues to widen.

While the level of physical activity outside schools varies by socioeconomic status, most schools offer and require Physical Education classes. These classes help ensure physical activity levels are equal during the school day. It is largely accepted that the Physical Education classes themselves promote physical activity; however fitness testing in the classes may not serve the same purpose. The fitness tests required by many Physical Education classes may include running tests, strength tests, agility tests, and sport tests. For decades, these tests have been conducted under the pretense of promoting physical fitness, however recent evidence from Cale and Harris (2009) may suggest that these tests do not actually promote physical fitness and may actually hinder it.

The theory is that physical testing will motivate young people to want to do better in the class, especially since the tests are completed in front of classmates. For several generations in the past, this theory seemed to work. However, according to a recent study by Garrett and Wrench (2008), children today are very different than their parents' and grandparents' generations. It seems that in today's youth, failing in front of peers is not enough to encourage and motivate children and may often do the opposite. Failing a test encouraged the older generations to improve and try to pass it the next time. However, with today's youth, failing does not encourage, and may actually discourage. Because of

the changing youth, fitness tests in Physical Education classes may actually be harming the physical fitness of the youth of the United States today.

A British study by Dagkas (2012) indicates that family influence on physical activity is one of the strongest markers of physical fitness among children. Families who are taught the value of physical activity and physical fitness have children more likely to carry those values into adult life. Although socioeconomic status does not translate exactly equally across the two cultures, it does appear the higher socioeconomic families in the United States are more likely to teach the children about the value of physical fitness and physical activity.

Physical Education classes do promote physical activity when they are required by a school. After a student finishes school, the likelihood of continuing physical activity on the same level is low. The British study indicated that those children who had been taught the importance of physical activity by parents and family would be more likely to continue the habits after graduation and in college.

Aside from the physical testing in Physical Education classes being inefficient, there seems to be a lack of physical education research in the United States today. This may be an indicator of the obesity epidemic the nation is facing today. It is unclear the reason for the lack of research, but it is possible to be caused by a lack of research subjects.

Fitness Testing

There are several methods of evaluating physical fitness. The YMCA protocol is a simple, yet effective method of measuring fitness. When used correctly, it can identify overall fitness, as well as training needs on an individual level. The test is composed of

multiple parts. These include: a health screening (Physical Activity Readiness Questionnaire), standard measurements – including standing height, weight, resting heart rate, and resting blood pressure – body composition, cardiorespiratory endurance, flexibility, and muscular strength and endurance.

Resting Heart Rate

There are various methods of measuring heart rate. Using the traditional method, a technician uses pressure to measure the number of heartbeats a patient has for 10, 15, 20, 30, or 60 seconds. Generally, the technician will place his or her first two fingers over the radial artery of the patient. By pressing hard enough to feel the pulse of blood with each heartbeat, yet not so hard as to cut off blood flow to the artery, the technician is able to count the number of beats that occur in a pre-designated time period. Usually this time period is measured by the wristwatch of the technician. The technician then multiplies the number by 6, 4, 3, 2, or 1 respectively for the times above to determine the heart rate.

More current methods allow for electronic measurement of heart rate. The traditional method is not inaccurate, but there is a large chance for operator error with it. There is a large chance of making an error by the factor of time, depending on the cadence of the pulses of blood through the artery. Although it is still used by many medical practitioners and individuals, many automatic blood pressure measurement machines are equipped to accurately measure heart rate. These methods are suggested by the American College of Sports Medicine.

Blood Pressure

Blood pressure is traditionally measured with a manual sphygmomanometer and stethoscope. The technician uses the cuff and sphygmomanometer to apply pressure to the brachial artery of the left arm. Generally the left arm is used because it is considered closer to the aorta, however on occasion the right arm can be used. By applying more pressure to the outside of the artery than is provided by blood flow inside the artery, it collapses. While the artery is collapsed, no blood flow can occur. The pressure is slowly released by a valve attached to the sphygmomanometer. When the pressure equalizes, blood flow will return to the artery. By measuring the pressure at which blood flow (pulse) returns to the artery with the stethoscope, the technician can assume that is equal to the pressure put on the artery from the inside by the blood. The pressure put on the artery by the heart contracting is higher than the pressure in the artery when the cardiac muscle is at rest, so the technician must listen to the artery until the sound of pulses ceases. When the technician ceases to hear pulses, equilibrium of the lowest pressure in the artery is assumed. The technician uses the two numbers observed on the sphygmomanometer as the patient's blood pressure.

As with resting heart rate measurements, this method allows for operator error. This accuracy of this method is largely dependent on the skill of the technician. Thus, research such as that by Weber et al. (2011) and Cheng et al. (2012) has led to the development and validation of automated instruments that are capable of measuring blood pressure. These instruments are more reliable than manual measurements; however they lack the common sense of humans. If a human makes an error, he or she may have

the capacity to realize there has been an error and re-evaluate the measurement. A machine lacks that ability, and therefore must be monitored by a human.

Body Composition

Body Composition can be measured using various methods. Until recently, underwater weighing was considered the gold standard in body composition analysis. The process was non-invasive and inexpensive. Although it is not readily available everywhere, a water tank is an inexpensive piece of equipment to install and maintain. Individuals are weighed underwater, after expelling all air from the lungs possible. The measurement is based on the concept that different body tissues have different densities. The summation of those densities determines an individual's weight underwater, so the mass, as recorded underwater is used to calculate the individual's body composition. One major problem with this method is that several volumes of air have to be assumed, as it is impossible to measure residual lung volume and total lung capacity in living individuals. The assumptions that this form of measurement mandates led to search for more accurate forms of measurement. DEXA (Dual-energy X-ray absorptiometry) is currently considered the most accurate of all the methods. This method uses X-rays and measures how much radioactivity is reflected compared to what was originally exerted. This method is considered the current "gold standard" in the field. While it may be the most accurate, it is a very expensive method and not easily accessible to everyone.

Because the previously discussed and many other methods of measuring body composition are expensive or not easily accessible, exercise physiologists have developed other methods of measuring body composition. The two most commonly used "mobile" methods of measuring are the skinfold method and BIA (Bioelectrical Impedance

Analysis). The skinfold method uses calipers to measure skin thickness, and consequently subcutaneous fat. This method is more accurate than BIA, however takes several minutes to obtain the measurements and run calculations. It also requires individuals to remove some articles of clothing, and not everyone is comfortable with such.

BIA uses electrical signals projected through the feet to measure percent body fat. The time between the signal being sent and the return of the signal is the basis of measuring the body fat. This method is considered less accurate than the above mentioned methods, as it takes into account only the individual's feet and lower legs. It is a whole body estimate based on only the feet and lower legs. Because fat distribution is not the same in any two individuals, it may not be one hundred percent accurate. However, it is the single most mobile method of measuring body composition. It uses only a BIA scale, and can be done anywhere. Subjects only have to remove shoes and socks to get a BIA estimate, and it takes less than 20 seconds to measure.

Cardiorespiratory Endurance

Cardiorespiratory endurance is defined as the ability of the circulatory and respiratory systems to supply oxygen to the skeletal muscles during exercise. There are numerous ways to evaluate cardiorespiratory fitness, and the YMCA protocol offers several different versions of the cardiorespiratory endurance test. Field tests include 12 minute run, 2400 meter run, one mile walk, 600 yard run/walk, and a quarter mile walk. There are treadmill test options and cycle ergometry test options as well. An alternative to those methods is step testing, such as the Harvard Step Test.

All field tests in the YMCA protocol include a warm-up period before testing begins for the subjects. The 12 minute run test is the simplest test. The subject is asked to

run for 12 minutes without stopping. The total distance is recorded, and the score is calculated. The 2400 meter run is also a very simple test. The subject is asked to run or walk, at the fastest maintainable pace, 2400 meters. Total time to completion is recorded. The one mile walk is the most complicated of the field tests. The subject is asked to walk one mile with an electronic heart rate monitor for one mile. Both the time to completion and the exercise heart rate are used to estimate the individual's fitness. The 600 yard walk/run test is useful for athletes who specialize in power sports. However, for non-athlete individuals, it does not give a plethora of information regarding the individual's capability to sustain an elevated heart rate for an extended period of time. The quarter-mile walk test also does not offer a large amount of information about an individual's ability to maintain an elevated heart rate for an extended period of time. This test is mostly used for elderly individuals, as it may be difficult from a biomechanical or cardiorespiratory standpoint for them to walk for extended distances.

The treadmill tests included in the protocol can only be used in a controlled environment, with proper supervision and equipment. The Bruce and Balke protocols are exhaustion tests. The individual is asked to run on the treadmill at varying, pre-determined workloads. Both tests measure the time it takes the individual to complete the specified workloads, and a score is derived from the time to completion. Also on the treadmill, there is a modified version of the one mile walk. This test measures the same aspects as the field version of the one mile walk; however it is done in a controlled environment. This test is often used for high-risk patients who may need constant supervision during the test.

The cycle tests have slightly more versatility than the treadmill tests, however still less than a field test. The main issue with cycling tests is that most individuals do not have experience cycling, and may not perform as well as they could on a running test. Also, these tests must all be completed in an exercise physiology laboratory. These tests are inconvenient due to the fact that equipment is necessary.

Step Testing generally involves an individual stepping up onto an elevated platform and back down for a pre-determined amount of time. The testers will determine a cadence for the subject to maintain. If the subject is unable to maintain the cadence, the test is usually terminated. The object of the test is to determine if an individual can maintain an elevated heart rate for an extended period of time without succumbing to fatigue.

Flexibility

Flexibility tests in the YMCA protocol include the flexibility specificity test, Lower back integrity, YMCA Flexibility Test (Sit and Reach), and the American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD) Older Adult Flexibility Test.

The flexibility specificity test and the lower back integrity test both focus on flexibility of just one area of the body. Because of the possibility of some subjects being more flexible in some areas of the body, these tests do not accurately represent the flexibility of the entire body. The AAHPERD Older Adult Flexibility Test is an aspect of the AAPHERD functional fitness test. The flexibility portion of the test focuses on functional flexibility, which does not indicate physical fitness. The Sit and Reach test measures whole body flexibility by using a box to measure how far an individual can

reach toward his or her feet. The test is simple to perform and the equipment is very portable. It is also a common test used in school Physical Education classes, so most of the sample population is familiar with it.

Muscular Strength and Endurance

Muscular Strength and Endurance tests included in the YMCA fitness testing protocol include the 1 Repetition Maximum test, 10 Repetition Maximum test, Grip test, chin-ups, push-ups, sit-ups, and curl-ups.

The 1 Repetition Maximum test is a test of the muscular strength of one specific muscle group. It can be used for any method of weight-lifting, including bench press, squat, power clean, or any other lift. The subject simply lifts as much weight as he or she possibly can in one single repetition. It can be performed at any location where weight lifting equipment is available. The problems associated with the test are usually on the part of the subject, but can cause errors in information. If the subject does not know exactly what his or her 1 Repetition Maximum is, he or she may over-estimate or under-estimate the number, causing wasted energy. This can lead to an error in the true value of the maximum. The 10 Repetition Maximum test has the same problems associated with the 1 Repetition Maximum test, as some subjects may not know exactly how much weight he or she can lift.

The grip test is a test of a subject's ability to utilize strength in the hand. The individual squeezes a hand-grip dynamometer at maximum force for the test. This test measures the absolute force the hand is capable of producing, but has no real applicable value to the entire body. It is possible for an individual to have excessive hand strength and be weak in other areas of the body.

Chin-ups, sit-ups, curl-ups, and push-ups all involve more than one muscle group in the body. These tests are considered to be more descriptive of the whole body's muscular strength and endurance than any of the other tests. The chin-up test requires an elevated bar, while the others do not. The push-up test and the sit-up test involve core strength as well as other areas of strength. Both tests require the subject to complete as many repetitions of the exercise as he or she can without stopping. These tests can be performed anywhere, and do not require any special equipment, as well as offering a good indication of true muscular strength and endurance overall.

CHAPTER III

METHODOLOGY

Subjects

Seventy-nine (43 male, 36 female) subjects ranging in age from 18-22 completed this study. The single qualification for the study was that the subjects must be undergraduate students at Mississippi State University. Subjects were to be free of any medical condition, which could hinder their ability to perform the exercise protocol. Prior to participation in the study, subjects were required to complete a medical history form and sign an informed consent form. The procedures outlined were reviewed and approved by the Institutional Review Board at Mississippi State University.

Pretest Evaluation

Subjects were required to attend only one session. During this session, thorough explanation of the informed consent and test protocol were discussed. Subjects completed the Physical Activity Readiness Questionnaire (PAR-Q). If any subject answered "yes" to any question, he or she was excluded from the study. Standard anthropometric measurements were obtained, including standing height, weight, and body composition. Height was measured using a stadiometer. Body weight was measured with shorts, t-shirt, and no shoes using electronic scales. Body composition was measured via bioelectrical impedance analysis (BIA).

Testing Protocol

Subjects were given the opportunity for a warm up consisting of up to a five minute walk and stretching, at the subject's discretion. After the warm up, the testing consisted of cardiorespiratory endurance, flexibility testing, and muscular strength and endurance.

Cardiorespiratory Endurance

Subjects were asked to complete a distance of 2400 meters as quickly as possible, at a self-determined pace. The subjects were allowed to walk, jog, or run, at their own discretion. This consisted of 12 laps on the designated track. If a subject was unable to run for the entire distance, jogging and/or walking were permitted. Time to complete the 2400 meters was recorded.

Flexibility

Subjects completed the Sit & Reach test for the flexibility measurement. Subjects were seated on the ground with legs fully extended in front of them, toes pointed upward, and soles of the feet flush with the base of the sit-and-reach box. The subject was then instructed to reach forward slowly, with the fingertips of both hands remaining in contact with the slide at all times. Once the subject reached his or her farthest extension point, he or she was instructed to hold the position for a "two count". Distance reached, in centimeters was recorded.

Muscular Strength and Endurance

Subjects were asked to complete a push-up test, completing as many repetitions as possible without pausing before reaching exhaustion. A pause of 2 consecutive seconds of no movement was considered exhaustion.

Male subjects kept toes on the floor, with legs, hips, and back straight. The subjects were instructed to lower their bodies such that elbows formed a 90º angle before pushing the body back up into the start position. Repetitions were counted by the tester.

Female subjects kept knees on the floor, with hips and back straight. The subjects were instructed to lower the body until elbows formed a 90º angle, and return to the starting position.

After completing the push-up test, subjects were asked to complete a sit-up test. Each subject performed as many bent-knee sit-ups as possible within 60 seconds. Subjects were permitted to rest between repetitions if they were unable to sit-up continuously. The subject's feet were anchored by the tester, with knees bent to 90º. Hands were clasped behind the neck, with elbows in front. As the subject raised the torso, the elbows traveled beyond or made contact with the knees.

Statistical Analyses

Body fat percentage differences between groups were determined by a t-test. Categorical differences between groups were determined by the chi-square test. Significance was established at $p < 0.05$.

CHAPTER IV

RESULTS

Evaluation

The subjects who completed the testing protocol were analyzed and compiled into categories based on fitness levels. Each subject was grouped into a category for every physical test.

The Cooper Institute in Dallas, Texas has used physiological research to establish criteria for fitness categories based on sex and age for 2400 meter run times. Based on these numbers, the subjects were grouped into fitness categories for their 2400 meter run time as shown in **Table 1**.

Table 1

Fitness categories based on time required to run/walk 2400 meters. The categories are shown in minutes.

	Men	**Women**
Excellent	≤9.57-10.56	≤10.98-12.11
Very Good	10.57-11.56	12.12-13.96
Good	11.57-12.87	13.97-15.58
Fair	12.88-14.54	15.59-17.87
Poor	≥14.55	≥17.88

The Canadian Physical Activity, Fitness & Lifestyle Approach: CSEP-Health & Fitness Program's Health-Related Appraisal and Counselling Strategy, 3rd Edition has established the following as norms based on age and sex for the standardized Sit and Reach Test. Based on these generalizations, subjects were grouped into fitness categories for their sit-and-reach test as shown in **Table 2**.

Table 2

Fitness categories based on Sit and Reach Test. The categories are shown in centimeters.

	Men		**Women**	
	18-19 year old	**20-22 year old**	**18-19 year old**	**20-22 year old**
Excellent	≥36	≥37	≥40	≥38
Very Good	31-35	31-36	35-39	34-37
Good	26-30	27-30	31-35	30-33
Fair	21-25	22-26	26-30	25-29
Poor	≤20	≤21	≤25	≤24

The Canadian Physical Activity, Fitness & Lifestyle Approach: CSEP-Health & Fitness Program's Health-Related Appraisal and Counselling Strategy, 3rd Edition has determined age and sex based norms for exhaustive push-ups. The subjects were grouped into fitness categories for their push-up exhaustion test as shown in **Table 3**.

Table 3

Fitness categories based on the number of push ups.

	Men		Women	
	18-19 year old	**20-22 year old**	**18-19 year old**	**20-22 year old**
Excellent	≥39	≥36	≥33	≥30
Very Good	29-38	29-35	25-32	21-29
Good	23-28	22-28	18-24	15-20
Fair	18-22	17-21	12-17	10-14
Poor	≤17	≤16	≤11	≤9

The Canadian Physical Activity, Fitness & Lifestyle Approach: CSEP-Health & Fitness Program's Health-Related Appraisal and Counselling Strategy, 3rd Edition has established norms for a one-minute partial curl-up test based on sex and age. Subjects were grouped into fitness categories for their one-minute sit-up test as shown in **Table 4**.

Table 4

Fitness categories based on the number of sit ups.

	Men	**Women**
Excellent	≥25	≥25
Very Good	21-24	18-24
Good	16-20	14-17
Fair	11-15	5-13
Poor	≤10	≤4

Gender Comparison

Figure 1 indicates the percentage body fat between male and female. Female subjects had a significantly higher percent body fat compared to male subjects ($p < 0.05$). The number of male and female subjects that fell into the poor, fair, good, very good, and excellent categories for the 2400 meter run is indicated in **Table 5** and **Figure 2**. It is important to note that only 14% of the subjects fell in the very good or excellent category, thus indicating that the cardiorespiratory fitness level of college age students can be improved.

The number of male and female subjects that fell into the poor, fair, good, very good, and excellent categories for the sit and reach test is indicated in **Table 6** and **Figure 3**. Only 32.9% of the subjects fell in the very good or excellent category. The number of male and female subjects that fell into the poor, fair, good, very good, and excellent categories for the push up test is indicated in **Table 7** and **Figure 4**. Interestingly, 68.3% of the subjects fell in the very good or excellent category. The number of male and female subjects that fell into the poor, fair, good, very good, and excellent categories for the sit up test is indicated in **Table 8** and **Figure 5**. In contrast to the push up test, only 8.9% of the subjects fell in the very good or excellent category.

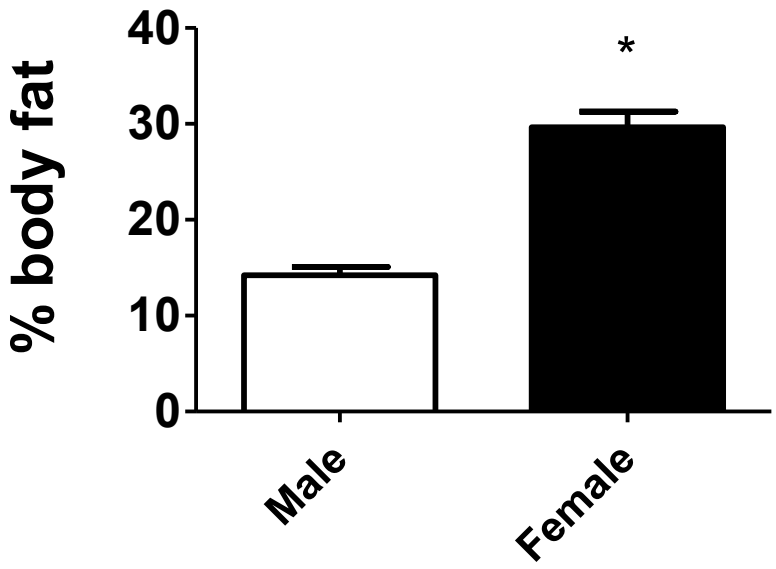

Figure 1. Percentage body fat in male and female subjects. * $p < 0.05$.

Table 5

Distribution of subjects for time to complete 2400 meters (male vs female).

			Sex		Total
			Male	Female	
2400 m run	Poor	Count	15_a	14_a	29
		% within 2400 m run	51.7%	48.3%	100.0%
		% within Sex	34.9%	38.9%	36.7%
		% of Total	19.0%	17.7%	36.7%
	Fair	Count	9_a	5_a	14
		% within 2400 m run	64.3%	35.7%	100.0%
		% within Sex	20.9%	13.9%	17.7%
		% of Total	11.4%	6.3%	17.7%
	Good	Count	16_a	9_a	25
		% within 2400 m run	64.0%	36.0%	100.0%
		% within Sex	37.2%	25.0%	31.6%
		% of Total	20.3%	11.4%	31.6%
	Very Good	Count	0_a	4_b	4
		% within 2400 m run	0.0%	100.0%	100.0%
		% within Sex	0.0%	11.1%	5.1%
		% of Total	0.0%	5.1%	5.1%
	Excellent	Count	3_a	4_a	7
		% within 2400 m run	42.9%	57.1%	100.0%
		% within Sex	7.0%	11.1%	8.9%
		% of Total	3.8%	5.1%	8.9%
Total		Count	43	36	79
		% within 2400 m run	54.4%	45.6%	100.0%
		% within Sex	100.0%	100.0%	100.0%
		% of Total	54.4%	45.6%	100.0%

Each subscript letter denotes a subset of Age categories whose column proportions do not differ significantly from each other at the .05 level.

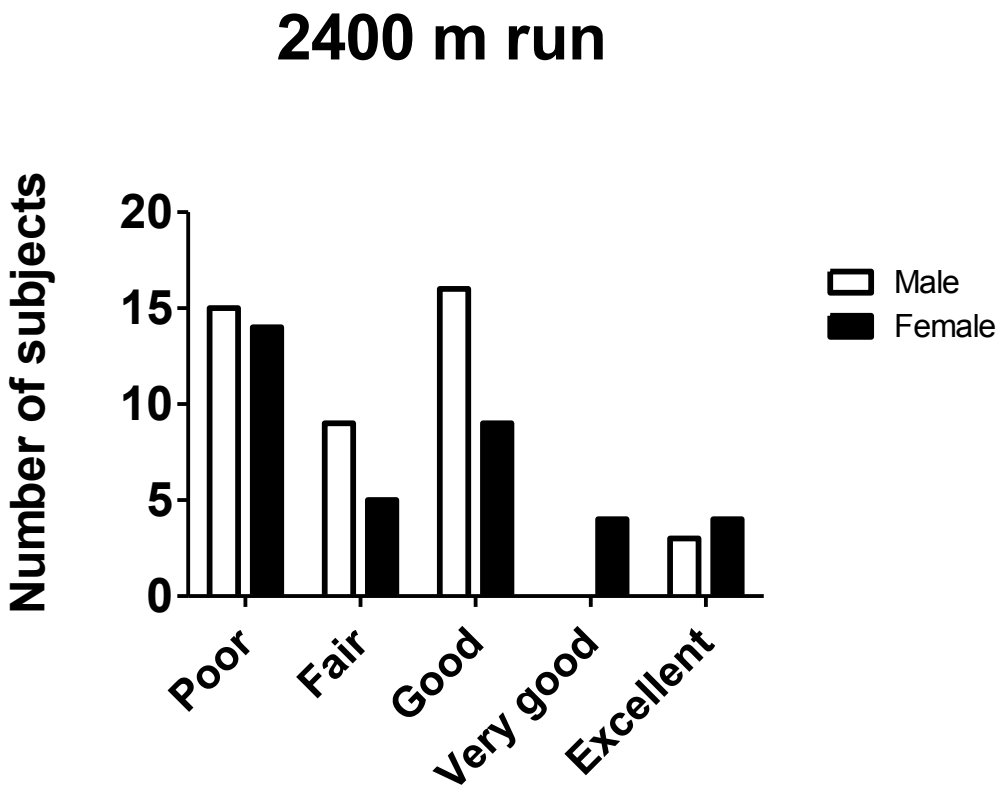

Figure 2. Number of subjects in each category based on the time to complete 2400 meters (male vs female).

Table 6

Distribution of subjects for the sit and reach test (male vs female).

			Sex		Total
			Male	Female	
Sit and reach	Poor	Count	3_a	14_b	17
		% within Sit and reach	17.6%	82.4%	100.0%
		% within Sex	7.0%	38.9%	21.5%
		% of Total	3.8%	17.7%	21.5%
	Fair	Count	11_a	7_a	18
		% within Sit and reach	61.1%	38.9%	100.0%
		% within Sex	25.6%	19.4%	22.8%
		% of Total	13.9%	8.9%	22.8%
	Good	Count	12_a	6_a	18
		% within Sit and reach	66.7%	33.3%	100.0%
		% within Sex	27.9%	16.7%	22.8%
		% of Total	15.2%	7.6%	22.8%
	Very Good	Count	10_a	5_a	15
		% within Sit and reach	66.7%	33.3%	100.0%
		% within Sex	23.3%	13.9%	19.0%
		% of Total	12.7%	6.3%	19.0%
	Excellent	Count	7_a	4_a	11
		% within Sit and reach	63.6%	36.4%	100.0%
		% within Sex	16.3%	11.1%	13.9%
		% of Total	8.9%	5.1%	13.9%
Total		Count	43	36	79
		% within Sit and reach	54.4%	45.6%	100.0%
		% within Sex	100.0%	100.0%	100.0%
		% of Total	54.4%	45.6%	100.0%

Each subscript letter denotes a subset of Age categories whose column proportions do not differ significantly from each other at the .05 level.

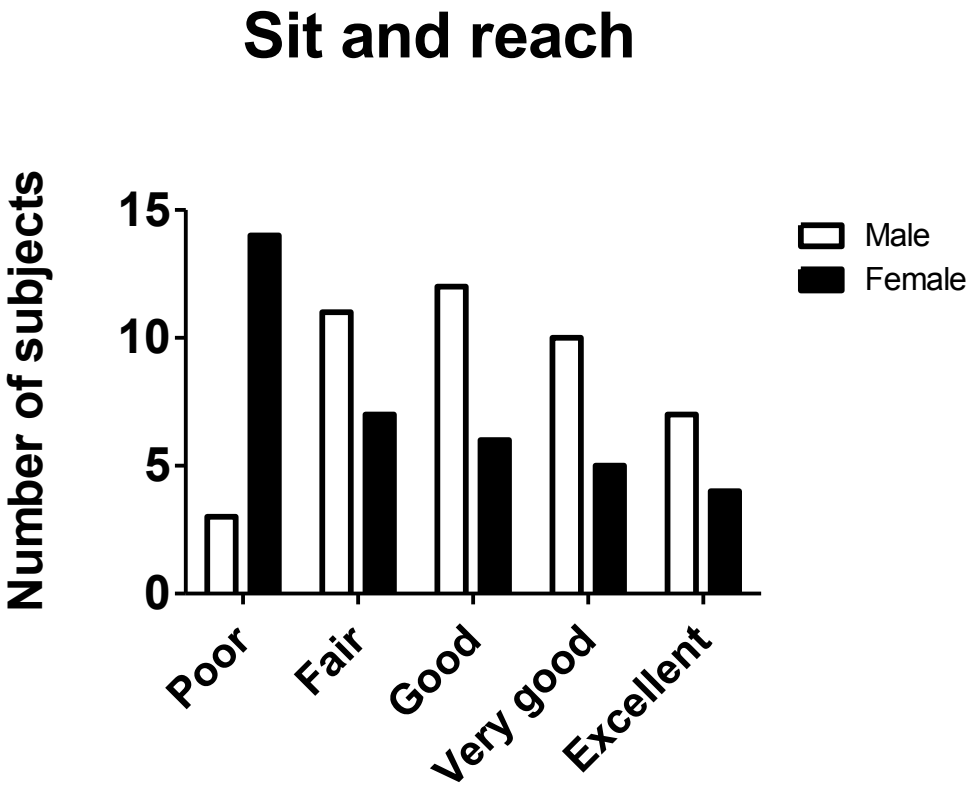

Figure 3. Number of subjects in each category based on the sit and reach test (male vs female).

Table 7

Distribution of subjects for the push up test (male vs female).

			Sex		Total
			Male	Female	
Push ups	Poor	Count	3_a	2_a	5
		% within Push ups	60.0%	40.0%	100.0%
		% within Sex	7.0%	5.6%	6.3%
		% of Total	3.8%	2.5%	6.3%
	Fair	Count	2_a	4_a	6
		% within Push ups	33.3%	66.7%	100.0%
		% within Sex	4.7%	11.1%	7.6%
		% of Total	2.5%	5.1%	7.6%
	Good	Count	7_a	7_a	14
		% within Push ups	50.0%	50.0%	100.0%
		% within Sex	16.3%	19.4%	17.7%
		% of Total	8.9%	8.9%	17.7%
	Very Good	Count	10_a	7_a	17
		% within Push ups	58.8%	41.2%	100.0%
		% within Sex	23.3%	19.4%	21.5%
		% of Total	12.7%	8.9%	21.5%
	Excellent	Count	21_a	16_a	37
		% within Push ups	56.8%	43.2%	100.0%
		% within Sex	48.8%	44.4%	46.8%
		% of Total	26.6%	20.3%	46.8%
Total		Count	43	36	79
		% within Push ups	54.4%	45.6%	100.0%
		% within Sex	100.0%	100.0%	100.0%
		% of Total	54.4%	45.6%	100.0%

Each subscript letter denotes a subset of Age categories whose column proportions do not differ significantly from each other at the .05 level.

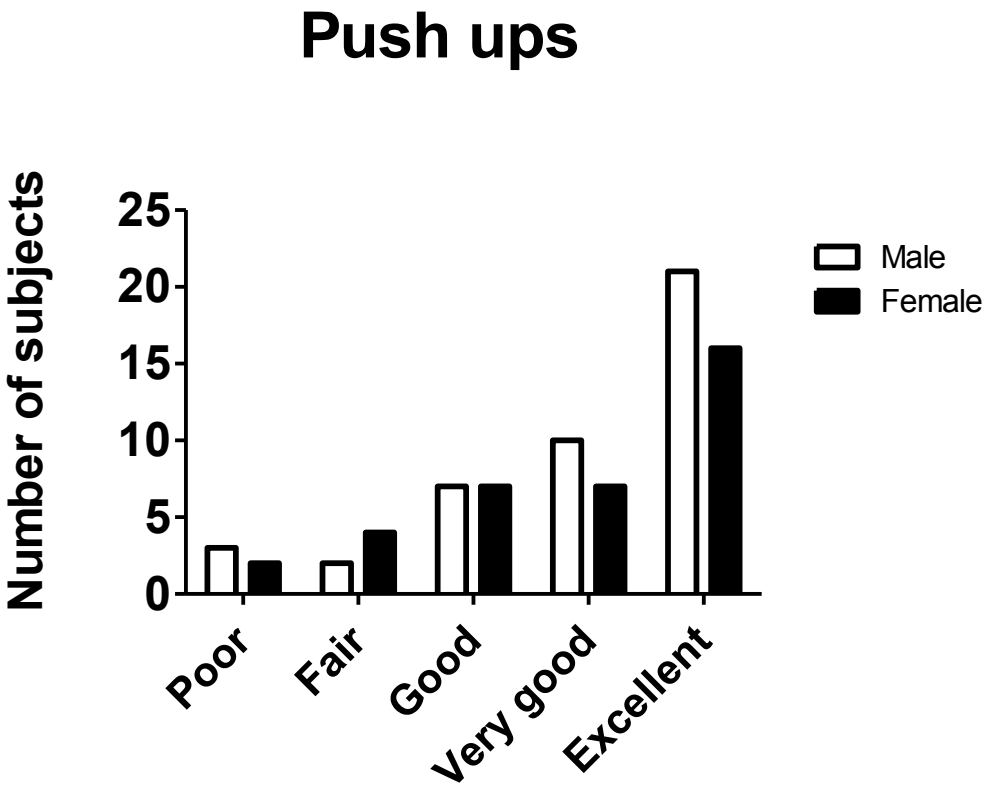

Figure 4. Number of subjects in each category based on the number of push up repetitions (male vs female).

Table 8

Distribution of subjects for the sit ups test (male vs female).

			Sex		Total
			Male	Female	
Sit ups	Poor	Count	21_a	26_b	47
		% within Sit ups	44.7%	55.3%	100.0%
		% within Sex	48.8%	72.2%	59.5%
		% of Total	26.6%	32.9%	59.5%
	Fair	Count	9_a	3_a	12
		% within Sit ups	75.0%	25.0%	100.0%
		% within Sex	20.9%	8.3%	15.2%
		% of Total	11.4%	3.8%	15.2%
	Good	Count	8_a	5_a	13
		% within Sit ups	61.5%	38.5%	100.0%
		% within Sex	18.6%	13.9%	16.5%
		% of Total	10.1%	6.3%	16.5%
	Very Good	Count	2_a	1_a	3
		% within Sit ups	66.7%	33.3%	100.0%
		% within Sex	4.7%	2.8%	3.8%
		% of Total	2.5%	1.3%	3.8%
	Excellent	Count	3_a	1_a	4
		% within Sit ups	75.0%	25.0%	100.0%
		% within Sex	7.0%	2.8%	5.1%
		% of Total	3.8%	1.3%	5.1%
Total		Count	43	36	79
		% within Sit ups	54.4%	45.6%	100.0%
		% within Sex	100.0%	100.0%	100.0%
		% of Total	54.4%	45.6%	100.0%

Each subscript letter denotes a subset of Age categories whose column proportions do not differ significantly from each other at the .05 level.

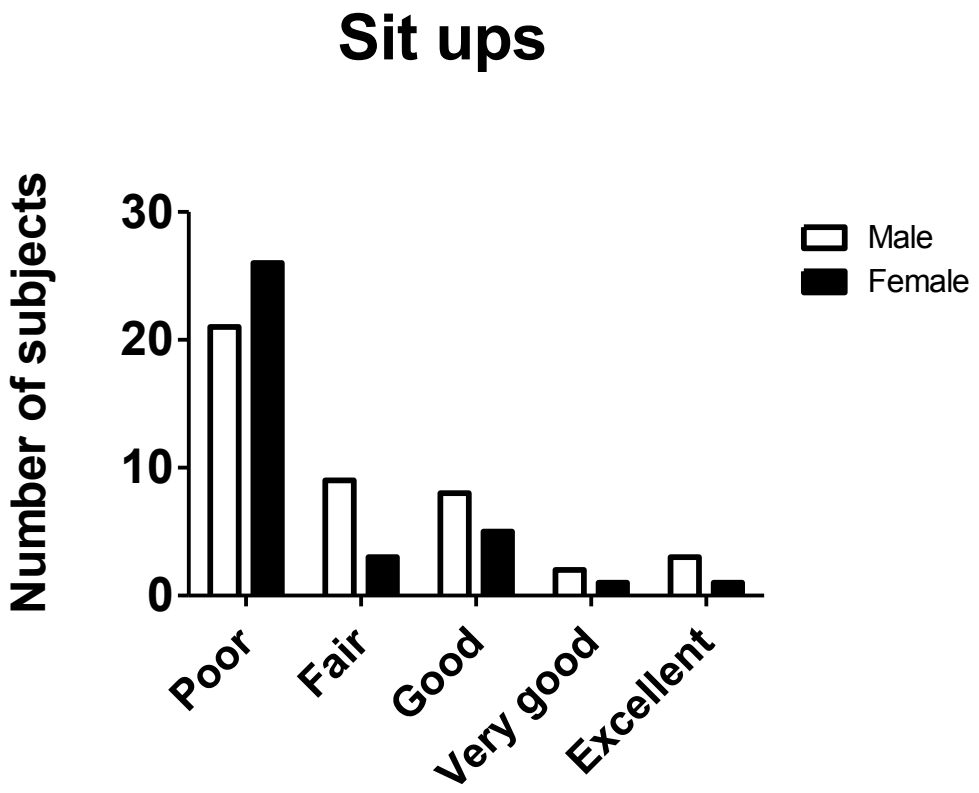

Figure 5. Number of subjects in each category based on the number of sit up repetitions (male vs female).

Age Comparison

Figure 6 indicates the percentage body fat between the two age groups. 18-19 year old subjects had a slightly higher percent body fat compared to 20-22 year old subjects, although the difference is not significant.

The number of 18-19 year old and 20-22 year old subjects that fell into the poor, fair, good, very good, and excellent categories for the 2400 meter run is indicated in **Table 9** and **Figure 7**.

The number of 18-19 year old and 20-22 year old subjects that fell into the poor, fair, good, very good, and excellent categories for the sit and reach test is indicated in

Table 10 and **Figure 8**. The distribution of subjects is not similar between the two groups, and a greater portion of the subjects in the 18-19 year old group scored in the lower categories than the 20-22 year old subjects.

The number of 18-19 year old and 20-22 year old subjects that fell into the poor, fair, good, very good, and excellent categories for the push up test is indicated in **Table 11** and **Figure 9**. The number of 18-19 year old and 20-22 year old subjects that fell into the poor, fair, good, very good, and excellent categories for the sit up test is indicated in **Table 12** and **Figure 10**. The distribution of results for both age groups is similar in both the push up test and the sit up test, with the upper classmen scoring slightly better than the lower classmen.

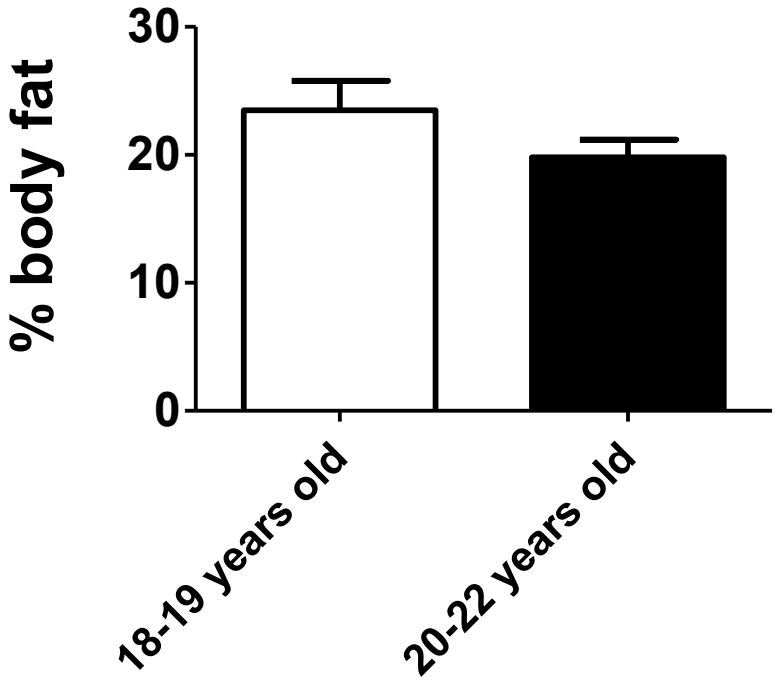

Figure 6. Percentage body fat in 18-19 year old and 20-22 year old subjects.

* $p < 0.05$.

Table 9

Distribution of subjects for time to complete 2400 meters (18-19 years old vs 20-22 years old).

			Age		Total
			18-19 years old	20-22 years old	
2400 m run	Poor	Count	7_a	22_b	29
		% within 2400 m run	24.1%	75.9%	100.0%
		% within Age	22.6%	45.8%	36.7%
		% of Total	8.9%	27.8%	36.7%
	Fair	Count	5_a	9_a	14
		% within 2400 m run	35.7%	64.3%	100.0%
		% within Age	16.1%	18.8%	17.7%
		% of Total	6.3%	11.4%	17.7%
	Good	Count	10_a	15_a	25
		% within 2400 m run	40.0%	60.0%	100.0%
		% within Age	32.3%	31.2%	31.6%
		% of Total	12.7%	19.0%	31.6%
	Very Good	Count	3_a	1_a	4
		% within 2400 m run	75.0%	25.0%	100.0%
		% within Age	9.7%	2.1%	5.1%
		% of Total	3.8%	1.3%	5.1%
	Excellent	Count	6_a	1_b	7
		% within 2400 m run	85.7%	14.3%	100.0%
		% within Age	19.4%	2.1%	8.9%
		% of Total	7.6%	1.3%	8.9%
Total		Count	31	48	79
		% within 2400 m run	39.2%	60.8%	100.0%
		% within Age	100.0%	100.0%	100.0%
		% of Total	39.2%	60.8%	100.0%

Each subscript letter denotes a subset of Age categories whose column proportions do not differ significantly from each other at the .05 level.

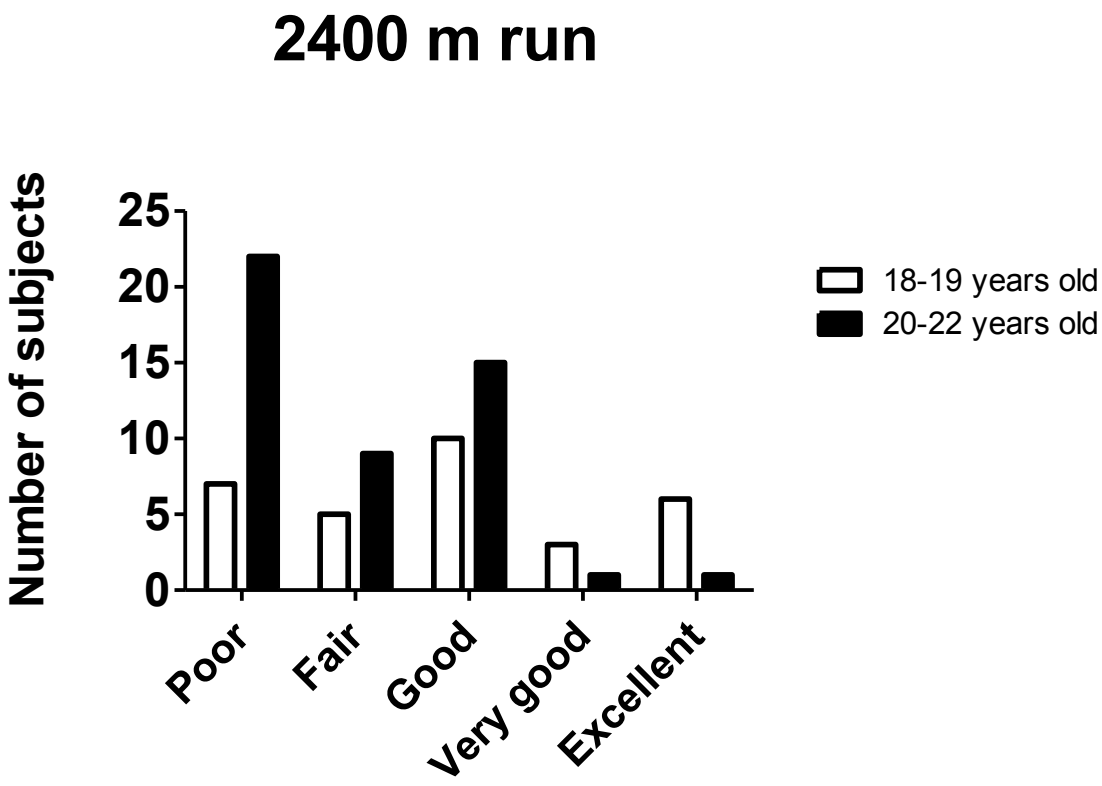

Figure 7. Number of subjects in each category based on the time to complete 2400 meters (18-19 years old vs 20-22 years old).

Table 10

Distribution of subjects for the sit and reach test (18-19 years old vs 20-22 years old).

			Age		Total
			18-19 years old	20-22 years old	
Sit and reach	Poor	Count	8_a	9_a	17
		% w/in Sit and reach	47.1%	52.9%	100.0%
		% within Age	25.8%	18.8%	21.5%
		% of Total	10.1%	11.4%	21.5%
	Fair	Count	5_a	13_a	18
		% w/in Sit and reach	27.8%	72.2%	100.0%
		% within Age	16.1%	27.1%	22.8%
		% of Total	6.3%	16.5%	22.8%
	Good	Count	5_a	13_a	18
		% w/in Sit and reach	27.8%	72.2%	100.0%
		% within Age	16.1%	27.1%	22.8%
		% of Total	6.3%	16.5%	22.8%
	Very Good	Count	7_a	8_a	15
		% w/in Sit and reach	46.7%	53.3%	100.0%
		% within Age	22.6%	16.7%	19.0%
		% of Total	8.9%	10.1%	19.0%
	Excellent	Count	6_a	5_a	11
		% w/in Sit and reach	54.5%	45.5%	100.0%
		% within Age	19.4%	10.4%	13.9%
		% of Total	7.6%	6.3%	13.9%
Total		Count	31	48	79
		% w/in Sit and reach	39.2%	60.8%	100.0%
		% within Age	100.0%	100.0%	100.0%
		% of Total	39.2%	60.8%	100.0%

Each subscript letter denotes a subset of Age categories whose column proportions do not differ significantly from each other at the .05 level.

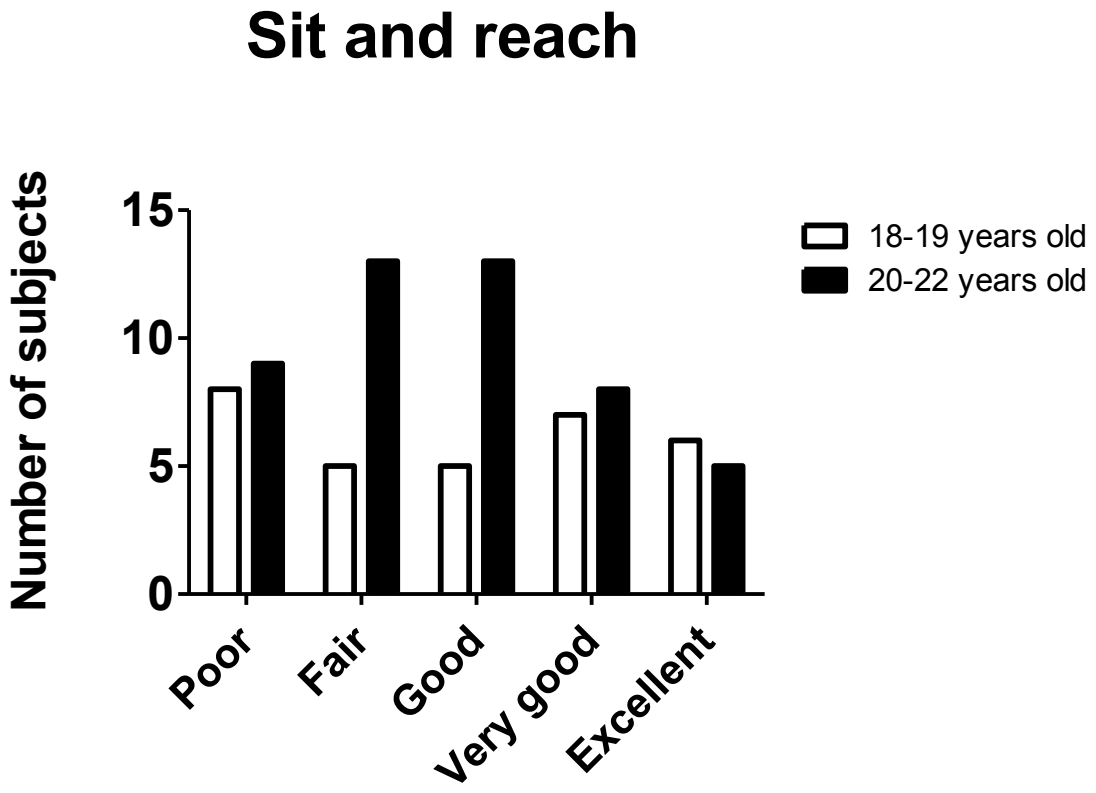

Figure 8. Number of subjects in each category based on the sit and reach test (18-19 years old vs 20-22 years old).

Table 11

Distribution of subjects for the pushups test (18-19 years old vs 20-22 years old).

			Age		Total
			18-19 years old	20-22 years old	
Push ups	Poor	Count	2_a	3_a	5
		% within Push ups	40.0%	60.0%	100.0%
		% within Age	6.5%	6.2%	6.3%
		% of Total	2.5%	3.8%	6.3%
	Fair	Count	2_a	4_a	6
		% within Push ups	33.3%	66.7%	100.0%
		% within Age	6.5%	8.3%	7.6%
		% of Total	2.5%	5.1%	7.6%
	Good	Count	4_a	10_a	14
		% within Push ups	28.6%	71.4%	100.0%
		% within Age	12.9%	20.8%	17.7%
		% of Total	5.1%	12.7%	17.7%
	Very Good	Count	9_a	8_a	17
		% within Push ups	52.9%	47.1%	100.0%
		% within Age	29.0%	16.7%	21.5%
		% of Total	11.4%	10.1%	21.5%
	Excellent	Count	14_a	23_a	37
		% within Push ups	37.8%	62.2%	100.0%
		% within Age	45.2%	47.9%	46.8%
		% of Total	17.7%	29.1%	46.8%
Total		Count	31	48	79
		% within Push ups	39.2%	60.8%	100.0%
		% within Age	100.0%	100.0%	100.0%
		% of Total	39.2%	60.8%	100.0%

Each subscript letter denotes a subset of Age categories whose column proportions do not differ significantly from each other at the .05 level.

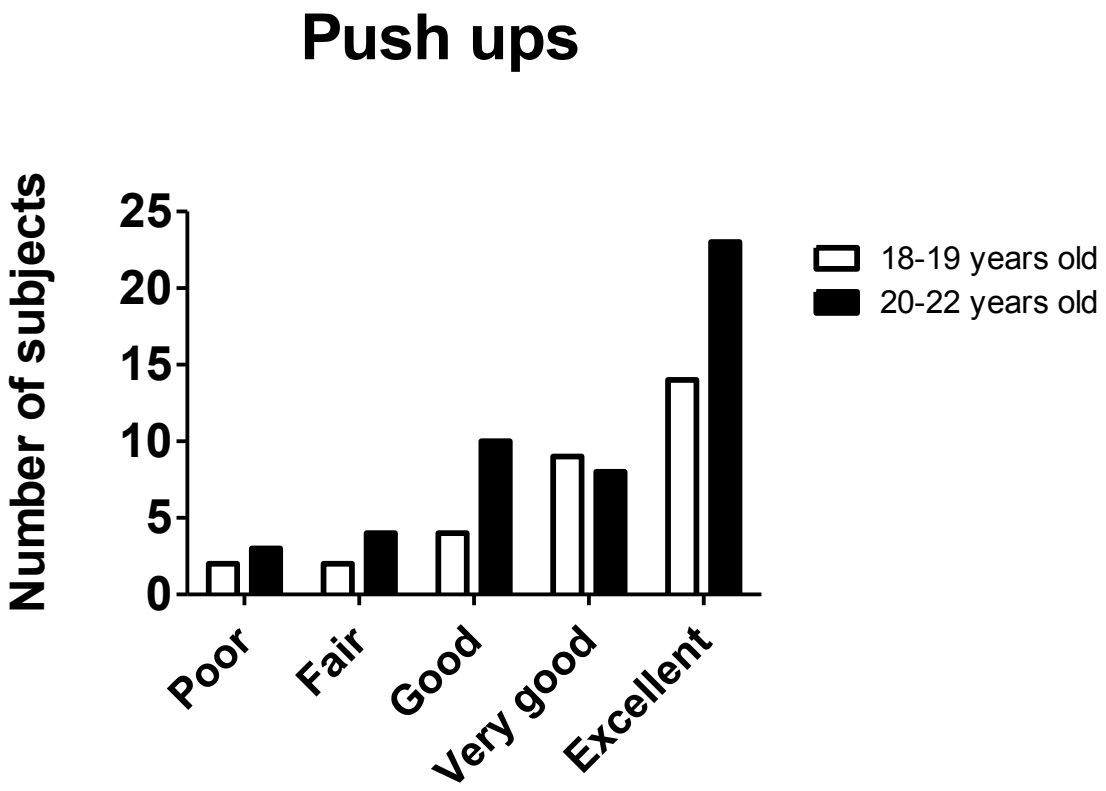

Figure 9. Number of subjects in each category based on the number of push up repetitions (18-19 years old vs 20-22 years old).

Table 12

Distribution of subjects for the sit up test (18-19 years old vs 20-22 years old).

			Age		Total
			18-19 years old	20-22 years old	
Sit ups	Poor	Count	17_a	30_a	47
		% within Sit ups	36.2%	63.8%	100.0%
		% within Age	54.8%	62.5%	59.5%
		% of Total	21.5%	38.0%	59.5%
	Fair	Count	5_a	7_a	12
		% within Sit ups	41.7%	58.3%	100.0%
		% within Age	16.1%	14.6%	15.2%
		% of Total	6.3%	8.9%	15.2%
	Good	Count	5_a	8_a	13
		% within Sit ups	38.5%	61.5%	100.0%
		% within Age	16.1%	16.7%	16.5%
		% of Total	6.3%	10.1%	16.5%
	Very Good	Count	1_a	2_a	3
		% within Sit ups	33.3%	66.7%	100.0%
		% within Age	3.2%	4.2%	3.8%
		% of Total	1.3%	2.5%	3.8%
	Excellent	Count	3_a	1_a	4
		% within Sit ups	75.0%	25.0%	100.0%
		% within Age	9.7%	2.1%	5.1%
		% of Total	3.8%	1.3%	5.1%
Total		Count	31	48	79
		% within Sit ups	39.2%	60.8%	100.0%
		% within Age	100.0%	100.0%	100.0%
		% of Total	39.2%	60.8%	100.0%

Each subscript letter denotes a subset of Age categories whose column proportions do not differ significantly from each other at the .05 level.

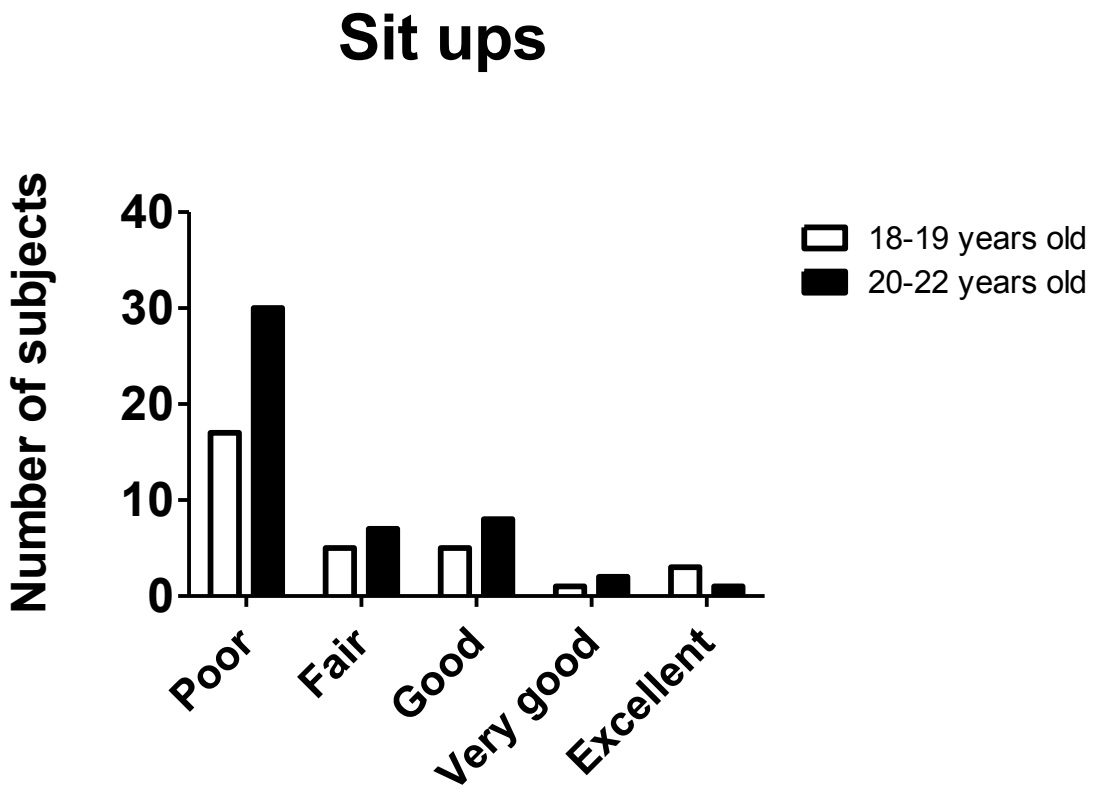

Figure 10. Number of subjects in each category based on the number of sit up repetitions (18-19 years old vs 20-22 years old).

Physical Activity Comparison

Figure 11 indicates the percentage body fat between the two physical activity groups. Subjects who regularly exercise >150 minutes per week had a significantly lower percent body fat compared to those subjects who regularly exercise 0-150 minutes per week ($p < 0.05$).

The number of subjects who exercise 0-150 minutes per week and >150 minutes per week that fell into the poor, fair, good, very good, and excellent categories for the 2400 meter run is indicated in **Table 13** and **Figure 12**. The subjects who exercise >150 minutes per week scored higher than those in the 0-150 minutes per week group on the

2400 meter run. The number of subjects who exercise 0-150 minutes per week and >150 minutes per week that fell into the poor, fair, good, very good, and excellent categories for the sit and reach test is indicated in **Table 14** and **Figure 13**. Surprisingly, the distribution for the two groups is similar.

The number of subjects who exercise 0-150 minutes per week and >150 minutes per week that fell into the poor, fair, good, very good, and excellent categories for the push up test is indicated in **Table 15** and **Figure 14**. The >150 minutes per week group had a large number of subjects on the higher end of the distribution, while the 0-150 minutes per week group had very few. The number of subjects who exercise 0-150 minutes per week and >150 minutes per week that fell into the poor, fair, good, very good, and excellent categories for the sit up test is indicated in **Table 16** and **Figure 15**. The distribution for the >150 minutes per week group is the opposite of what was expected, with a large number of subjects on the lower end.

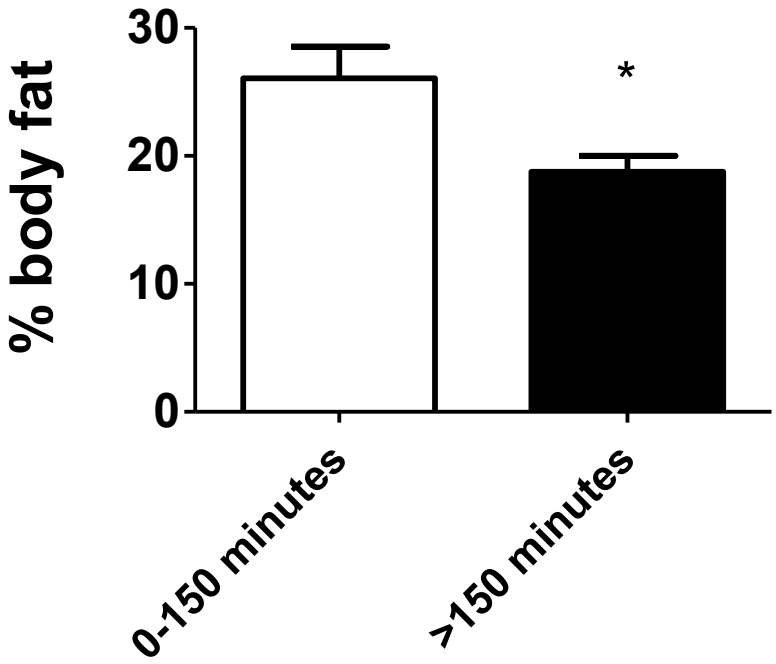

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Figure 11. Percentage body fat in subjects who regularly exercise 0-150 minutes per week and subjects who regularly exercise >150 minutes per week.

* $p < 0.05$.

Table 13

Distribution of subjects for time to complete 2400 meters (0-150 minutes weekly exercise vs >150 minutes weekly exercise).

			Weekly exercise		Total
			0-150 minutes	>150 minutes	
2400 m run	Poor	Count	17_a	12_b	29
		% within 2400 m run	58.6%	41.4%	100.0%
		% within Weekly exercise	63.0%	23.1%	36.7%
		% of Total	21.5%	15.2%	36.7%
	Fair	Count	4_a	10_a	14
		% within 2400 m run	28.6%	71.4%	100.0%
		% within Weekly exercise	14.8%	19.2%	17.7%
		% of Total	5.1%	12.7%	17.7%
	Good	Count	3_a	22_b	25
		% within 2400 m run	12.0%	88.0%	100.0%
		% within Weekly exercise	11.1%	42.3%	31.6%
		% of Total	3.8%	27.8%	31.6%
	Very Good	Count	1_a	3_a	4
		% within 2400 m run	25.0%	75.0%	100.0%
		% within Weekly exercise	3.7%	5.8%	5.1%
		% of Total	1.3%	3.8%	5.1%
	Excellent	Count	2_a	5_a	7
		% within 2400 m run	28.6%	71.4%	100.0%
		% within Weekly exercise	7.4%	9.6%	8.9%
		% of Total	2.5%	6.3%	8.9%
Total		Count	27	52	79
		% within 2400 m run	34.2%	65.8%	100.0%
		% within Weekly exercise	100.0%	100.0%	100.0%
		% of Total	34.2%	65.8%	100.0%

Each subscript letter denotes a subset of Regular Exercise categories whose column proportions do not differ significantly from each other at the .05 level.

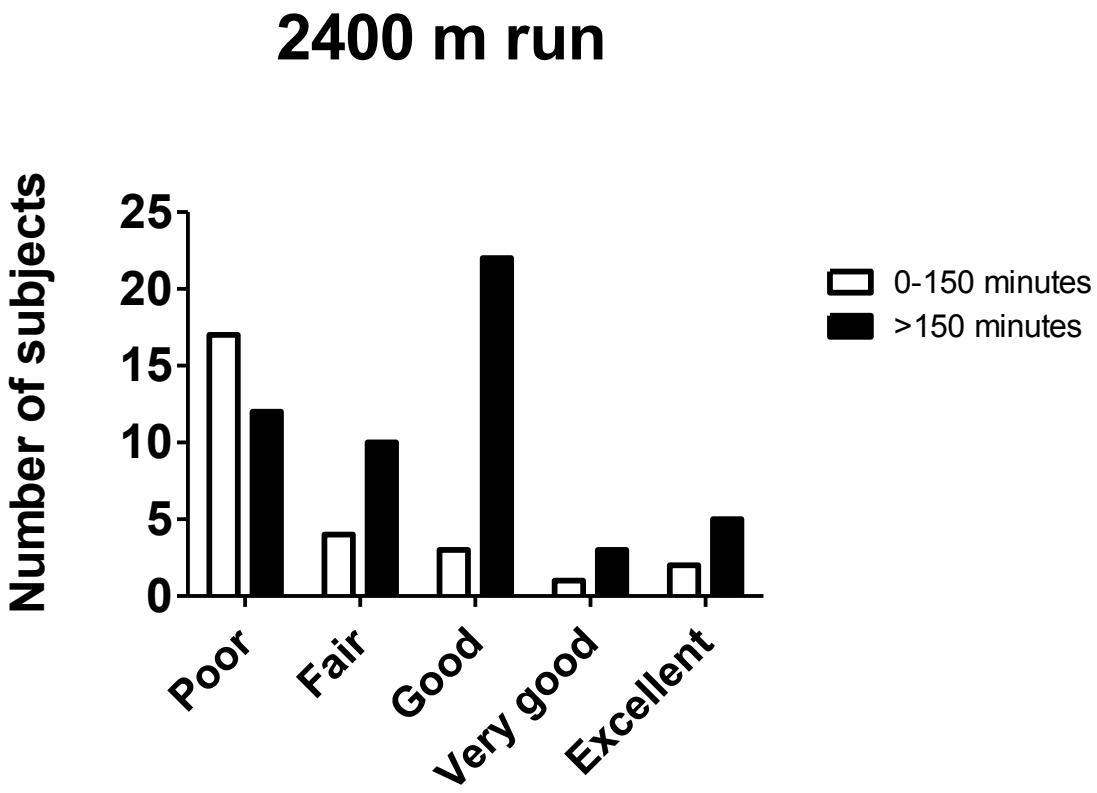

Figure 12. Number of subjects in each category based on the time to complete 2400 meters (0-150 minutes weekly exercise vs >150 minutes weekly exercise).

Table 14

Distribution of subjects for the sit and reach test (0-150 minutes weekly exercise vs >150 minutes weekly exercise).

			Weekly Exercise		Total
			0-150 minutes	>150 minutes	
Sit and reach	Poor	Count	10_a	7_b	17
		% within Sit and reach	58.8%	41.2%	100.0%
		% within Weekly exercise	37.0%	13.5%	21.5%
		% of Total	12.7%	8.9%	21.5%
	Fair	Count	3_a	15_a	18
		% within Sit and reach	16.7%	83.3%	100.0%
		% within Weekly exercise	11.1%	28.8%	22.8%
		% of Total	3.8%	19.0%	22.8%
	Good	Count	6_a	12_a	18
		% within Sit and reach	33.3%	66.7%	100.0%
		% within Weekly exercise	22.2%	23.1%	22.8%
		% of Total	7.6%	15.2%	22.8%
	Very Good	Count	5_a	10_a	15
		% within Sit and reach	33.3%	66.7%	100.0%
		% within Weekly exercise	18.5%	19.2%	19.0%
		% of Total	6.3%	12.7%	19.0%
	Excellent	Count	3_a	8_a	11
		% within Sit and reach	27.3%	72.7%	100.0%
		% within Weekly exercise	11.1%	15.4%	13.9%
		% of Total	3.8%	10.1%	13.9%
Total		Count	27	52	79
		% within Sit and reach	34.2%	65.8%	100.0%
		% within Weekly exercise	100.0%	100.0%	100.0%
		% of Total	34.2%	65.8%	100.0%

Each subscript letter denotes a subset of RegularExercise categories whose column proportions do not differ significantly from each other at the .05 level.

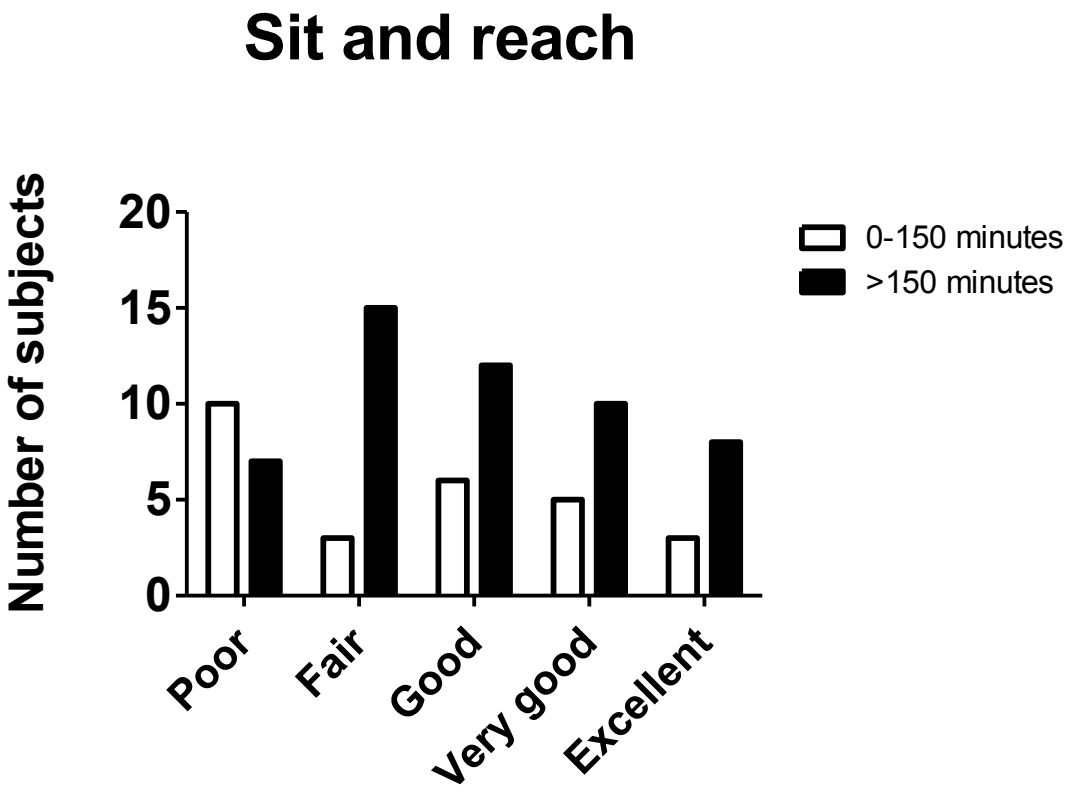

Figure 13. Number of subjects in each category based on the sit and reach test (0-150 minutes weekly exercise vs >150 minutes weekly exercise).

Table 15

Distribution of subjects for the pushups test (0-150 minutes weekly exercise vs >150 minutes weekly exercise).

			Weekly exercise		Total
			0-150 minutes	>150 minutes	
Push ups	Poor	Count	4_a	1_b	5
		% within Push ups	80.0%	20.0%	100.0%
		% within Weekly exercise	14.8%	1.9%	6.3%
		% of Total	5.1%	1.3%	6.3%
	Fair	Count	4_a	2_a	6
		% within Push ups	66.7%	33.3%	100.0%
		% within Weekly exercise	14.8%	3.8%	7.6%
		% of Total	5.1%	2.5%	7.6%
	Good	Count	7_a	7_a	14
		% within Push ups	50.0%	50.0%	100.0%
		% within Weekly exercise	25.9%	13.5%	17.7%
		% of Total	8.9%	8.9%	17.7%
	Very Good	Count	5_a	12_a	17
		% within Push ups	29.4%	70.6%	100.0%
		% within Weekly exercise	18.5%	23.1%	21.5%
		% of Total	6.3%	15.2%	21.5%
	Excellent	Count	7_a	30_b	37
		% within Push ups	18.9%	81.1%	100.0%
		% within Weekly exercise	25.9%	57.7%	46.8%
		% of Total	8.9%	38.0%	46.8%
Total		Count	27	52	79
		% within Push ups	34.2%	65.8%	100.0%
		% within Weekly exercise	100.0%	100.0%	100.0%
		% of Total	34.2%	65.8%	100.0%

Each subscript letter denotes a subset of RegularExercise categories whose column proportions do not differ significantly from each other at the .05 level.

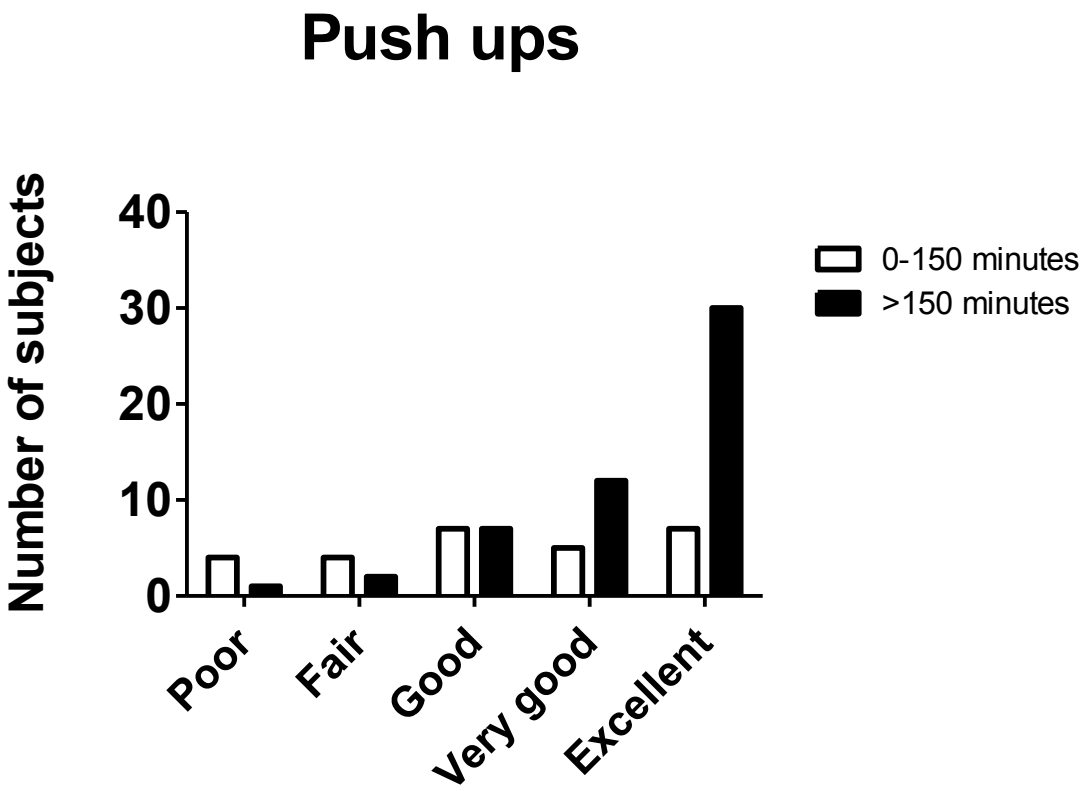

Figure 14. Number of subjects in each category based on the number of push up repetitions (0-150 minutes weekly exercise vs >150 minutes weekly exercise).

Table 16

Distribution of subjects for the sit up test (0-150 minutes weekly exercise vs >150 minutes weekly exercise).

			Weekly exercise		Total
			0-150 minutes	>150 minutes	
Sit ups	Poor	Count	20_a	27_a	47
		% within Sit ups	42.6%	57.4%	100.0%
		% within Weekly exercise	74.1%	51.9%	59.5%
		% of Total	25.3%	34.2%	59.5%
	Fair	Count	1_a	11_b	12
		% within Sit ups	8.3%	91.7%	100.0%
		% within Weekly exercise	3.7%	21.2%	15.2%
		% of Total	1.3%	13.9%	15.2%
	Good	Count	4_a	9_a	13
		% within Sit ups	30.8%	69.2%	100.0%
		% within Weekly exercise	14.8%	17.3%	16.5%
		% of Total	5.1%	11.4%	16.5%
	Very Good	Count	2_a	1_a	3
		% within Sit ups	66.7%	33.3%	100.0%
		% within Weekly exercise	7.4%	1.9%	3.8%
		% of Total	2.5%	1.3%	3.8%
	Excellent	Count	0_a	4_a	4
		% within Sit ups	0.0%	100.0%	100.0%
		% within Weekly exercise	0.0%	7.7%	5.1%
		% of Total	0.0%	5.1%	5.1%
Total		Count	27	52	79
		% within Sit ups	34.2%	65.8%	100.0%
		% within Weekly exercise	100.0%	100.0%	100.0%
		% of Total	34.2%	65.8%	100.0%

Each subscript letter denotes a subset of RegularExercise categories whose column proportions do not differ significantly from each other at the .05 level.

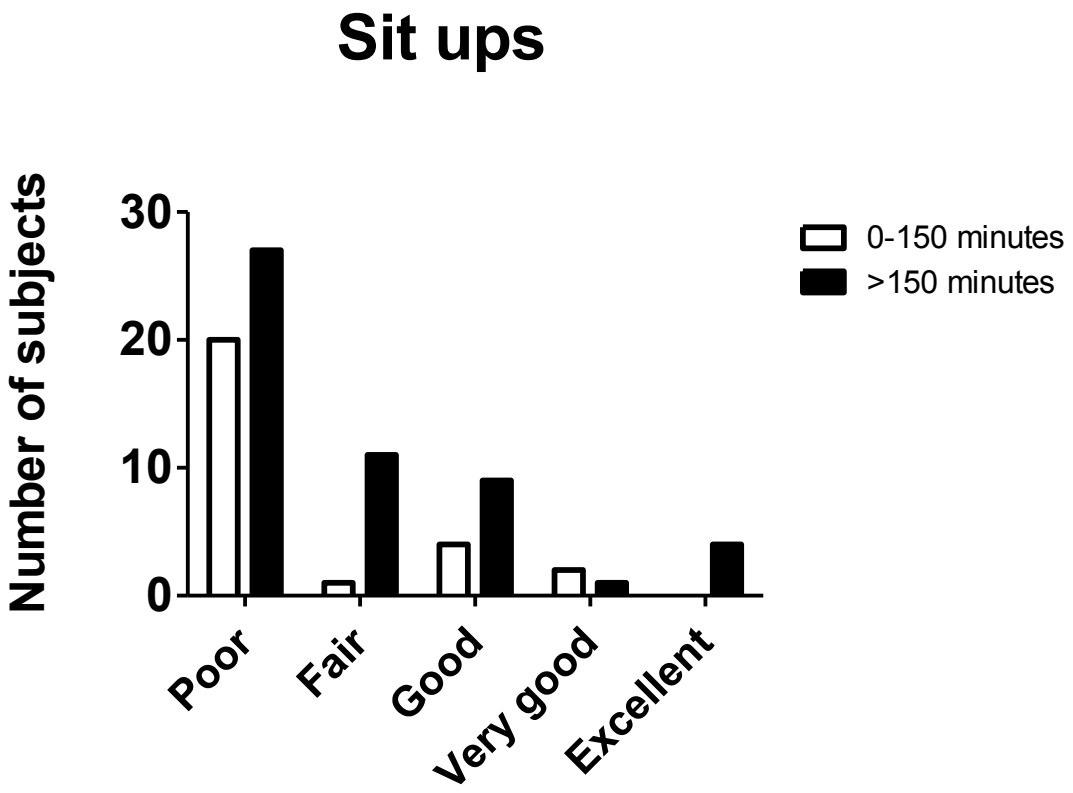

Figure 15. Number of subjects in each category based on the number of sit up repetitions (0-150 minutes weekly exercise vs >150 minutes weekly exercise).

CHAPTER V

DISCUSSION

The purpose of this study was to identify physical fitness differences between gender, age, and physical activity level. The data collected in the study concluded that upper classmen (20-22 year old) students rated higher in physical fitness categories than the lower classmen. Also, those who self-reported exercising 150 or more minutes per week also rated higher in physical fitness categories than those who do not exercise 150 minutes per week.

The testing protocol in the current study consisted of cardiorespiratory endurance, flexibility testing, and muscular strength and endurance. In regards to the cardiorespiratory endurance test, the 2400 meter (i.e., one and a half mile) run test was used. The instructions to the subjects included referring to it as a one and a half mile run. This helped the subjects have a better understanding of the distance expected of them, as most of them have a better understanding of the English system of measurement rather than the metric system. At the chosen facility for the research, the track is a 200 meter track. This caused the run to be twelve laps, rather than the traditional track's distance of six laps. It is possible this affected run times, but not likely. Also, since the track is indoor and so small, the corners are very tight. Often a runner must slow down coming into the curve in order to not lose control and stumble. Although this can cause the runner to have a slower overall time, it is not likely this affected the scoring, since the categories

of fitness level all included a two to three minute window. The distribution of results on the run show that lower classmen scored better in this portion, while those who exercise more than 150 minutes per week scored better than those who do not regularly exercise 150 minutes per week. The distribution of scores was similar for both genders on this test.

Some subjects were familiar with the sit and reach test, through Physical Education tests in school, or through the Department of Kinesiology at Mississippi State University. Although those subjects who were familiar with it before the assessment may have had an advantage in technique, the advantage would have been minute. Since the classification categories were several centimeters apart, it is unlikely this possible advantage affected the scores enough to alter the fitness category the individual would have tested in. The distribution of scores was similar for both groups when looking at regular exercise time, but more upper classmen scored higher than lower classmen on this assessment. Females had higher scores on this test than males.

The self-reported data of amount of time per week spent doing physical activity does not offer the expected fitness results, as it pertains to abdominal core strength. The sit up test actually yielded results the opposite of what was expected. This could indicate a number of things, namely exercise habits during physical activity. It seems the subjects do not regularly exercise the abdominal core during their physical activity. The pushup test yielded similar results for both upper classmen and lower classmen, as well as those who exercise regularly, and those who do not. This is not an expected result and further research is necessary to determine the cause of such occurrence.

The "freshman fifteen" is a concept that has been happening on college campuses for decades. No matter what educational measures have been taken, the problem still seems to exist. Although this study does not reveal what causes the problem, it does help to reveal at which point in college fitness seems to be the lowest. If this study were to be revisited, consideration should be given to a larger sample size. It was not feasible to attain a sample of greater than 100 subjects for this study, but in the future, a larger group may reveal a more precise point at which fitness significantly declines in college students. This study was able to narrow down a window during which fitness declines, but not an exact point in time, nor possible causes. Future research could include health analyses to determine if there is a specific cause of this decline in fitness.

There are several previous studies that can be applicable to the results obtained in the present study. These studies include best measurements of fitness for college students as well as best methods of education for college students. For example, Dadelo and Tomosauskas (2005) followed whether or not teaching college students to self assess is effective. They concluded that teaching students how to self-assess improved both physical fitness and function, as well as academic performance. Although students were not given methods of self-assessment during the present study, they were told any scores they desired to know. Many were interested to know their body fat percentage. In the future, these students could be followed to see if knowledge of their body composition had any effect on exercise and fitness habits.

Also, Cardinal and Spaziani (2007) examined the effects of teaching a lifetime fitness for health class to college students. The authors determined that the class increases physical activity among subjects, compared to control students not enrolled in the course.

Using this theory, in conjunction with the results of the present study, it may be possible to isolate where the problem among college students occurs and have interventive strategies before the problem is allowed to occur.

A study at Georgia Southern University by Melton, Hansen, and Gross (2010) showed that physical activity programs that change with changing student interest are the most effective at keeping students interested in physical activity. The number of students enrolled in the study show that the student body at Georgia Southern University is interested in enrolling in physical activity courses. Although those courses are available to the student body at Mississippi State University, they are not often utilized by students outside the Kinesiology department. The Department of Recreational Sports at Mississippi State University does offer an alternative to enrolling in a physical activity course for students outside the Kinesiology department. The group exercise classes as well as the club and intramural sports available are constantly changing with student needs.

Wight et al. (2008) studied the effectiveness of a point based physical activity program. The study indicated no significant differences in the amount of physical activity completed by the groups. The study indicates that education about the necessity of physical activity is more effective than education about which activities are most beneficial. When applied to the university setting, this study, along with the Cardinal study indicate that a class focusing on the importance of healthy activity is more effective than details of what is most healthy.

Graser et al. (2011) showed that children enjoy fitness assessments much more with a self-testing atmosphere. When this is applied to young adults – specifically those

in college – the feelings would likely be similar. Teaching students how to evaluate their own fitness would likely yield a more conducive atmosphere to desire to be physically active and healthy.

By using the conclusions from the previous studies and applying the conclusions from the present study, it may be possible to recommend an ideal method of physical and health education for college students. Based on the results of all the studies, the following conclusion can be asserted. Physical activity interventions, such as a lifetime fitness for health class should be offered or mandated for lower classmen at Mississippi State University and other universities similar to it. Ideally, the class may focus on the importance of physical activity for fitness and health, without details as to which activities are most beneficial. The class should teach students how to self-assess and allow the students to do so. When all previous studies are considered, with the present study, lower classmen need the most attention.

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