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Tyler Sorensen
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THE PLANT BASED DIET:

INCREASING OVERALL HEALTH THROUGH SIMPLE DIET

By:

Tyler Sorensen

AN UNDERGRADUATE THESIS

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Abstract

This project, conducted under the guidance of the University of Nebraska-Lincoln, was carried out in order to investigate how eating a plant-based diet rich in fruits, vegetables, grains, and legumes, a diet that has been proven to prevent and reverse heart disease, will affect the lipid levels and overall heath of a younger person not showing signs of heart disease. In addition, this project aims to validate the implications of consuming processed oils on a regular basis and to increase overall awareness of the foods that we consume by advocating for a healthier overall way of life for the human population and the environment. This is a very important and pertinent issue that currently distresses many Americans and affects not only adults, but also children in schools and playgrounds across the country. There is sufficient evidence surfacing across the medical community stating that coronary artery disease, obesity, high blood pressure, heart attacks, and other conditions and diseases that are running rampant across America can be slowed or even completely reversed with a simple change in diet. No pills, no shots, just food. The following program goes into detail providing evidence for these claims and advocates for a healthier and more informed nation and lifestyle.

Introduction

"Coronary artery disease need not exist, and if it does, it need not progress". (Esselstyn, 2008, pg. 3) These are strong words pertaining to a disease that kills half a million United States citizens every year and is the number one cause of death in western civilizations (Esselstyn 2008). So, why does this disease still persist and what can we do to change it? The answer that is slowly beginning to percolate throughout the medical community is simple and life changing, eat a whole food plant-based diet where consumption of animal products is completely eliminated.

This project aims to further this evidence through the completion of a dietary program that has been devised from the previous work of two specific American doctors. The primary purpose of this project is to investigate how eating a plant-based diet, proven to prevent and reverse heart disease, will affect the lipid levels and the overall health of a younger person not showing signs of heart disease. The findings could validate the implications of consuming processed oils on a regular basis and increase overall awareness of the foods that we consume by advocating for a healthier overall lifestyle for the human population and the environment.

This project is important because eating a western diet rich in fried and fast foods is slowly making chronic diseases like heart disease, hypertension, diabetes, and obesity a younger persons disease. Today anyone can walk into virtually any western elementary school and find evidence of this trend. Also, it is important because a plant-based diet increases environmental health by cutting back on meat, poultry, and dairy production and shipping. According to a 2006 report by the United Nations Food and Agriculture Organization (FAO), livestock contribute to

18% of the world's anthropogenic greenhouse gas emissions (FAO 2006). This number seems extremely high, but through a complicated and detailed analysis it accounts for emissions that are tied to every aspect of production and shipping. Also, worldwide meat consumption is on the rise and will likely lead to an increase of its share of the 18% of emissions (U.S. Census Bureau).

The reason that I have so much interest in human health and the reason for testing the diet out on myself in the first place was due to my family history. On my fathers side of the family, heart disease and chronic heart problems are unfortunately rather extensive. My grandfather, whom I never met, passed away due to a heart attack. My grandmother passed away after suffering 3 heart attacks and I have many family members on that side of the family that are overweight. This all adds up to one potentially fatal outcome for me. However, I am going to be the first to take stand against this chronic disease that plagues my family, fight back, and avoid it all together. In the process I intend to learn a great deal about healthy dietary alternatives so that I may increase the overall awareness of my peers and community.

I hypothesize that over the course of six months, following this dietary program will lower total cholesterol below 150 mg/dL, lower low-density lipoproteins below 80 mg/dL, and cholesterol will fluctuate in accordance with oil intake (use and non-use). This could drastically reduce and even eliminate the risk of heart disease.

Literature Review

The primary literary sources used to support the thesis hypothesis and the inspiration for conducting this project were the books Prevent and Reverse Heart Disease by Dr. Caldwell Esselstyn Jr. M.D. and The China Study by Dr. T. Colin Campbell PhD. These are highly respected experts in their fields conducting research that could eventually change the way that we look at diseases and medicine in general. Some have shunned them in their findings, but when you look at the research and results, it is hard to argue against what they are advocating for.

Dr. Esselstyn is a world-renowned heart disease specialist, surgeon, and chairman of the breast cancer task force at the Cleveland Clinic in Ohio. The Cleveland Clinic is widely recognized as one of the best heart clinics in the world. Therefore, he is a chairman of the one of the most prestigious heart institutes in the world, so I feel that what he says should be taken seriously.

Dr. T. Colin Campbell is the Jacob Gould Schurman Professor Emeritus of Nutritional Biochemistry at Cornell University. He has more than seventy grant-years of peer-reviewed research funding and has authored more than 300 research papers dealing with nutrition and other facets of medicine (T. Colin Campbell Foundation). In addition, he also wrote The China Study, which is currently known as the most comprehensive study on nutrition ever conducted (Campbell 2006).

I was hooked by a quote that he says in the first page of the first chapter of Dr. Esselstyn's book. It reads, "My message is clear and absolute: coronary artery disease need not exist, and if it does, it need not progress." There is much to be done with coronary artery disease, and I feel there must be a way to prevent it from ever

occurring. While Dr. Esselstyn's book focuses on prevention and reversal it does not talk much about prevention from an early age. So, I decided to conduct this program on myself to find out just what would happen if a younger, healthy, person tried the diet.

In 1985 Dr. Esselstyn took 23 voluntary patients that were suffering from multiple chronic diseases including: heart disease, angina, type 1 and 2 diabetes, and the list goes on. Most had been advised to have, or already had heart surgery like bypass, stents, etc. He gives one patient example where her original physician told her to go find a rocking chair and find peace in waiting for death. This demonstrates the horrible conditions of the patients. Dr. Esselstyn put these 23 patients on his diet plan and over a period of years their heart problems were slowed and in most cases reversed (Esselstyn 2008). This furthers the evidence that healthy eating habits, where animal proteins are eliminated can prevent or even reverse these diseases.

Materials and Methods

Two test subjects, myself plus another, strictly adhered to the following dietary program for 6 months (November 18, 2011-May 18, 2012). The program consisted of consuming a plant-based diet and observing and recording the changes both positive and negative that were found. The details to the program are as follows:

Dietary Guidelines:

Foods that were not permitted for consumption

1. Anything with a face or a mother (meat, poultry, fish)
2. Dairy Products
3. Oils (even extra virgin olive oil)
4. Refined Grains
5. Nuts

Foods that were permitted for consumption:

1. Vegetables (avocados were to be eaten in moderation due to a high fat content)
2. Legumes
3. Whole Grains
4. Fruit (less than 4 servings/day due to sugar content)
5. Beverages (juices were kept to a low daily level due to high sugar levels and coffee, tea, and alcohol were consumed in moderation)

Oils were to be eaten on a monthly rotation that consisted of one month where absolutely no oils were consumed, followed by the next month in which oil was permitted. In this program when oils were eliminated there was no room for moderation, not even the slightest bit for greasing a pan. The following month oils were consumed as they normally would be to cook with, dip bread in, etc. This cycle of a month on oils followed by a month off of oils was strictly adhered to for the duration of the project to see if it caused a fluctuation in lipid levels. This made a total of 3 months consuming oil and 3 months in which oil was completely avoided.

The process began with a pre-diet blood test that measured total cholesterol levels, high-density lipoproteins (HDL), low-density lipoproteins (LDL), and triglycerides. There were also pre-diet body tests including total body weight, body mass index (BMI), and total body fat content. The blood tests were conducted on a regular basis throughout the program. A pre-diet test was followed by a two-week test, a four-week test, and then a test every month there after for the duration of the project. A post-diet test was conducted upon completion of the six-month trial. The rationale for having 3 blood tests in the first month and only one test in each of the following five months was because research professionals indicated that the most dramatic and drastic drops in cholesterol levels would happen somewhere within that first month (Carr 2011). Since weight and body fat does not fluctuate rapidly, rather than weekly body tests, pre-, monthly, and post-diet body tests were conducted. Also, weight and fat loss were not the focus or goal of the program, they were just an anticipated overall benefit.

The target rates for the blood tests were below 150 mg/dL for total cholesterol and below 80 mg/dL for low-density lipoproteins. These standards are lower than the USDA's national standards or guidelines, but these targets were picked because most nutritional doctors typically see them as the appropriate and safest levels of cholesterol (Esselstyn 2008). A target level was not set for high-density lipoproteins because they are the "good" cholesterol and they were not expected to become dangerously low or high. Also, a target goal was not set for triglycerides because they are essentially, in basic terms, excess calories stored in fat cells that are released, as your body needs them. When calorie intake is higher than expenditure the triglycerides can build up and cause plaque accumulation. Since both participants exercised regularly and had a fast paced lifestyles, I did not for see them building up. I do want to point out that although high-density lipoproteins and triglycerides have no specific target ranges set, their levels were still recorded throughout the diet for analysis at the end of the project.

To analyze the cholesterol, triglycerides, High-Density lipoprotein (HDL), and Low-Density Lipoprotein (LDL), blood tests were taken at the University of Nebraska-Lincoln Health Center through the lab and under the supervision of the lab director. Food was not allowed to be eaten for at least 12 hours before each blood test to ensure that the food would not falsify the lipid level results. The body testing (BMI, body fat percentage, and total body weight) was taken through the University of Nebraska-Lincoln under the supervision of Dr. Shinya Takahashi, an assistant professor of practice in the nutrition and health sciences department. For both subjects (male and female) BMI and weight were calculated through an

electronic scale that measures height and weight and automatically displays the BMI. For both subjects the body fat percentage was calculated by first measuring the body index and then converting that number into body fat percentage by way of a standard formula (See Appendix: A). For the male, body index was found by using the standard Three-Site Formula for men, which measures the chest, abdomen, and thigh with a caliper in millimeters (See Appendix: A). For the female, the Standard Three-Site Formula for women was used, which measures the tricep, suprailiac, and thigh again with a caliper in millimeters (See Appendix: A). Each site was measured with the caliper three times per test and those numbers were averaged to make one consistent number. After the six-month trial all of the data was entered and analyzed using Microsoft excel.

Results

For the male participant, the total change in cholesterol was 205 mg/dL down to 148 mg/dL for a total drop of 57 mg/dL (graph: A, table: 2). The total change in Low-Density Lipoprotein (LDL) was 140 mg/dL to 80 mg/dL for a total drop of 60 mg/dL (table: 2). Total change in body weight was 175.8 lbs to 159.2 lbs for a total weight loss of 16.6 lbs. (graph: C, table: 1) and total change in body fat percentage was 12.83% to 10.35% for a total of 2.48% loss of body fat (graph: B, table: 1).

For the female participant the total change in cholesterol was 176 mg/dL down to 161 mg/dL for a total drop of 15 mg/dL (graph: A, table: 2). The total change in Low-Density Lipoprotein (LDL) was 75 mg/dL to 57 mg/dL for a total of 18 mg/dL (table: 2). Total body weight loss was 119 lbs to 117.4 lbs for a total loss of 1.6 lbs (graph: C, table: 1) and total change in body fat percentage was 21.55% down to 20.47% for a total of 1.08% (graph: B, table: 1).

There are a few limitations of the project that need to be addressed at this point. First, there were only two test subjects, which does not meet the criteria for statistical significance. It would have been a good idea to test muscle mass as well to prove that the participants were not loosing body weight due to muscle loss, which would also help prove that it is perfectly healthy to eat this diet and that it is still possible to get sufficient amounts of protein, which is the number one skepticism of this diet. Also, the study was only conducted for 6 months; therefore it is not long enough to really convey true statistics. This type of study is one that should be carried out over a period of years or decades not months. However, I do feel that in

those short six months that the data generated was beginning to form a pattern and yield some very accurate and optimistic results.

Discussion

The hypothesis stated that if this program were followed properly for a duration of 6 months that total cholesterol would fall below 150 mg/dL, low-density lipoproteins would fall below 80 mg/dL, and cholesterol would fluctuate in accordance with oil intake (use and non-use). Also, if this happened, that there would be no sign of heart disease or heart related problems. Both the male and female participants met all of those goals except for the female participant's cholesterol level, which was at 161 mg/dL at the end of six months. Although that does not meet the hypothesized goal it is still a very healthy cholesterol level. Therefore, post completion of this project and after reviewing the data I feel that the diet was effective. This is especially true for the male subject.

Overall, the male subject fluctuated much more and had much more dramatic drops in all categories. For example, the male dropped 16.6 lbs (9.4% of total weight) and the female only dropped 1.6 lbs (1.3% of total weight). The male and female cholesterol beginning and endpoints were close together, but if you look at fluctuations from month to month it can be noted that the male's cholesterol dropped much more extensively through the middle months and crept back up at the end. Triglycerides and HDL (High-Density Lipoprotein) were all over the board and after extensive research there was no reasoning found for this except that triglycerides can fluctuate greatly with food intake.

When it comes to the results for oil consumption and its affect on lipid level fluctuation the results are optimistic, but this is the one area where the evidence was not sufficient enough to say whether oil consumption affected lipid level

fluctuation for sure. Some of the months the hypothesis held true, but then lipid levels would shift in an unpredictable manner. For the male the cholesterol level fluctuated down when off of oil and up when consuming oils as predicted four out of the six months and for the female participant five out of the six months. So, the results were good and showed a trend of oil consumption affecting lipid levels, but some of the changes were very slight, fluctuating only a few mg/dL.

Another indirect purpose of this study was to increase awareness of the food we eat in the community and as a by-product this educational aspect ended up really coming to the forefront of the experience. This project is responsible for changing the way that at least 10 friends and family members eat and perceive food. It is not always about convincing someone to change eating habits, but rather presenting the facts from the literature and from this project and then allowing them to make an informed decision. I have been able to successfully pass on information about eating in a healthy manner, and also to look at food as fuel and not as a stimulant or guilty pleasure. I have been able show people in the community that you should be aware of what you put into your body and that sometimes those in charge of setting national health mandates and standards do not always set high enough standards or have the general population in their best interest. This is simply due to conflict of interest. For example, the USDA is responsible for setting healthy dietary standards for the general population, but they also at head up agricultural development and promotion.

Based on the results from this project, eating a plant-based diet increases health and can reduce the chance of disease by eliminating harmful proteins and

cholesterol from the body. The subject's weight, cholesterol, body fat percentage, and BMI levels were all reduced over the sixth month period of the program, all of which are key players in the formation of coronary artery disease, high blood pressure, hypertension, and even cancer. Therefore, I conclude that a person who chooses to eat a plant-based diet will have greatly reduced chances of developing these diseases. The drastic change in the male's cholesterol from 205 mg/dL to 128 mg/dL in the first month also demonstrates the potential to slow or reverse these symptoms through consumption of a plant-based diet.

Conclusion

This has been a life changing experience, not only physically, but mentally and spiritually as well. Not only has it changed the way that I eat and the way that I view food, but it has increased my quality of life and introduced me to a new group of peers in the community that also care about what they consume and put into their bodies. We are part of an ever-growing movement that is committed to increasing the health of everyone young and old by way of food. There is a shift taking place and most people are unaware. Food is now being grown at home or by small, organic, family owned farms that promote bio-diversity and poly-cultures instead of industrial, genetically modified, monoculture farms that eliminate bio-diversity. There is a growing trend of farmers markets that can be found seven days a week and restaurants that use fresh, whole, local ingredients from local organic farms. They create relationships with each other and let the seasons and freshness of the crops dictate the menu. In these times of economic doubt, industrialization, urban sprawl, and the disease brought on by uninformed eating habits, we need to look to the past in order to take a step forward as a community as we look into the future. It is not too late to reverse the tragic atrocities that are happening to children and people of all ages across the country.

"Let food be thy medicine and medicine be thy food" -Hippocrates 432 B.C. If this ideology can stand the test of time and maintain support from medical experts, it must contain truth. But the concept of food has been lost and diluted over the years to the point that most people are eating nothing but prepackaged meals and fast food. This is a direct way to an early grave. It is unfortunate that most of these

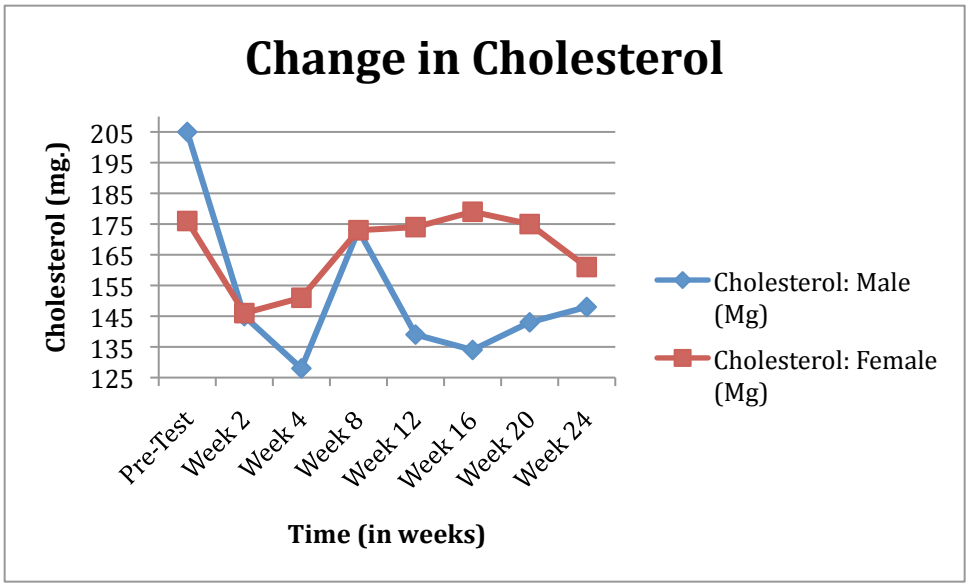
eating habits are due to false information, lack of education, inexpensive cost, convenience, and the media telling people 24 hours a day that prepackaged food and fast food is what they need. Through my experience with this project I have become a believer that a lot of chronic diseases and problems can be healed and reversed by eating a plant-based diet.

I would like to take this time to thank my thesis advisor Dr. Timothy Carr for taking time out of his busy schedule to aid me in conducting my thesis. I would also like to thank Dr. Shinya Takahashi for his assistance in collection of data for the body tests (total weight, BMI, Total body fat). Finally, a thank you to my thesis reader Norbert Belz for his help in the editing process. I am very gracious for all of their contributions to my thesis program and I would like to acknowledge their intense and extensive assistance. I would also like to thank you for taking the time to read and assess my undergraduate thesis conducted under the guidance of the University of Nebraska-Lincoln. I hope that through this process you can start the progression of enlightenment and begin to understand the importance of this program and to see the overall good that I intend to put into action through it. In my opinion we are collectively going down the wrong path in many aspects of medicine. We no longer look to the root of the problem and practice preventive medicine, but instead look for a cure that treats only symptoms. The current approach will not have a positive outcome for the overall health of the human population and the environment. But, we can change that if we unite around the cause of greater well-being and inform others so that future generations will have the voice and the information to make informed decisions.

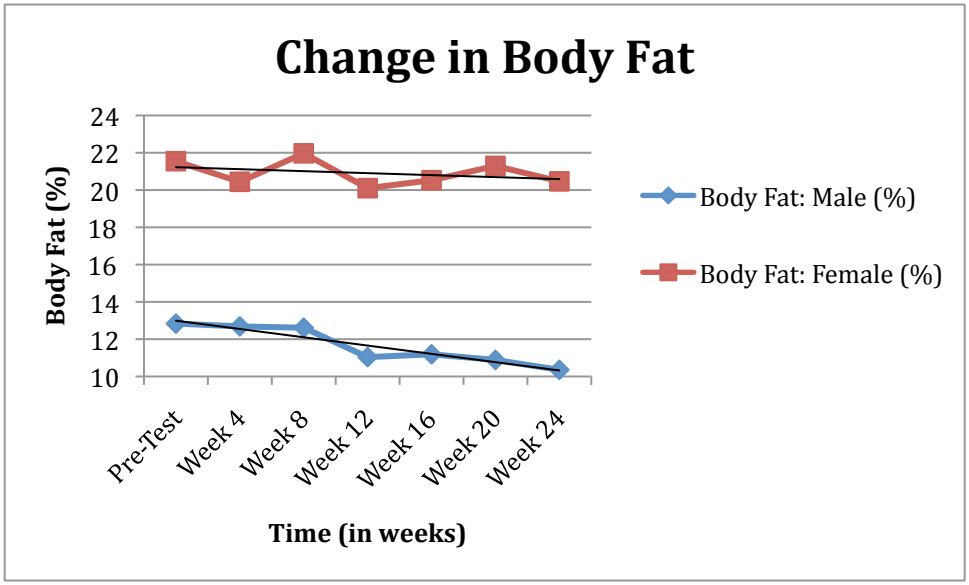
Appendix: A

Description of standards and calculations used for body measurements.

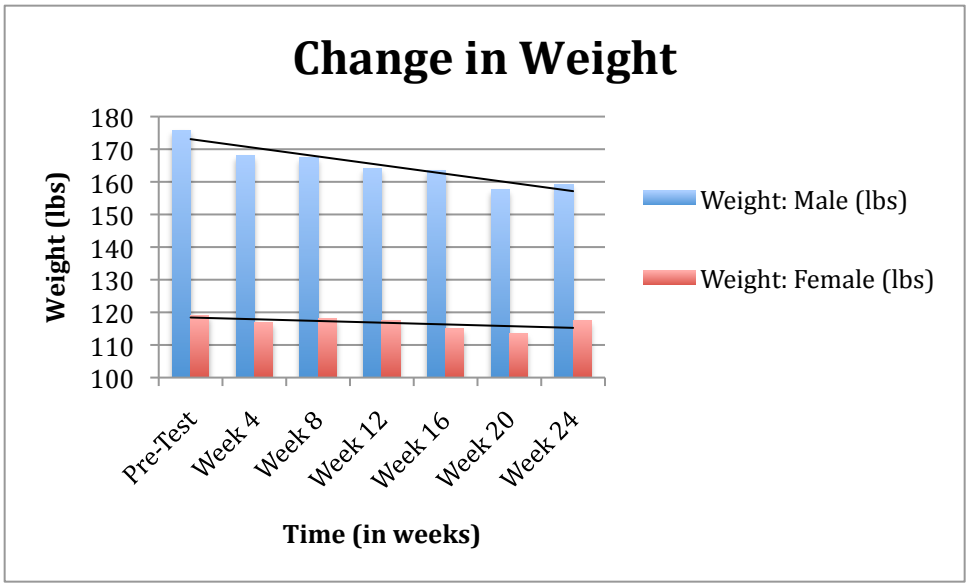
1. Male Body Density: Three-Site Formula (chest, abdomen, thigh)
    - Body Density=1.10938-0.0008267*(sum of three skin folds)+0.0000016*(sum of three skin folds)^2-0.0002574*(age)
2. Female Body Density: Three Site Formula (triceps, suprailiac, thigh)
    - Body Density=1.099421-0.0009929*(sum of three skin folds)+0.0000023*(sum of three skin folds)^2-0.0001392*(age)
3. Percent Body Fat (male and female)
    - Body Fat %=(495/body density)-450
4. Definitions:
    - Abdominal-Vertical fold; 2cm to the right side of the umbilicus.
    - Triceps-Vertical fold; on the posterior midline of the upper arm, halfway between the acromion and olecranon processes, with the arm held freely to the side of the body.
    - Chest-Diagonal fold; one half the distance between the anterior axillary line and the nipple (men), or one third of the distance between the axillary line and the nipple (women).
    - Suprailiac-Diagonal fold; in line with the natural angle of the iliac crest taken in the anterior axillary line immediately superior to the iliac crest.
    - Thigh-Vertical fold; on the anterior midline of the thigh, midway between the proximal border of the patella and the inguinal crease.



Graph A: Change in Cholesterol



Graph B: Change in Body Fat



Graph C: Change in Body Weight

	Body Density: Male	Body Fat: Male (%)	Weight: Male (lbs)
Pre-Test	1.069496425	12.83464669	175.8
Week 4	1.069839375	12.68627942	168
Week 8	1.07001115	12.61200175	167.4
Week 12	1.073664625	11.03782175	164.2
Week 16	1.073312875	11.18891474	163.6
Week 20	1.074017175	10.88648443	157.6
Week 24	1.0752574	10.35488805	159.2

	Body Density	Body Fat: Female (%)	Weight: Female (lbs)
Pre-Test	1.049735525	21.54734522	119
Week 4	1.052201869	20.44204606	117
Week 8	1.048799869	21.96802245	118.2
Week 12	1.052970519	20.09863162	117.6
Week 16	1.052010425	20.52765661	115
Week 20	1.050300369	21.29375056	113.6
Week 24	1.052149625	20.46540553	117.4

Table 1: Male and Female Body Measurements

	Cholesterol: Male (Mg)	HDL: Male	LDL: Male	Triglycerides: Male
Pre-Test	205	48	140	59
Week 2	145	40	91	77
Week 4	128	39	76	99
Week 8	173	44	109	122
Week 12	139	49	80	107
Week 16	134	34	77	34
Week 20	143	44	85	135
Week 24	148	56	80	61

	Cholesterol: Female (Mg)	HDL: Female	LDL: Female	Triglycerides: Female
Pre-Test	176	87	75	78
Week 2	146	59	70	88
Week 4	151	79	64	84
Week 8	173	82	86	58
Week 12	174	73	88	113
Week 16	179	85	83	42
Week 20	175	79	81	87
Week 24	161	87	57	78

Table 2: Male and Female Lipid Levels

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