8-2005

A Study of the Relationship of Self-Reported Resistance Training to Lipid Profiles.

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A Thesis
presented to
the faculty of the Department of Physical Education, Exercise, and Sport Sciences
East Tennessee State University

In partial fulfillment
of the requirements for the degree
Masters of Arts in Physical Education

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August 2005

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Keywords: Resistance Training, Lipid Profile, Cholesterol

ABSTRACT

A Study of the Relationship of Self-Reported Resistance Training to Lipid Profiles

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The primary purpose of this study was to determine the relationship of self-reported resistance training to lipid profiles. The study consisted of 10 subjects between the ages of 19 and 35. Participants were assigned to an exercise group or control group based on self-reported resistance training and according to ACSM standards. After means were determined for the data gathered, the exercise group had lower averages of weight, percent body fat, total cholesterol, low-density lipoprotein and triglycerides, as well as, a higher average of high-density lipoproteins. Two-sample t-tests were performed to determine significance. It was determined that no significant difference existed between serum lipid profile levels of the control group and the self-reported exercise group. This study is important because it expands our knowledge of the relationship between resistance training (RT) and lipid profiles, relying on self-reported data and focusing on an at-risk population.

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CHAPTER 1

INTRODUCTION

The effects of specific lipids have been associated with the risk for cardiovascular disease (CVD) for years and many studies, including those by Ballor and Poehlman (1992), Kokkinos et al. (1995), and Laaksonen et al. (1999), have found a link between exercise and lipid profiles, resulting in a decreased risk for CVD, especially with aerobic training. Few studies, such as those conducted by Goldberg, Elliot, Schutz, and Kloster (1984), Boyden et al. (1993), Hurley (1989), Kokkinos et al. (1991), Manning et al. (1991), and Ullrich, Reid, and Yeater (1987), have focused on the effects of resistance training and lipid profiles, and unfortunately have resulted in conflicting conclusions. However, studies such as these also have major flaws that have been pointed out in a comparison study conducted by Hurley et al. (1987), such as not having a control group, taking only one blood sample and not having adequate baseline levels for comparison. Flaws also include limited or no control of diet (which is also known to have a great effect on lipid levels associated with CVD), and most have been cross-sectional studies, which lend themselves to questionable conclusions.

Problem Statement

Previous studies have illustrated that aerobic or endurance training can have a significant positive effect on serum lipid levels related to the risk of CVD; however, little has been done in the area of resistance training, and results differ from study to study. Therefore, the primary purpose of this study was to determine the relationship of self-reported resistance training to lipid profiles.

Most research has failed to investigate the effects of specific intensity and duration of exercise on serum lipid levels. Research has also shown that the college-age population, especially males, may be at an increased risk for CVD. For the purpose of this study, young adult participants were screened at the Center for Physical Activity (CPA) and the D.P. Culp Student Center on the East Tennessee State University (ETSU) Campus to determine whether or not they met specific criteria (see Appendix D) to participate in this study. Lipid profiles were later conducted, followed by analysis of serum lipid levels known to be associated with CVD. Based on the self-reported data collected, participants were assigned to the exercise group or the control group according to American College of Sports Medicine (ACSM) standards. ACSM standards recommend a minimum of "one set of 8-10 exercises that conditions the major muscle groups 2-3 d*wk" (Pollock et al., 1998). Taking this information into consideration, as well as other research that has been conducted, it is believed that this topic needs to be further investigated. This study is important because it expands our knowledge of the relationship between resistance training (RT) and lipid profiles. The study is unique because it relies on self-reported RT. However, it relates to other studies by focusing on a population of young adults, which is a group determined to be at risk for cardiovascular disease in a study conducted by Sparling, Snow and Beavers (1999).

Definitions

- Aerobic –Requiring oxygen for respiration (http://cancerweb.ncl.ac.uk)
- Aminolipid – an amino acid-containing lipid (Gomi et al. 2002).
- Anaerobic – living, active, or occurring in the absence of free oxygen (http://dictionary.reference.com)

- Catabolism - destructive metabolism involving the release of energy and resulting in the breakdown of complex materials within the organism (http://dictionary.reference.com)

- Chromolipid (lipochrome) - A pigmented lipid (http://cancerweb.ncl.ac.uk)

- Chylomicron - fat globule found in blood or lymph, used to transport fat from the intestine to the liver or to adipose tissue; have a very low density and a low protein and high triacylglyceride content (http://cancerweb.ncl.ac.uk)

- Glycolipid – a lipid that contains a carbohydrate radical (http://dictionary.reference.com)

- Hyperglyceridemia -Elevated plasma concentration of glycerides, which usually are present without chylomicrons; normal if transiently present after absorption of a meal containing lipids; abnormal if a persistant state (http://cancerweb.ncl.ac.uk)

- Hyperlipoproteinemia - A condition marked by an abnormally high level of lipoproteins in the blood (http://dictionary.reference.com)

- Isoform - any of two or more functionally similar proteins that have a similar but not identical amino acid sequence and are either encoded by different genes or by RNA transcripts from the same gene which have had different exons removed (http://dictionary.reference.com)

- Lecithin cholesterol acyltransferase (LCAT) - An enzyme that reversibly transfers an acyl residue from a lecithin to cholesterol, forming a 1-acylglycerophosphocholine (a lysolecithin) and a cholesterol ester (http://cancerweb.ncl.ac.uk)

- Lipoprotein lipase - An enzyme of the hydrolase class that catalyses the reaction of triacylglycerol and water to yield diacylglycerol and a fatty acid anion (http://cancerweb.ncl.ac.uk)

- Phenotype - visible properties of an organism that are produced by the interaction of the genotype and the environment (http://dictionary.reference.com)

- Phospholipids – lipids containing one or more phosphate groups, particularly those derived from either glycerol or sphingosine (http://cancerweb.ncl.ac.uk)

- Polymorphic - Occurring in several or many forms, appearing in different forms at different stages of development (http://cancerweb.ncl.ac.uk)

- Polypeptide - a molecular chain of amino acids (http://dictionary.reference.com)

- VO2max – VO_2 max is the maximum volume of oxygen that by the body can consume during intense, whole-body exercise, while breathing air at sea level. This volume is expressed as a rate, either liters per minute (L/min) or millilitres per kg bodyweight per minute (ml/kg/min) (Seiler, 1996).

Limitations

This study focused on the relationship of self-reported resistance training to lipid profiles. However, it is subject to specific criteria and may be limited by the following:

- Small population of young adults
- Includes only students from ETSU
- Study relies on self-reported information from participants

Assumptions

This study relies on self-reported information as a major component; therefore, the following assumptions must be made:

- Participants were truthful in reporting information
- Participants were not using any supplements or drugs to gain weight, lose weight, or increase muscle mass
- Participants followed instructions leading up to blood draw

Delimitations

In an effort to obtain reliable data, participants for the study were limited to those who met the following criteria:

- Young adults between the ages of 18 and 35 years
- Subjects who participated in resistance training at least two days per week
- Subjects who were not taking cholesterol lowering medications
- Subjects who were not taking diabetes medications
- Subjects who did not have diabetes or high blood sugar
- Subjects who did not have a history of diabetes

- Subjects for the control group had not participated in regular or consistent exercise within the last six months

CHAPTER 2

REVIEW OF LITERATURE

The primary purpose of this study was to determine the relationship of self-reported resistance training to lipid profiles. This chapter will provide an overview of literature that is relevant to the study.

Overview of Lipids

Lipids, a generic term for fats and lipoids, are alcohol-ether soluble constituents of protoplasm, that are insoluble in water. They comprise fats, fatty oils, essential oils, waxes, phospholipids, glycolipids, aminolipids, chromolipids (lipochromes), and fatty acids, and because lipids are not water soluble, they are transported as components of lipoproteins. The relationship of certain lipoproteins, such as high-density lipoproteins (HDLs), low-density lipoproteins (LDLs), and very low-density lipoproteins (VLDLs), to CVD, as well as triglyceride (TG) and total cholesterol (TC) levels in relation to CVD have been well documented over the last decade. Research has linked high HDL levels, low LDL levels, low VLDL levels and low TG levels to lower levels of TC, leading to decreased risk for CVD (Wikipedia, n/a).

HDL is a lipoprotein that transports cholesterol in the blood. It is composed of a high proportion of protein and relatively little cholesterol. It is believed that about one third to one fourth of blood cholesterol is carried by HDL, and that HDLs carry cholesterol away from the arteries back to the liver, where it is passed from the body. According to the American Heart Association (AHA), some medical experts think HDL slows the build up of plaque in arteries by removing excess cholesterol. LDL, another lipoprotein, transports cholesterol in the blood and is composed of a moderate amount of protein and a large amount of cholesterol. When too much

LDL circulates in the blood, it can, with other substances, form plaque and build up in the inner walls of the arteries that feed the heart and brain. According to the AHA, acceptable levels for HDL, LDL, and TG are as follows: greater than 40 mg/dl, less than 130 mg/dl and less than 150 mg/dl respectively (American Heart Association, 2005). VLDL is defined as large lipoproteins rich in TG that circulate throughout the blood giving up their TGs to fat and muscle tissue until the VLDL remnants are modified and converted to LDL (Wikipedia).

Apolipoproteins

Apolipoproteins are protein constituents of lipoproteins that play an important role in lipoprotein metabolism by acting as recognition sites for cell membrane receptors and as cofactors in enzymatic reactions (Medical Information Department, 2005). Several apolipoproteins have been identified as being associated with risks of CVD, more specifically apolipoproteins A, B, C, and E. Apolipoprotein A (apo A) is a lipoprotein found in human blood serum in the HDL and very high-density lipoprotein (VHDL) fraction (Phillips, Wriggers, Li, Jones, & Schulten, 1997). Apo A consists of several different polypeptides, the most important of which are apolipoprotein A-I and A-II that maintain the structural integrity of the HDL particles and are activators of lecithin cholesterol acyltransferase (LCAT) (Wikipedia).

Apolipoprotein B (apo B) is a structural protein of chylomicrons VLDL and LDL. It is important in the secretion and transport of these lipoproteins and functions as recognition signals for binding and internalization of LDL particles by the LDL receptor (Anant et al. 2001). Apolipoprotein C (apo C) consists of lipoproteins located on the surface of VLDL and is transferred to HDL throughout the catabolism of VLDL and affect lipoprotein lipase activity (Jonas, Sweeny & Herbert, 1984). A genetic lack of apolipoprotein C-II results in hyperglyceridemia and low levels of HDL. Apolipoprotein E (apo E) makes up the prominent protein constituents of plasma VLDL, chylomicrons and a sub fraction of HDL, as well as of remnant lipoproteins, which are derived from the lipoprotein lipase-mediated intravascular catabolism of TG rich lipoproteins. Apo E is composed of 299 amino acids synthesized primarily by the liver but also by the spleen, kidneys, adrenal glands, gonads, brain, macrophages and astrocytic glia (Robitaille et al., 1996). Apo E is recognized by the LDL receptor and apo E receptor. Any defect in the apo E metabolism leads to increased plasma apo E levels, which is believed to lead to type III hyperlipoproteinemia. The human apo E gene is polymorphic and three common alleles (2, 3, and 4) code for the three apo E isoforms. The combination of these isoforms gives six phenotypes that are recognizable on isoelectric focusing gels of VLDL. In most populations, the "2" allele is associated with lower TC and LDL levels, and the "4" allele is associated with higher levels of TC and LDL compared to the "3" allele (Robitaille et al.).

Supporting Evidence

From 1960 to 1991, six National Health and Nutrition Examination Surveys (NHANES) were conducted concerning cholesterol levels among adults in the United States. Johnson et al. (1993) compiled data from four of those six surveys, illustrating that mean TC levels increase for both men and women with each succeeding age group until the age range of 45 – 54, after which mean TC levels decline. The NHANES findings show that the age-related fall in average cholesterol levels for ages 55-74 continues in the age group 75 and older, with men having higher levels in the younger age groups and women having higher levels in the older age categories, and a crossover occurring around the 45 – 54 age group. Differences of TC levels were also observed among various race / ethnicity groups, with Mexican Americans and non-Hispanic blacks having lower average totals than non-Hispanic whites (Johnson et al.).

A study focusing on CVD in women points out that little is known about the effect of lipid concentration on CVD in women; however, total HDL and LDL cholesterol levels have been conclusively demonstrated to be independent predictors of CVD in men. This study examined 1405 women aged 50 – 69, with a follow-up study at an average of 14 years. Calculations for age-adjusted CVD death rates and summary relative risk estimate by categories of lipid and lipoprotein levels were used to identify HDL and TG levels as strong predictors of CVD death for women in age-adjusted and multivariate analyses. On the other hand, LDL and TC levels were poorer predictors of CVD mortality in women of this age group (Bass, Newschaffer, Klag & Bush, 1993).

In a study of college students, with a sample of 1,088 subjects (764 male and 324 female) and a mean age of 20.2 years, researchers observed that males had significantly higher LDL and significantly lower HDL cholesterols than females. In addition, the ratio of TC / HDL was also significantly higher for the males compared to the females. It was also discovered that 11.1% (121) of the subjects had an elevated LDL cholesterol level, of which 79% (95 of the 121) were male. Researchers noted that, according to the NHANES study, age and TC are positively correlated; therefore, one would expect TC levels would rise somewhat across the age groups observed (18 – 24 in the current study and 20 – 34 in the NHANES study) (Sparling et al., 1999).

Robitaille et al. (1996) conducted a study with a sample of 435 subjects (233 male and 202 female) ages 18-74 years of age for the purpose of gathering data on CVD risk factors, with particular emphasis on the effects of apo E and allele frequencies on lipid and lipoprotein levels.

It was determined that for this sample, apo E, "3" was the most common allele, followed by "2" and "4", respectively. Values of TC, LDL, and TG were significantly higher in males than females, and females had significantly higher HDL values. The study also found significant differences between pre- and post-menopausal females, with pre-menopausal females having higher lipid and lipoprotein values. Males and females were also divided into groups based on apo E alleles (2, 3 or 4). Males in the "2" group were found to have lower values of TC and LDL than those of the "3" group, and those of the "3" group showed lower levels than group "4". The same effects were observed in females; however, a significant difference was seen in only LDL for post-menopausal females. TG levels were also found to be higher for males in the "2" and "4" groups compared with the "3" group, but no difference was seen in females. It was also discovered that the "2" allele was associated with lower TC and LDL, but the "4" allele had the opposite effect. For TG levels the "2" allele was associated with an increase for males and a more pronounced increase in post-menopausal females, but the "4" allele was associated with higher TG in males only (Robitaille et al.).

Based on evidence that apo B is associated with lipid levels and increased risk of CVD, is the protein component of VLDL and LDL, and is responsible for recognition of the LDL receptor and secretion of VLDL particles in hepatocytes, Bentzen, Poulsen, Vaag, & Fenger, (2003) conducted a study concerning the influence of apo B on glucose and lipid metabolism. Through this study, which consisted of 226 monozygotic and 338 dizygotic same-sex twins aged 55 – 74 who were distinguished based on different polymorphisms in the coding regions of the apo B gene, it was determined that monozygotic twins with normal or impaired glucose tolerance who were heterozygous for the T711 polymorphism had the highest HDL levels, while the heterozygote group with type 2 diabetes had the lowest values. Upon conclusion of this study, it was determined the apo B L2712P polymorphism was the only one of those examined in the study to have any influence on lipid parameters. However, L2712L is also associated with lower lipid levels, which implies a role for apo B in lipid metabolism. (Bentzen et al.).

Aerobic (Endurance) Training and Lipids

Several studies have also shown a strong, positive correlation between endurance training and a reduced risk for CVD, due to higher levels of HDL and lower levels of LDL and VLDL. An early study by Huttunen et al. (1979) looked at the effects of mild to moderate exercise on HDL and other lipoproteins in middle-aged men. In this study it was discovered that TG decreased and HDL increased in the exercise group, but no change was reported in the control group. It was also determined that as the concentration of apo A-I remained constant, the HDL / apo A-I ratio increased in the exercise group only, while LDL and apo A-II levels decreased in both groups (Huttunen et al.).

Another study examining HDL and apo A-I in sedentary middle-aged men after physical conditioning also reported increases in HDL, as well as apo A-I, with significant increases already occurring after four and eight weeks of training. The study also noted decreases in TC and TG levels in the exercise group. However, no changes were noted for any measures in the control group (Kiens et al., 1980).

A study comparing the effects of aerobic exercise on lipid and lipoprotein levels of men and women was conducted at the University of Pennsylvania and the Division of Lipid Research at Johns Hopkins University. This study revealed men and women had significantly different lipid pattern in response to exercise. In this particular study, men increased HDL and HDL / LDL ratio levels and decreased LDL levels, while women illustrated decreases in HDL and LDL levels with no significant change in the HDL / LDL ratio (Brownell, Bachorik, & Ayerle, 1982). Another study, using middle-aged men as subjects, concluded aerobic exercise contributed to increases in HDL and decreases in TG levels; however, levels of TC and LDL were not significantly changed (Wood et al., 1988).

Other studies have focused on older populations of men and women. One study showed that by walking an 18-hole golf course (approximately 8,000 yards) three times per week, LDL levels could be significantly lowered and HDL levels increased in males aged 48 – 80 (Palank & Hargreaves, 1990). A similar study illustrated that women aged 61 – 81 who walked at 70 – 80% of their maximum heart rate three days a week for approximately eight weeks can increase HDL levels; however, significant changes were not observed in TC and LDL levels (Whitehurst & Menendez, 1991).

One particular study compared the number of miles run per week to levels of HDL in middle aged men (30 – 64 years) and found a significant correlation between miles run per week and HDL levels, along with positive correlations in frequency, duration, and intensity associated with miles run per week. In relation to this, LDL and TG levels were inversely correlated with miles run per week, frequency, and duration (Kokkinos et al., 1995).

Another study investigated the effects of a single bout of ultra endurance exercise on lipid levels; in this case 39 subjects who competed in the Ironman Triathlon volunteered for the study. After blood samples were taken to determine steady state values (two days prior to the competition) the study sample was taken within 15 minutes of completion of the event. Significant decreases were observed in TC, TG, LDL, and apo B levels, with the greatest change being observed in TG levels. The data from this study suggest that exercise in both men and women improves lipid and lipoprotein risk factors for developing coronary artery disease (Ginsburg et al., 1996).

Aerobic exercise and lipid profiles have also been studied in type I diabetic men. Laaksonen et al. (1999) attempted to test the hypothesis that a 12 – 16 week aerobic exercise program would induce antiatherogenic changes in lipid, lipoprotein and apolipoprotein levels. According to the results of this study, a positive correlation was illustrated between daily energy expenditure and TG levels, the HDL / TC ratio and the apo A-I / apo B ratio; however, there were no other associations observed with other lipid or lipoprotein levels that reached statistical significance (Laaksonen et al.). A more recent study reports that regular long distance running lowers LDL levels; however, no other significant differences were found among remaining lipids (Tomaszewski et al, 2004).

Resistance (Anaerobic / Weight) Training and Lipids

Few studies have been conducted on the effects of resistance training (RT) on lipids and lipoproteins. One of the first studies examined the lipid and lipoprotein levels of sedentary men and women (aged 24 – 36) after a 16-week weight training program. According to this investigation, women demonstrated decreases in TC, LDL, and TG, as well as HDL and the HDL / LDL ratio. Men also appeared to have reductions in LDL as well as the TC / HDL and LDL / HDL ratios (Goldberg et al., 1984). Another study that examined the effects of resistance training concluded that 16 weeks of resistance training could increase HDL and decrease LDL as well as the TC / HDL ratio in sedentary males aged 40 – 55 (Hurley et al., 1987). Yet another study illustrated that after an eight week weight lifting program, HDL levels could be significantly increased and LDL levels could be decreased in men 18 – 35 years of age (Ullrich et al., 1987).

A study comparing resistive training to aerobic training revealed that some investigators reported HDL levels in male strength trained athletes similar to those of endurance trained athletes, while others have reported lower HDL levels and higher TC / HDL ratios. It is believed by the authors of this comparison that experimental design flaws may have contributed to the contradictory results. The comparison concludes that while reductions in LDL and increases in HDL have been observed as effects of resistance training, it is not possible to determine whether the results of these studies reflect actual training differences or merely selection biases (Hurley, 1989).

In contrast to previous studies, one particular examination of strength training on lipid profiles takes a strong stand that this type of training does not improve lipid profiles in men (aged 46 ± 11). This study required subjects to undergo a 20 week strength training program after which it was determined that neither concentrations of HDL, LDL, nor TC illustrated significant changes (Kokkinos et al., 1991). A study that was being conducted almost simultaneously studied the effects of resistive training on lipid levels in obese women. The results of this study showed that after 12 weeks of training, there were no significant changes in the levels of TC, HDL, LDL, TG, apo A-I, apo B, or the TC / HDL ratio, suggesting that increases in strength due to resistance training (in the absence of weight loss) did not alter the lipid profiles (Manning et al., 1991). Another study compared CVD risk factors in aerobically and resistance trained females and showed no significant differences in levels of TC, TG, LDL, or HDL between the groups (Ballor & Poehlman, 1992). A study investigating the effects of resistance training on lipid and lipoprotein levels in premenopausal women was conducted, concluding that five months of resistance exercise was associated with significant decreases in TC and LDL (Boyden et al., 1993). A more recent study determined that resistance trained women had significant decreases in TC, LDL, the HDL/LDL ratio and percent body fat (Prabhakaran, Dowling, Branch, Swain & Leutholtz, 1999). Another study that examined how RT affected lipid profiles in older men and women (age 54-71) suggests that RT may potentially alter the lipid profile in older, weight-stable men and women (Joseph, Davey, Evans & Campbell., 1999).

Diet

It appears that one major flaw in most of the studies that have been conducted is the lack of control for dietary changes or dietary intake in general. Although this may not be a determining factor on its own, it is nonetheless, a factor that needs to be considered. Two particular studies were available that somewhat distinguished dietary effects on lipid profiles from the effects of training and in both studies the subjects were men with ages ranging from 19 – 59 (both studies combined). The first study divided its subjects into four groups, one of which was labeled "inactive weight loss". In this group caloric intake was reduced by the amount of 3500 kcal / week to promote weight loss of one pound per week and no exercise was prescribed. The results of this examination revealed weight loss due to diet alone could increase HDL significantly (Sopko et al., 1985). The other study concluded that weight loss due to diet could result in significant increases in HDL as well as decreased TG levels (Wood et al., 1988).

Exercise Intensity and Duration

Another aspect of the studies that has been somewhat accounted for but seems to have received little attention as to its relevance is the intensity and duration of the exercise being performed. Studies that focus more on endurance training have specified intensity as the number of miles run per week (Kokkinos et al., 1995; Williams, Wood, Haskell & Vranizan, 1982; Wood et al., 1983;**).** In a study conducted by Huttunen et al. (1979), a modified version of Balke's formula was used to calculate the prescribed intensity level for training. The formula states: resting heart rate + .40 x (maximal heart rate – resting heart rate) (Balke, 1974). Other studies, such as those conducted by Keins et al. (1980) and Brownell et al. (1982) used different percentages of maximal heart rate to determine levels of intensity. Laaksonen et al. (1999), as well as Keins et al. (1980), based intensity of exercise on measures of VO2 peak. As for resistance training studies, exercise intensity was measured by the number of sets and repetitions performed for each exercise and/or a specified percentage of one repetition maximum (1 RM). One exception was a study conducted by Hurley et al. (1987), which used a circuit as the program; therefore, the intensity was measured by the number of repetitions that could be completed within a given time.

The duration of exercise is another factor that needs to be considered. The aerobic studies conducted training with durations ranging from 30 to 60 minutes, specifying how many times per week exercise was to be performed. Studies focusing on resistance training had no other specification of duration other than the number of times per week exercises were to be performed.

Summary

Lipids are fatty substances transported as components of lipoproteins. Lipoproteins make up a profile, known as a lipid profile, whose values have a direct relationship to cardiovascular disease. The research covered in this chapter illustrates that aerobic or cardiovascular training obviously has a positive influence on lipid profiles. This type of exercise has been shown to decrease values of TC, LDL, and TG as well as increase HDL levels in men and women.

Anaerobic or resistance training has also been referred to; however, conflicting results make it difficult to determine exactly what kind of relationship RT has with lipid profiles. While several studies have focused on cardiovascular and resistance training, there are some elements that are missing or have not been fully emphasized, causing flaws in the studies. One such factor is exercise intensity and endurance; although, this has been focused on more in studies on aerobic exercise, it is still unclear what role this component may play. Another factor is diet, which is known to play a significant role in determining lipid profiles but continues to be overlooked in many studies.

CHAPTER 3

METHODS

The primary purpose of this study was to determine the relationship of self-reported resistance training to lipid profiles. This chapter provides an overview of how the study was conducted.

Subjects

Participants were young adults (19-35 years) currently enrolled at a East Tennessee State University (ETSU), who either participated in a resistance training program or had not participated in any consistent form of exercise in the past six months. Subjects were not allowed to participate in this study if they were taking cholesterol (Appendix B) lowering medications, diabetes medications (Appendix C), weight gain or weight loss supplements, or if they had a history of diabetes or heart disease. Three males and seven females participated in the study. Two of the males and three of the females were assigned to the exercise group, while one male and four females were assigned to the control group.

Instrumentation

Screening, which consisted of several documents (see Appendices A and D-G), that had to be reviewed or completed, was conducted after approval was granted from the ETSU Institutional Review Board (IRB). Data were then reviewed to determine if participants would be assigned to the self-reported exercise group or the control group. Qualified participants were contacted to come in on a designated morning, following an overnight fast, in order to obtain blood samples. Serum lipid levels were determined by analyzing blood samples, and data were tested for significance using two-sample t-tests after results were reported from the lab.

Procedure

For the purposes of this study, college age participants were screened at the Center for Physical Activity (CPA) and the D.P. Culp Center on the campus of ETSU. Screenings were compiled and participants were assigned to the self-reported resistance training group or the control group. Each subject was required to report his or her typical exercise routine and answer other health related questions (See Appendices E-G). After subjects were assigned to groups and history and exercise data gathered, participants were instructed to report to the Human Performance Lab in Memorial Center on the ETSU campus, following an overnight fast, where blood samples were obtained. On this day, participants were also assessed for height (measured in inches), weight (measured on a scale in pounds), and percent body fat (measured via bioelectrical impedance). Lipid profiles were assessed through analyses of the blood samples, with testing being conducted through Clinch Valley Medical Center. The blood sample analysis consists of using a centrifuge to separate the serum, which rises to the top of the tube, from the red blood cells, which settle at the bottom. The serum is then put into a photometric analyzer, which uses different wavelengths to read light refractions and report serum lipid levels.

Data Analysis

Once the data were compiled, serum lipid levels were analyzed and compared to the subjects' reports of exercise routines. To determine the level of significance ($p < .05$), two-sample t-tests were performed, and p-values were compared to determine the relationship between the control group and the self-reported resistance training group.

CHAPTER 4

RESULTS

The primary purpose of this study was to determine the relationship of self-reported resistance training to lipid profiles. This chapter will provide the results of this study.

Exercise Group Versus Control Group

Data gathered for the control group illustrated age ranging from 21 to 35 years, height ranging between 64 and 72 inches, weight ranging from 128 to 201 pounds, and percent body fat values ranging from 16.3 to 37. The results from the blood samples showed the control group to have TC levels ranging from 130 to 195, HDL levels from 34 to 53, LDL levels from 61 to 132, and TG levels from 69 to 217 (Table 1).

Table 1

Control Group Data

	Females (n=4)	Males (n=1)
Age (years)	21-28	21
Height (in.)	64-66	72
Weight (lbs.)	128-195	201
Body Fat (%)	16.3-37	24.2
TC (mg/dl)	130-173	195
HDL (mg/dl)	34-53	36
LDL (mg/dl)	61-101	132
TG (mg/dl)	69-217	101

Data collected for the exercise group revealed ages between 19 and 25 years, height between 61.5 and 72.5 inches, weight from 115 to 162.2 pounds, and percent body fat ranging from 11.3 to 20.2. Results from the blood draw revealed TC levels from 129 to 202, HDL from 36 to 56, LDL from 59 to 140, and TG from 66 to 103 (Table 2).

Table 2

Exercise Group Data

	Females (n=3)	Males (n=2)
Age (years)	23-25	19-20
Height (in.)	61.5-65.2	69.5-72.5
Weight (lbs.)	115-162.2	123.6-148.6
Body Fat (%)	14.5-20.2	11.3-11.6
TC (mg/dl)	140-159	129-202
HDL (mg/dl)	36-45	44-56
LDL (mg/dl)	71-103	59-140
TG (mg/dl)	87-103	66-85

Males Compared to Females

Based on information collected from study participants, the males' ages ranged from 19 to 21, with a mean age of 20 and the females' ages ranged from 21 to 35, with a mean age of 25.7. Height for males was between 69.5 and 72.5 inches, with a mean of 71.3 and weight was between 123.6 and 201 pounds, with a mean of 157.7. Height for females ranged between 61.5 and 66 inches with a mean of 64.1, while weight ranged from 115 to 195 pounds and averaged 152.6. Percent body fat measured between 11.3 and 24.2 for males, averaging 15.7, but ranged between 14.5 and 37 percent for the females, with a mean of 24.3. The total cholesterol (TC) of the males ranged from 129 to 202, with a mean of 175.3, while the females' ranged from 130 to 173 and averaged 153. HDL and LDL for males measured between 36 and 56 and 59 and 140, averaging 45.3 and 110.3, respectively. HDL and LDL for females were between 36 and 53 and 61 and 103, and averaged 42 and 89.1, respectively. TG for males was between 66 and 101, with a mean of 84 and TG for females was between 69 and 217, averaging 113.3 (see Tables 3 and 4).

Table 3

Data for Males

	Control (n=1)	Exercise (n=2)
Age (years)	21	19-20
Height (in.)	72	69.5-72.5
Weight (lbs.)	201	123.6-148.6
Body Fat (%)	24.2	11.3-11.6
TC (mg/dl)	195	129-202
HDL (mg/dl)	36	44-56
LDL (mg/dl)	132	59-140
TG (mg/dl)	101	66-85

Table 4

Data for Females

	Control (n=4)	Exercise (n=3)
Age (years)	21-28	23-25
Height (in.)	64-66	61.5-65.2
Weight (lbs.)	128-195	115-162.2
Body Fat (%)	16.3-37	14.5-20.2
TC (mg/dl)	130-173	140-159
HDL (mg/dl)	34-53	36-45
LDL (mg/dl)	61-101	71-103
TG (mg/dl)	69-217	87-103

Exercise Group Females Compared to Control Group Females

Females in the control group ranged in age from 21 to 35, while those in the exercise group ranged from 23 to 25. Height and weight ranged between 64 and 66 inches and 128 and 195 pounds, respectively, for those in the control group. Those in the exercise group had heights ranging from 61.5 to 65.2 inches and weights ranging from 115 to 162.2 pounds. Females in the control group ranged from 16.3 % to 37 % body fat, while those in the exercise group had between 14.5 and 20.2 % body fat. TC and TG for the control group ranged from 130 to 173 and

69 to 217, respectively, and HDL and LDL ranged between 34 and 53 and 61 and 101, respectively. For the exercise group, TC and TG ranged from 140 to 159 and 87 to 103, respectively, with HDL ranging from 36 to 45 and LDL ranging from 71 to 103 (see Tables 5 and 6).

Table 5

Control Group Data for Females

	Control (n=4)
Age (years)	21-28
Height (in.)	64-66
Weight (lbs.)	128-195
Body Fat (%)	16.3-37
TC (mg/dl)	130-173
HDL (mg/dl)	34-53
LDL (mg/dl)	61-101
TG (mg/dl)	69-217

Table 6

Exercise Group Data forFemales

	Exercise (n=3)
Age (years)	23-25
Height (in.)	61.5-65.2
Weight (lbs.)	115-162.2
Body Fat (%)	14.5-20.2
TC (mg/dl)	140-159
HDL (mg/dl)	36-45
LDL (mg/dl)	71-103
TG (mg/dl)	87-103

Exercise Group Males Compared to Control Group Males

Males in the exercise group had ages ranging from 19 to 20, heights from 69.5 to 72.5 inches, weights from 123.6 to 148.6 pounds, and percent body fat ranging from 11.3 to 11.6. The results from the blood draw for this group showed TC to range from 129 to 202, HDL levels from 44 to 56, LDL levels from 59 to 140, and TG levels from 66 to 85. The male in the control group had the following measurements: age – 21, height – 72 inches, weight – 201 pounds, %BF – 24.2, TC – 195, HDL – 36, LDL – 132, and TG – 101 (see Table 7).

Table 7

Data for Exercise Group Males

	Exercise (n=2)
Age (years)	19-20
Height (in.)	69.5-72.5
Weight (lbs.)	123.6-148.6
Body Fat (%)	11.3-11.6
TC (mg/dl)	129-202
HDL (mg/dl)	44-56
LDL (mg/dl)	59-140
TG (mg/dl)	66-85

Statistical Findings

Control Group Compared to Exercise Group

When t-tests were performed on the data, no significant difference was found between the control group and the exercise group for total cholesterol, high-density lipoprotein, low density lipoprotein, triglycerides, or weight. However, a significant difference was determined to exist for percent body fat.

Table 8

Statistical Significance for Control Group (n=5) versus Exercise Group(n=5)

	P-value
Weight (lbs.)	.09
Body Fat (%)	.01*
TC (mg/dl)	.4
HDL (mg/dl)	.41
LDL (mg/dl)	.48
TG (mg/dl)	.15

*p≤0.05, determining a significant difference

Looking at the graph below (Fig. 1), although there were no significant findings other than percent body fat, it is apparent the exercise group expressed lower averages of weight, percent body fat, TC, LDL, and TG, as well as higher HDL levels. These factors contribute to a healthier profile.

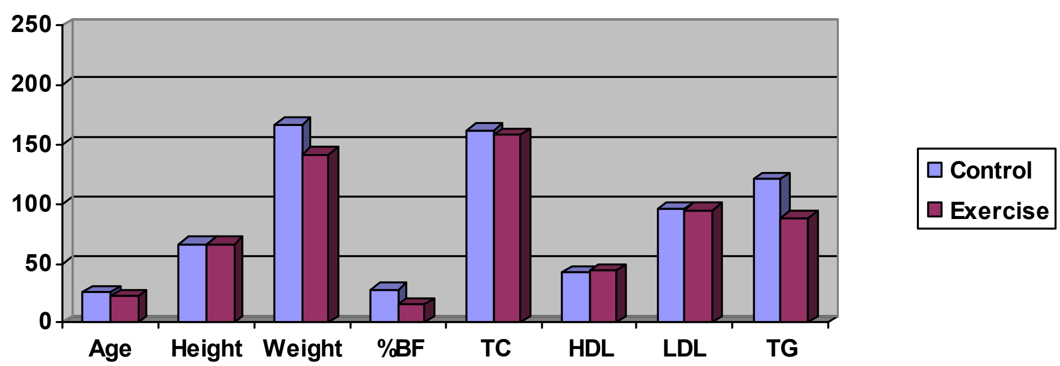

Figure 1. Comparison of Data Averages for Control and Exercise Groups

Exercise Group Males Compared to Exercise Group Females

After statistics were performed on the data collected, it was determined that there were no significant differences between females who reportedly participated in at least two days of resistance training (RT) per week and their male counterparts.

Table 9

Statistical Significance for Exercise Group Males (n=2) and Females (n=3)

	P-value
Weight (lbs.)	.66
Body Fat (%)	.06
TC (mg/dl)	.77
HDL (mg/dl)	.29
LDL (mg/dl)	.88
TG (mg/dl)	.23

*p≤0.05, determining a significant difference

When averages were compared between exercise group males and females (see Fig. 2), data showed males to have higher values for height, TC, HDL, and LDL. Women in this group had higher average values for age, weight, percent body fat, and TG.

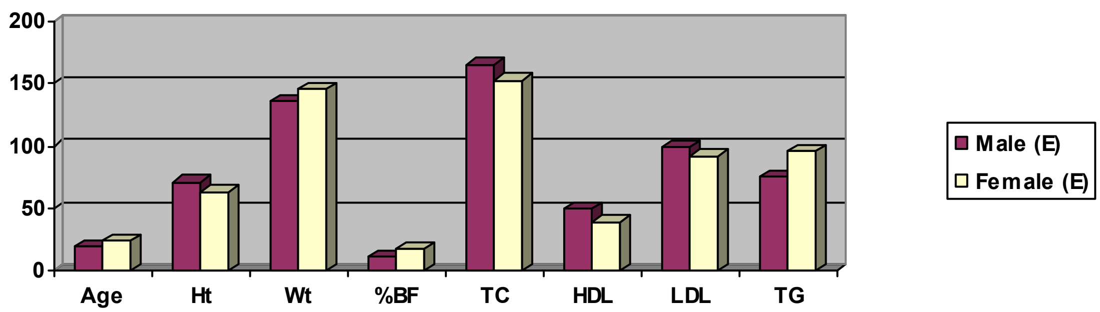

Figure 2. Average Comparisons for Exercise Group Males and Females

After data were compared for males and females of the control group (see Fig. 3), it was visible that females had lower average values for weight, TC, and LDL. They also had higher average values for age, percent body fat, HDL, and TG.

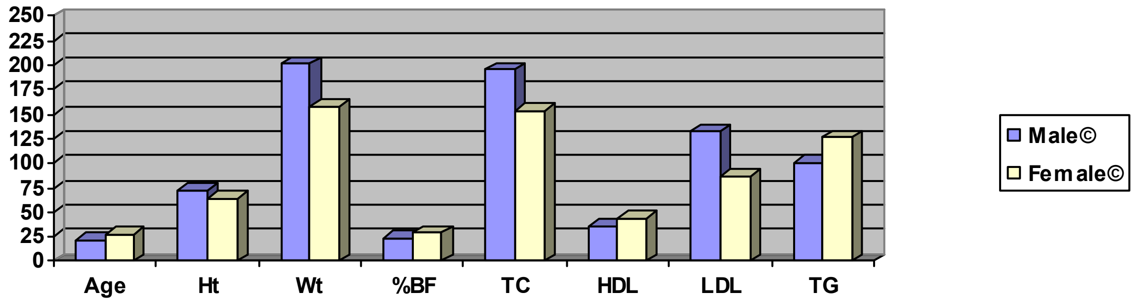

Figure 3. Average Comparisons for Control Group Males and Females

Control Group Females Compared to Exercise Group Females

Analysis of data comparing females from each group, showed females in the exercise group had significantly lower percent body fat values than those in the control group.

Table 10

Statistical Significance for Exercise Group Females (n=4) and Control Group Females(n=3)

	P-value
Weight (lbs.)	.28
Body Fat (%)	.04*
TC (mg/dl)	.46
HDL (mg/dl)	.78
LDL (mg/dl)	.63
TG (mg/dl)	.23

*p≤0.05, determining a significant difference

Although the only significant difference between females of both groups was percent body fat, Figure 4 illustrates the overall benefits of exercise for females. Females in the exercise group had lower mean values for age, height, weight, percent body fat, TC, HDL, and TG. They also exhibited higher average values for LDL.

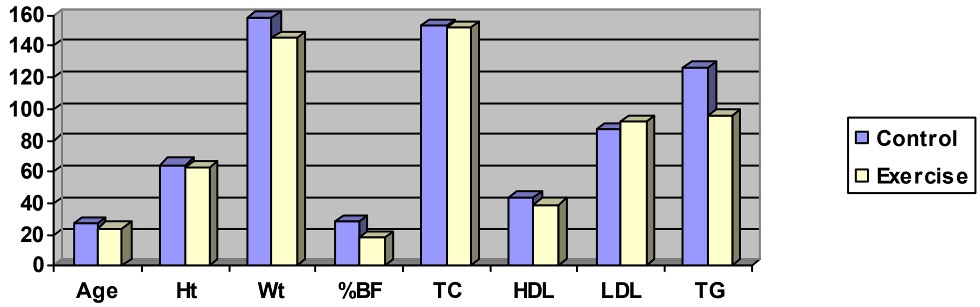

Figure 4. Average Comparisons for Exercise and Control Group Females

Control Group Males Compared to Exercise Group Males

When testing was conducted on data collected comparing males from each group, no significance was found between the two groups.

Table 11

Statistical Significance for Exercise Group Males (n=2) and Control Group Male (n=1)

	P-value
Weight (lbs.)	.60
Body Fat (%)	.48
TC (mg/dl)	1.0
HDL (mg/dl)	.15
LDL (mg/dl)	.64
TG (mg/dl)	.50

*p≤0.05, determining a significant difference

However, when mean values were compared between males of each group, the control group exhibited higher levels for age, height, weight, percent body fat, TC, LDL and TG but lower levels for HDL (see Fig. 5).

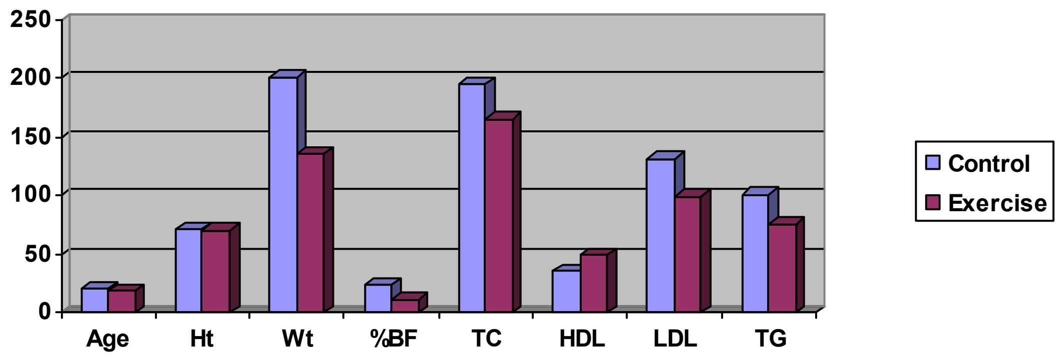

Figure 5. Average Comparisons for Control and Exercise Group Males

CHAPTER 5

DISCUSSION

The primary purpose of this study is to determine the effects of self-reported resistance training on lipid levels associated with cholesterol. This chapter will provide a summary and discussion of results from the study.

Significance of the Study

This study is important because it expands our knowledge of the relationship between resistance training (RT) and lipid profiles. The study is unique because it relies on self-reported data. However, it relates to other studies by focusing on a population of young adults, which is a group determined to be at risk in a study conducted by Sparling et al. (1999).

Relevance of Results

Based on the results from this study, it was determined that the only significant difference between the control and self-reported resistance training groups was a lower percent body fat for those who participated in resistance training at least two days per week. Another significant finding was that women who reported participating in at least two days of resistance training per week had lower percent body fat values than those who did not. These results correspond with those of a study conducted by Prabhakaran et al. (1999).

Results of this study did not indicate a significant effect on lipid profiles relative to reported participation in resistance training; however, a couple factors that may have influenced this. The low number of participants in this study represents a limited sample for testing. Another factor is dietary analysis, which has been found to have impact on lipid profiles, was not taken into consideration as a contributing factor. Another possible flaw in the study is that the information was self-reported; it may be difficult for some participants to recall exactly what types of exercise they perform, which could lead to inaccurate information.

Conclusion

Previous studies investigating the relationships between resistance training and lipid profiles have produced conflicting results. This study, while providing additional insight, did not show any significant relationship between self-reported resistance training and serum lipid levels. The only significant finding discovered in this study was lower percent body fat, which existed between females of the control group and self-reported resistance training group, as well as the control group and self-reported exercise groups as a whole. In order to gain a better understanding of the relationship between resistance training and lipid profiles, further studies need to be conducted on this topic. It is recommended that future studies have a larger number of participants as well as controls for dietary analysis and resistance training programs.

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APPENDICES

Appendix A: Informed Consent Document

East Tennessee State University

Informed Consent

PRINCIPLE INVESTIGATOR: Melissa Davis, ATC-L

TITLE OF PROJECT: An Analysis of the Effect of Resistance Training on Lipid Profiles Based on Self Reported Exercise

This Informed Consent will explain about being a research subject in an experiment. It is important that you read this material carefully to decide if you wish to participate.

PURPOSE: The object of this study is to determine if resistance training has any significant effect of lipid levels related to risk factors for CVD, compared to sedentary subject. Based on self-reported training participation, a blood sample will be taken, and a basic cholesterol screen will be performed, comparing your results to those of the opposite group.

DURATION: The study will require that you attend only one scheduled testing session.

PROCEDURES:

Visit 1 – Recruitment, Consent and Survey

Potential participants will be recruited at the Center for Physical Activity (CPA) and the Culp Center on the main campus of East Tennessee State University (ETSU). Upon showing interest in the study, potential participants will be given a copy of the Informed Consent and the recruiter(s) will answer any relevant questions potential participants may have. Once a potential participant has decided to be a member of a study group and signed the Informed Consent, he will be asked to complete a series of surveys, so that relevant study information may be obtained. Surveys will include a personal information sheet, a cardiovascular and health history form, a physical activity questionnaire, and a resistance training questionnaire.

Visit 2 – Testing

Participants will be asked to report to the Human Performance Lab located on the first floor on the East side of the Mini-Dome during morning hours (approximately 7-10 AM) following an overnight fast (date to be determined). Upon arrival, participants will be verified and checked off and several measurements will be taken. Height will be measured using a medical quality height scale, and weight will be measured on a research quality digital scale. Body composition (or percent body fat) will be determined via Bioelectrical Impedance Analysis (BIA) or a four-site skin-fold test using calipers. (Bioelectrical impedance measures the resistance of current through the body; a very low 1.5 volt current is passed through two sets of electrodes and the resistance to electrical flow is measured. Fat mass, fat-free mass and percent body fat will be determined by resistance, reactance and impedance. Using the calipers, measurement will be taken by measuring pinched skin-fold at predetermined sites, and percent body fat will be calculated using a generalized body composition equation. All data will be recorded on the participants' data sheet.

After these measurements have been recorded, participants will have their blood drawn by, Vickie Davis (MT), a certified / licensed phlebotomist, medical lab technologist or medical technologist. A minimal amount of blood (approximately 7 mL) will be drawn from the participants' arm via a 23 or 21 gauge syringe. The tube will be labeled and taken to the laboratory at Clinch Valley Medical Center where a basic lipid profile will be conducted.

POSSIBLE RISKS / DISCOMFORTS: The procedure is not a high risk procedure; those involved may experience mild discomfort with the skin-fold calipers or the BIA. Also, during the blood draw, the potential will exist for mild pain or bleeding, bruising or infection, as well as fainting, due to the overnight fast. However, we will attempt to keep this to a minimum by using experienced and knowledgeable lab technicians.

POSSIBLE BENEFITS: Participants will receive free body composition analysis, nutrition analysis and cholesterol screening.

CONTACT FOR QUESTIONS: If you have any questions, concerns or research-related medical problems at any time, you may contact Melissa Davis at 423-652-9372 or melissa_os@hotmail.com . You may also contact the Chairman of the Institutional Review Board at 423-439-6055 for any questions you may have about your rights as a research participant.

CONFIDENTIALITY: Every attempt will be made to see that the study results are kept confidential. A copy of the records from this study will be stored in the Physical Education Department Human Performance Lab located in the Memorial Center for a t least 10 years after the end of this research. The results of this study may be published and/or presented at meetings without naming a subject. Although your rights and privacy will be maintained, the Secretary of the Department of Health and Human Services, The East Tennessee State University/V.A. Medical Center Institutional Review Board, the
Food and Drug Administration and the East Tennessee State University Department of Physical Education have access to these records. All records will be kept completely confidential according to current legal requirements. Records will not be revealed unless required by law or as noted above.

COMPENSATION FOR MEDICAL TREATMENT: East Tennessee State University will pay for the cost of any emergency first aid for any injury which may happen as a result of your being in this study. They will not pay for any other medical treatment. Claims against ETSU or any of

its agents or employees may be submitted to the Tennessee Claims Commission. These claims will be settled to the extent allowable as provided under TCA Section 9-8-307. For more information about claims, call the Chairman of the IRB of ETSU at 423-439-6055.
VOLUNTARY PARTICIPATION: The nature, demands, risks and benefits of the study have been explained to me as well as are known and available. I understand what my participation involves. Furthermore, I understand that I am free to ask any questions and withdraw from the study at any time without penalty. I have read, or have had read to me, and fully understand the consent form. I sign it free and voluntarily. A signed copy has been given to me.

Your study record will be maintained in the strictest confidence according to current legal requirements and will not be revealed unless required by law or as noted above.

SIGNATURE OF VOLUNTEER DATE

SIGNATURE OF PARENT/GUARDIAN (IF APPLICABLE) DATE

SIGNATURE OF INVESTIGATOR OR DESIGNATE DATE

SIGNATURE OF WITNESS DATE

Appendix B: Cholesterol Lowering Medications

Generic Name	**Brand Name**
Lipitor	Atorvastatin
Lescol	Fluvastatin
Mevacor	Lovastatin
Pravacol	Pravastatin
Crestor	Rosuvastatin
Zocor	Simvastatin
Questran	Cholestyramine
Colestid	Colestipol
Welchol	Colesevelam
Tricor	Fenofibrate
Lopid	Gemfibrozil

Appendix C: Diabetes Medications

Generic Name	**Brand Name**
Metformin HCL	Glucophage
Pioglitizone	Actos
Rosiglitizone	Avandia
Chlorpropamide	Diabinese
Gliclazide	Diamicron
Glimepiride	Amaryl
Glipizide	Glucotrol
Glyburide	Diabeta, Glynase, Micronase
Tolazamide	Tolinase
Tolbutamide	Orinase
Acarbose	Precose
Miglitol	Glyset
Replaglinide	Prandin
Nateglinide	Starlix
insulin aspart	Novolog, NovoRapid
insulin lispro	Humalog
insulin glargine	Lantus
insulin	Humulin, Iletin, Novolin, Velosulin, Regular, Actrapid, NPH(N), Insultard, Lente (L), UltraLente(U)
Avandia/Metformin	Avandamet
Metformin/Glyburide	Glucovance
Metformin/glipizide	Metaglip
Aminophylline	
	Amprenavir, Alpha-interferon
Asparaginase	Elspar
Chlorpromazine	Thorazine

Generic Name	Brand Name
Calcitonin	Calcimar
Cyclophosphamide	Cytoxan
Diltiazem	Cardizem
Diazoxide	Hyperstat
Didanosine	Videx
Ethacrynic acid	Edecrin
Furosemide	Lasix
Haloperidol	Haldol
Indinavir	Crixivan
Indomethacin	Indocin
Isoniazid	
Levodopa	
Lithium	Eskalith
Morphine	MSContin
Methyldopa	
Megestrol acetate	Megace
Nelfinavir	Viracept
Phenytoin	Dilantin
Pentamidine	Pentam
Ritonavir	Norvir
Saquinavir	Fortovase
Theophylline	Theo-Dur
Thiazides	HCTZ

APPENDIX D: Flyer for Participants

YOUNG ADULTS NEEDED FOR CHOLESTEROL STUDY

TITLE: A Study of the Relationship of Self-Reported Resistance Training on Lipid Profiles

Study directed by Melissa Davis, ATC-L

Department of Physical Education Exercise and Sport Sciences
East Tennessee State University

Purpose: To determine the relationship of self-reported resistance training on lipid profiles.

Requirements to participate:

- No regular exercise in the last 6 months (control group)
- Lift weights at least 2 days per week (exercise group)
- Age 18 or older
- Currently enrolled in a college or university
- Not taking cholesterol lowering medication
- Not taking diabetes medications
- Not taking supplements for weight gain or weight loss
- Does not have diabetes or high blood sugar
- Does not have history of heart disease

Study participants receive:

- Free cholesterol report
- Body fat analysis

CONTACT:
Melissa Davis, ATC-L
423-878-2104 OR 276-623-5926

APPENDIX E: Personal Information and Health History

DEPARTMENT OF PHYSICAL EDUCATION, EXERRCISE AND SPORT SCIENCES
EAST TENNESSEE STATE UNIVERSITY,
JOHNSON CITY, TN 37604

APPLYING FOR (PLEASE CHECK ONE): _____ EXERCISE GROUP

_____ CONTROL GROUP

PERSONAL INFORMATION

NAME: ________________________________
Last First MI

BEST PLACE TO CONTACT:
EMAIL:____________________________
PHONE:____________________________

INSTITUTION ATTENDING: ________________________ □

RACE:
___ White
___ African American
___ Asian or Pacific Islander
___ Hispanic or Latin American
___ Native American
___ Other

CARDIOVASCULAR HEALTH HISTORY

A. If any members of your immediate family have or have had any of the following conditions, indicate their age at the time of the event.

	Father	Mother	Brother(s)	Sister(s)
Heart Attack	_____yr	_____yr	_____yr	_____yr
Stroke	_____yr	_____yr	_____yr	_____yr
Coronary Artery Disease	_____yr	_____yr	_____yr	_____yr
If deceased, age at death	_____yr	_____yr	_____yr	_____yr

B. Indicate if any members of your immediate family have or have had the following conditions by marking the appropriate lines.

	Father	Mother	Brother(s)	Sister(s)
High Blood Pressure	______yr	______yr	______yr	______yr
High Cholesterol	______yr	______yr	______yr	______yr
Diabetes	______yr	______yr	______yr	______yr
Obesity	______yr	______yr	______yr	______yr

STUDY CONDUCTED BY: Melissa Davis, ATC-L

APPENDIX F: Physical Activity Questionnaire

DATE:_____/_____/_____

NAME:______________________________ ID NUMBER: ______________

PHYSICAL ACTIVITY QUESTIONNAIRE

Please indicate your usual activities

	Sessions per Week (circle best number)	Time	per Sessoin
Baseball/Softball	1 2 3 4 5 6 7	______Hours	______Minutes
Basketball	1 2 3 4 5 6 7	______Hours	______Minutes
Bowling	1 2 3 4 5 6 7	______Hours	______Minutes
Cycling (road)	1 2 3 4 5 6 7	______Hours	______Minutes
Cycling (stationary)	1 2 3 4 5 6 7	______Hours	______Minutes
Dancing (aerobic)	1 2 3 4 5 6 7	______Hours	______Minutes
Eliptical trainer	1 2 3 4 5 6 7	______Hours	______Minutes
Football	1 2 3 4 5 6 7	______Hours	______Minutes
Golf (ride)	1 2 3 4 5 6 7	______Hours	______Minutes
Golf (walk)	1 2 3 4 5 6 7	______Hours	______Minutes
Gymnastics	1 2 3 4 5 6 7	______Hours	______Minutes
Handball	1 2 3 4 5 6 7	______Hours	______Minutes
Hiking	1 2 3 4 5 6 7	______Hours	______Minutes
Horseback Riding	1 2 3 4 5 6 7	______Hours	______Minutes
Indoor treadmill	1 2 3 4 5 6 7	______Hours	______Minutes
Jogging/Running	1 2 3 4 5 6 7	______Hours	______Minutes
Martial Arts	1 2 3 4 5 6 7	______Hours	______Minutes
Racquetball	1 2 3 4 5 6 7	______Hours	______Minutes
Rope jumping	1 2 3 4 5 6 7	______Hours	______Minutes
Rower (fitness center)	1 2 3 4 5 6 7	______Hours	______Minutes
Rowing/Canoeing	1 2 3 4 5 6 7	______Hours	______Minutes
Soccer	1 2 3 4 5 6 7	______Hours	______Minutes
Stepper (fitness center)	1 2 3 4 5 6 7	______Hours	______Minutes
Swimming	1 2 3 4 5 6 7	______Hours	______Minutes
Tennis	1 2 3 4 5 6 7	______Hours	______Minutes

Volleyball	1 2 3 4 5 6 7	______Hours	______Minutes
Walking	1 2 3 4 5 6 7	______Hours	______Minutes
Yardwork/Gardening	1 2 3 4 5 6 7	______Hours	______Minutes
Other	1 2 3 4 5 6 7	______Hours	______Minutes
Other	1 2 3 4 5 6 7	______Hours	______Minutes

APPENDIX G: Resistance Training Questionnaire

DATE: _____/_____/_____

NAME: ________________________________ **ID#:______________**

RESISTANCE TRAINING QUESTIONNNAIRE

How many days per week do you lift weights? _____days per week

How many sets of each exercise do you complete during each workout? ______ sets

How many reps do you complete for each set? ______reps

I intentionally vary my workouts from day to day, week to week or month to month.

_____ yes ______no

I use circuit training for most of my workouts. ______yes ______no

Do you alternate upper body and lower body workouts? _____yes _____no

Please complete the resistance training chart on the next page.

	MON		TUES		WED		THURS		FRI		SAT		SUN	
EXERCISES	S	R	S	R	S	R	S	R	S	R	S	R	S	R
CHEST														
BENCH														
INCLINE BENCH														
MACHINE BENCH														
DUMBBELL BENCH														
DUMBBELL INCLINE														
DUMBBELL CHEST FLY														
MACHINE CHEST FLY														
DECLINE BENCH PRESS														
DUMBBELL DECLINE BENCH														
CABLE CROSSOVER FLY														
CLOSE GRIP BENCH														
SHOULDERS / ARMS														
MILITARY PRESS														
DUMBBELL MILITARY PRESS														
MACHINE SHOULDER PRESS														
DUMBBELL LATERAL RAISE														
DUMBBELL FRONT RAISE														
SHOULDER SHRUGS														
POWER SHRUGS														
STANDING SHOULDER PRESS														
BEHIND NECK PRESS														
DIPS														
WEIGHTED DIPS														
WIDE GRIP PULL UP														
CLOSE GRIP PULL UP														
STRAIGHT BAR CURL														
PREACHER CURL														
DUMBBELL BICEP CURL														
MACHINE BICEP CURL														
E-Z BAR CURL														
TRICEP PUSHDOWN														
TRICEP EXTENSION														
FRENCH CURL														
MACHINE TRICIP EXTENSION														

	MON		TUES		WED		THURS		FRI		SAT		SUN	
EXERCISES	S	R	S	R	S	R	S	R	S	R	S	R	S	R
SHOULDERS / ARMS CONTINUED														
DUMBBELL TRICEP EXTENSION														
WRIST CURLS														
REVERSE WRIST CURLS														
FOREARM CURLS														
JAM PRESS OR PUSH UPS														
DUMBBELL BENT OVER RAISE														
UPRIGHT ROW														
MACHINE UPRIGHT ROW														
BACK AND NECK														
WIDE GRIP PULLDOWN														
LAT PULLDOWN														
CLOSE GRIP LAT PULL														
BENT-OVER ROW														
BACK EXTENSIONS														
LOW BACK MACHINE														
BENT ARM PULLOVER														
1 ARM DUMBBELL ROW														
MACHINE PULLOVER														
LOW CABLE ROW														
STIFF LEG DEAD LIFT														
DEAD LIFT														
NECK MACHINE														
MANUAL RESISTANCE NECK														
ABS														
WEIGHTED SIT UP														
WIEGHTED CRUNCHES														
CRUNCHES														
ABDOMINAL MACHINE														
SIT UPS														
TRUNK TWISTS														
DUMBBELL SIDE BEND														
ROTARY TORSO MACHINE														

	MON		TUES		WED		THURS		FRI		SAT		SUN	
EXERCISES	S	R	S	R	S	R	S	R	S	R	S	R	S	R
LEGS														
PARALLEL SQUAT														
FRONT SQUAT														
LEG PRESS														
MACHINE LEG PRESS														
BARBELL LUNGE														
LEG EXTENSION														
LEG CURL														
HIP FLEXOR														
HIP EXTENSOR														
HEEL RAISE														
TOE PRESS														
STANDING CALF RAISE														
SEATED CALF RAISE														
MACHINE HIP ADDUCTION														
MACHINE HIP ABDUCTION														
SNATCH SQUAT														
PUSH PRESS														
POWER CLEAN														
GOOD MORNINGS														
SNATCH														
JAMMER PRESS														
RACK CLEAN														
POWER PRESS														
HANG CLEAN														
SNATCH SQUAT														

VITA

Melissa A. Davis

Personal Data:	Date of Birth: January 15, 1980 Place of Birth: Richlands, Virginia Marital Status: Single
Education:	Public Schools, Richlands, Virginia Emory & Henry College, Emory, Virginia; Physical Education, B.S., 2002 East Tennessee State University, Johnson City, Tennessee; Physical Education, M.A., 2005
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Publications:	None
Honors and Awards:	None