EFFECT OF GINGER (*Zingiber officinale*) ON THE BLOOD CHOLESTEROL LEVEL OF GUINEA PIG (*Cavia porcellus*)

A Research Paper
Presented to
Faculty of Philippine Science High School Western Visayas
Bito-on, Jaro, Iloilo City

In Partial fulfillment
Of the Requirements for
SCIENCE RESEARCH II

By

Rothell Hechanova
Noel Carlo Pueyo

IV-Graviton

January 2004

Philippine Science High School System
PHILIPPINE SCIENCE HIGH SCHOOL WESTERN VISAYAS
Doña Lawaan H. Lopez Campus
Bito-on, Jaro, Iloilo City

APPOINTMENT OF THE RESEARCH COMMITEE
SCHOOL Year 2003-2004

Effect of Ginger on the Blood Cholesterol Level of Guinea pigs

Researchers: Pueyo, N.C.

Hechanova, Rothell

Research Chairs:

Dr. Josette T. Biyo _____

Ms. Shena Faith Ganela _____

Mrs. Gerochi _____

Mr. Fuentespina _____

Approved by:

SMT Unit Coordinator _____

Humanities Unit Coordinator _____

CISSD Chief _____

Acknowledgement

We would like to acknowledge our parents, the teachers, the faculty and staff for their support in this research paper. We also would like to thank the Director of PSHS-WV, Dr. Rebecca Yandog, the Academic Chief, Dr. Josette Biyo, and our class adviser, Sir Edgar Almero and our panelists Ma'am Gerochi, Ma'am Ganela, and Sir Fuentespina, who sacrificed a few hours just to participate in our defense.

We also would like to acknowledge the assistance of Dr. Mariam Margarita J. Lena for aiding us in our research paper and Rebadulla Animal Hospital for aiding us in the blood extraction for the research paper.

The research paper was made possible because of their efforts. We also would like to give our warmest gratitude to Doc Billy who aided us in this research, spending a lot of time with us in our research, of Rebadulla Animal Hospital.

HECHANOVA, ROTHELL T.; PUEYO, NOEL CARLO P. ; "EFFECT OF GINGER (*Zingiber officinale*)ON THE BLOOD CHOLESTEROL LEVEL OF GUINEA PIG (*Cavia porcellus*)." UNPUBLISHED RESEARCH PAPER. PHILIPPINE SCIENCE HIGH SCHOOL WESTERN VISAYAS, ILOILO CITY. NOVEMBER 2003.

Abstract

Ginger is a staple in the diet of many Filipinos because of its abundance and its multiple purposes. *Zingiber officinale*, or Ginger, has helped in alleviating gas pains and colds. Studies show that ginger can kill tuberculosis germs both in vitro and vivo. It is effective in alleviating respiratory conditions like asthma, cough and cold. It reduces spasms and cramps, cleanses colon, stimulates circulation and dispel chills. It also prevents nausea and vomiting, alleviates gas pain and indigestion; helps reduce cholesterol; regulates blood pressure and prevents blood clots that trigger heart attacks and some strokes.

This study is aimed to determine whether ginger (*Zingiber officinale*) has a significant effect on the blood cholesterol level of guinea pigs (*Cavia porcellus*). The dependent variables are the amount of butter and ginger to be administered. The independent variable is the blood cholesterol level of the guinea pigs.

The guinea pigs were obtained and isolated at one cage per guinea pig. They were fed with three different diets for 5 days per treatment. These were normal diet, butter diet, and ginger diet. They were also given sufficient supply of water and grass. the blood samples were obtained from the guinea pigs through either cauterization of the nails and the use of the syringe.

Results had shown that ginger is a potential agent in reducing the blood cholesterol of guinea pigs. It has helped reduce an amount of blood cholesterol level in the guinea pigs and it may prove effective in higher forms of mammals.

Table of Contents

CHAPTER I

INTRODUCTION

A. Background of the Study

Hypertension is a circulatory disorder in which the blood pressure is in excess of the normal range for a person's age and sex. This condition proves to be dangerous because it damages the blood vessels in the kidney, heart and brain. It may eventually lead to renal failure, congestive heart failure and/or cerebrovascular accident or stroke (Benowitz, 1992). These complications are the most popular cause of human mortality today (Van de Graaf and Fox, 1989).

Use of a variety of commercial drugs is common aside from nonpharmocologic treatment of the disease. These drugs, however are not always effective in reducing the fatal complications, because of side effects (Benowitz, 1992).

This research realized the need to establish the use of ginger as a multiple cure for cholesterol-influenced hypertension. This may also establish another potential use of ginger and may ultimately help to improve the health situation in the country.

B. Statement of the Problem

Will ginger extract lower down the blood cholesterol level of mammals such as guinea pigs, *Cavia porcellus*?

C. Hypothesis of the Study

Ginger extract can lower down the blood cholesterol level in guinea pigs, *Cavia porcellus.*

D. Objectives of the Study

This study was conducted to determine the effect of ginger extract in the amount of blood cholesterol level in guinea pigs.

E. Scopes and Limitations of the Study

This study is specifically centered on the effect of ginger on the blood cholesterol level of the guinea pigs. Although there are several factors affecting the blood cholesterol level of guinea pigs such as gender, age, genetic history, food intake and some others, the study is only using factor of food intake and the other factors, such as age or gender, are not of any concern. By feeding the guinea pigs regularly with foods rich in cholesterol, it will take days to make sure that they had enough or more than enough blood cholesterol

level to test it with. Using 3 replicates, the study can test whether ginger had played an important role in the reduction of blood cholesterol level.

F. Significance of the Study

Based on the result of the proposed study, the effectiveness of *Zingiber officinale* as an effective herb in the reduction of blood cholesterol level shall be determined and shall be used in treatment or in avoidance of hypertension and some other disorders.

Because it is common in some places, especially in some farms or towns in the Philippines, *Zingiber officinale* is easy to acquire to convert into medicine and as treatment. Aside from being abundant, ginger is also cheap.

This study also helps in ways on how to find alternative sources of medicine that may treat some ailments and disorders.

G. Definition of Terms

Guinea Pigs *(Cavia porcellus)*- common name for certain small rodents with short, rounded ears and no tails. They have small, stout bodies, about 20 to 40 cm (about 8 to 16 in) long. The hair in some species is long and varies in texture from rough to smooth. Some guinea pigs are solidly white, black, or tawny; others are white, streaked, or blotched with darker colours. Guinea pigs are domesticated cavies, but in popular usage

the term is applied to all species of cavies, domesticated or wild. Wild guinea pigs are native to South America. Among the most important species are those native to the higher ranges of the Andes and Peru, and a species found in domestication from Venezuela to Chile. Wild guinea pigs live in burrows, and also occasionally in dense vegetation. Their diet consists of vegetation. Most wild guinea pigs breed once a year, although one species breeds continually throughout the year under good conditions. They usually produce litters of two to four young, which are born in an advanced state of development and are able to feed themselves by nibbling foliage the day after birth.

Cholesterol- complex alcohol constituent of all animal fats and oils. It can be activated to form vitamin D. Cholesterol is one of a group of compounds known as sterols and is related to such other sterols as the sex hormones and the hormones of the adrenal cortex.

A close relationship exists among levels of blood cholesterol in the body; those of other fats or lipids, and the development of Atherosclerosis. In this disorder, plaques containing cholesterol are deposited on the walls of arteries, particularly those of small and medium size, reducing their inside diameter and the flow of blood. Clotting of blood, such as may occur in the coronary arteries to cause a heart attack, is most likely to develop at places where arterial walls are roughened by such plaques.

Although many foods, particularly dairy products and meat fat, contain cholesterol, the body also synthesizes this sterol from cholesterol-free substances. Nevertheless, investigation indicates that a cholesterol-rich diet causes abnormally high levels of cholesterol and the related fats and lipids in the blood. Evidence strongly indicates that people with such high levels are more likely to develop Atherosclerosis and heart attacks than those with lower levels. Also significant is the fact that scientists have identified two forms of cholesterol-carrying proteins in the blood, called high-density and low-density lipoproteins. The low-density form is thought to promote Atherosclerosis, whereas the high-density component may retard it. In 1984, the United States National Heart, Lung and Blood Institute reported results of a study indicating that high levels of low-density lipoproteins also increased the risk of heart attacks and heart disease.

Persons who have abnormally high levels of cholesterol—especially low-density cholesterol—on a congenital basis can reduce their risk of heart attack by lowering their blood cholesterol. This is done by following a diet low in cholesterol and saturated fats, getting sufficient exercise, and using certain drugs. In 1987, lovastatin, one of a class of drugs that inhibit cholesterol synthesis, was approved for sale in the United States. Many similar drugs are now available.

Ginger-Valued primarily for the distinctive tang it lends to cuisine, Ginger Root also has proven medicinal effects. Its ability to prevent vomiting has been verified by

clinical trial, and it has been shown to stimulate the intestines and promote production of saliva, digestive juices, and bile. It also tends to boost the pumping action of the heart. Native to Southeast Asia, Ginger was brought to Spain, and then America, by the Spanish in the 15th and 16th centuries. It is now commercially cultivated in tropical regions of the United States, India, China, and the West Indies. The plant is a creeping perennial that spreads underground. Only the root is medicinal.

CHAPTER II

REVIEW OF RELATED LITERATURE

Cholesterol is that most frustrating of health problems: you can't see it and you can't feel it, but it builds up in your arteries, it can cause a great deal of damage. Narrowing blood vessels and weakening walls, it is one of the primary causes of strokes, heart attacks, and sudden death.

Furthermore, as we learn more about cholesterol, we have realized that the type of cholesterol, which circulates, is as important or more so than the total amount.

Cholesterol is a fatty substance, which is closely related to the development of blocked arteries. The level of cholesterol in the blood can be managed, minimizing the risks of it causing such problems. There is more than one type of cholesterol molecule in the body- high "bad" cholesterol increases the risk of developing clogged arteries, a heart attack or stroke. Low "good" cholesterol can do the same. The lower the cholesterol, the lower the risk- there is no absolute "normal".

Cholesterol is a steroid that provides energy to the body. It provides benefits and can even harm the body. Cholesterol, as a steroid, is an essential nutrient that provides the energy required by the body. However, too much of cholesterol and less participation involving physical activities can really harm the body. It is because the body has no use of cholesterol whenever the body does not require it to be consumed. It is the deposited as an excess in the blood vessels leading to the development of clogged arteries. Narrowing of blood vessels and weakening of walls, are the primary causes of strokes, heart attacks, and sudden death.

Cholesterol, a complex alcohol constituent of all-animal fats and oils. It can be activated to form vitamin D. Cholesterol is one of a group of compounds known as sterols and is related to such other sterols as the sex hormones and the hormones of the adrenal cortex.

HDL, *High Density Lipoprotein*, the "good cholesterol", is found in herbs and plants and helps reduce the blood cholesterol level. If there is a low amount of HDL present in the body, it will result into increased risk of developing clogged arteries, a heart attack or stroke.

HDL is responsible for taking away the LDL that is deposited in the blood vessel walls. It is a form of cholesterol that contradicts LDL and serves as an anti-LDL. It is advised that a person with high LDL and low HDL have some vegetables and fruits, as well as some herbs, that is high in HDL, in their regular diet. The more one eats food rich in HDL, the safer he is from cholesterol-influenced Hypertension, although there is no definite way to determine whether you are in a safe zone or not.

LDL, also known as the "bad cholesterol" or Low-density Lipoprotein is a factor that contributes to increased risks of stroke and other related heart problems. If there is high amount of LDL, there is an increased risk of developing clogged arteries or stroke. However, having such low amount of LDL, there is a decreased risk of developing clogged arteries that may eventually lead to stroke.

LDL is shown deposited in blood vessels leading it to be clogged and increasing the high-blood pressure. It can lead to the constriction of the arterioles and thus, leading to death. LDL is a harmful substance that is contained by the foods, depending on what kind or the amount of either in HDL or LDL, we take.

One cannot say he should not eat foods rich in LDL for it can increase his risk to develop clogged arteries because such foods may be rich in nutrients and carbohydrates

that are needed by the body. He really should eat those kinds food but only to a minimum amount so that his body can acquire the necessary nutrients needed by his body. He should regulate the intake of those kinds of food and include HDL-rich foods so as to maintain a stable and healthy blood cholesterol level.

The factor that causes an increase in Low-density Lipoprotein is mainly food. High intake of foods rich in LDL can result into an increase of Blood Cholesterol Level. These foods include chocolates, butter, meat, eggs and some dairy products. These foods should be a regular diet for an individual and that individual should not discard these foods even if he fears to have a high blood cholesterol level. Such foods are a necessity to the body and should not be discarded because the body acquires nutrients to sustain growth and maintain a healthy body and mind. Meats are rich in protein but contain a high amount of LDL. But just like other foods rich in LDL, meat provides energy to the body. The body converts the chemical energy in foods to kinetic energy and thus making the body fit for performing a task.

Regular exercise can reduce the LDL amount in the blood vessels because the body needs sufficient amount of energy to perform such task. When one does not exercise at all and consumes a lot of food rich in fats and LDL, then, it is no doubt, he has a higher risk in developing clogged arteries. But even though a person who also consumes foods rich in

fat and LDL but regularly exercises, he has less risk in developing clogged arteries. It is because his body makes use of all the nutrients he has in his body to exercise and makes no waste of those nutrients thus, reducing the amount of LDL that are deposited in his blood vessels.

Guinea pigs are cute and timid creatures. They are slightly smaller than a rabbit but they much bigger in size compared to laboratory white mice. They make squeals or irritating, but cute, noises when they are in need of something, making them easy to monitor and easy to feed. Their diet consists of vegetation

Because it is of the 'right' size, acquiring its blood cholesterol level is easy unlike that of a white mice or smaller animals. However, it is not its size that makes it suitable for the experiment. It is suitable also because such creature is easier to control than larger creatures like as rabbits.

At about 20 to 40 cm (about 8 to 16 in) long, guinea pigs have hair some long and some varies in texture from rough to smooth. Some guinea pigs are solidly white, black, or tawny; others are white, streaked, or blotched with darker colors. Guinea pigs are domesticated cavies, but in popular usage the term is applied to all species of cavies, domesticated or wild.

patients with tuberculosis. With these attributes of ginger, we can really see its potential in curing ailments and conditions that are related to the cures it had given.

Its ability to prevent vomiting has been verified by clinical trial, and it has been shown to stimulate the intestines and promote production of saliva, digestive juices, and bile. It also tends to boost the pumping action of the heart. The plant is a creeping perennial that spreads underground. Only the root is medicinal.

CHAPTER III

MATERIALS AND METHODS

A. Materials

Guinea Pig Cages

Guinea Pigs

Syringes

Test Tubes

Grasses

Butter

Ginger Roots

Mortar and Pestle

B. Treatment Procedures

I. Preparation of Test Organism

The group secured three cages at the Science Laboratory. The members then purchased three guinea pigs, three feeding plates, and a sufficient supply of grasses for feeding. The test organisms were allowed to adjust to the new environment and were given a sufficient supply of food and water for sustenance.

The guinea pigs were then placed in three separate cages. The first, second, and third guinea pig served as the control group (normal diet) for five days. All three of the guinea pigs also served as the experimental organisms. They were fed with butter for five days and ginger for another five days.

II. First Blood Extraction and Laboratory Analysis

After five days of their normal diet, the guinea pigs were brought to a veterinary clinic for blood extraction. The blood sample was then rushed to a medical clinic that can check blood samples using Liebermann-Burchard Method for cholesterol for a minimum amount of 0.5 cc.

III. Preparation and Administration of Butter

Acquiring a pinch of butter, enough to fill 3 ml, we melted the butter and fed it to the guinea pigs by syringe force-feeding. We fed the guinea pigs for only one time per day.

IV. Second Blood Extraction and Laboratory Analysis

After five days of butter force-feeding, the group brought the guinea pigs to the veterinary clinic for their second blood extraction and the blood sample was again rushed to a medical facility. This is to check whether the butter had increased the blood cholesterol level of guinea pigs.

V. Preparation and Administration of Ginger Extracts

The ginger supplement was prepared by washing, two-minute boiling, and using a mortar and pestle, the ginger was pounded until it had provided enough juices. The juice that was extracted was fed to the guinea pigs through syringe force-feeding. They were fed once a day for a duration of 5 days.

VI. Third Blood Extraction and Laboratory Analysis

After five days of ginger-feeding, the guinea pigs were again brought to the veterinary clinic for their third blood extraction. This was to check whether ginger had reduced the blood cholesterol level of the guinea pigs.

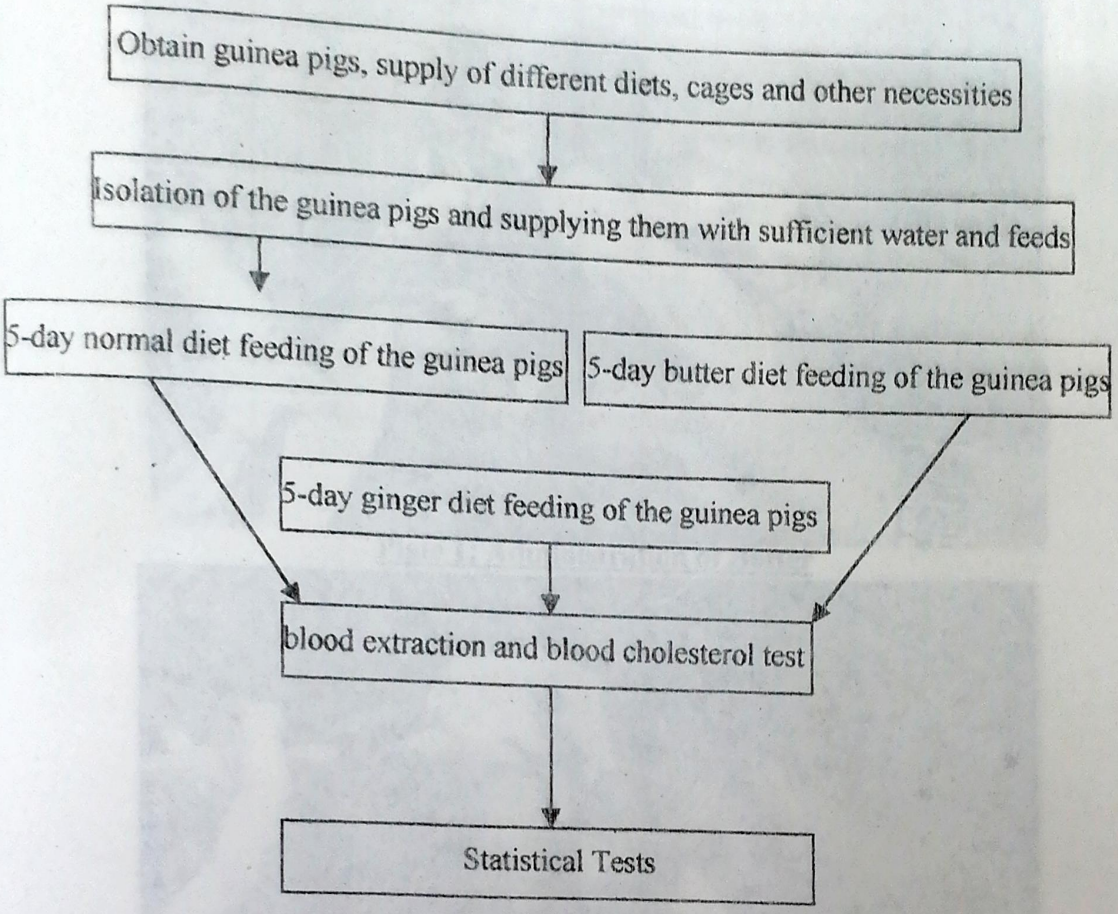
VII. Statistical Analysis

With the two sets of data from the tests, the change in the blood cholesterol level of the guinea pigs had been computed for. The changes of all three guinea pigs in the experimental stage had been compared statistically using the T-test for dependent groups.

VII.A T-test for dependent sample, to determine the significant difference in blood cholesterol level of the guinea pigs that were given normal diet and butter.

VII.B T-test for dependent sample, to determine the significant difference in blood cholesterol level of guinea pigs that were given a high cholesterol diet and after ginger was administered.

Flow chart of Methodology



List of Plates

Plate 1: Administration of Butter

Plate 2: Administration of Ginger

Plate 3: Blood Extraction

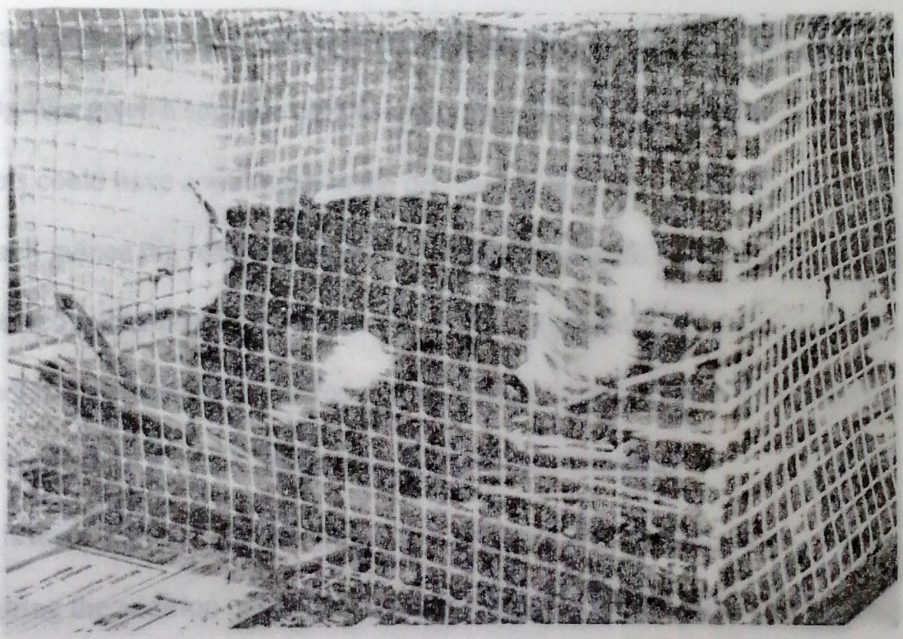


Plate 4: Normal Diet

CHAPTER IV

Presentation and Analysis of Data

Results of the experiment showed that the guinea pigs responded to the high cholesterol diet butter feeding, with an increase in blood cholesterol level from 5.2967 to 5.627 after 5 days. The guinea pigs were fed with each of the three different diets with duration of 5 days each.

Each guinea pig responded differently depending on their physical activity. Each guinea pig was given a separate cage to settle. The way they spend their energy after each of the diets could have contributed to the decrease of their blood cholesterol level.

Each guinea pig reacted differently after the feeding of each of the diets. One was even observed to have spat out small drops of liquid (melted) butter. This was observed during and after feeding of butter and ginger. After the feeding, they were observed to consume a mouthful of grass to alleviate the flavor and the taste.

It is also observed that the blood cholesterol of some guinea pigs are have a little change during the addition of the diets. According to the results, some of the guinea pigs' blood cholesterol level even decreased. We have analyzed that it may be the metabolism

of the guinea pigs that could have caused such results. We have arrived to such analysis because the guinea pigs are not at all of the same size.

The results show that ginger has little potential to lower the blood cholesterol level of the guinea pigs. The results clearly show how ineffective ginger is in reducing the blood cholesterol level of guinea pigs.

The results show that ginger has little capacity to reduce the blood cholesterol level of the guinea pigs that appears to be even less than the normal diet. However it is not only ginger that helped in the reduction of blood cholesterol level of the guinea pigs. Plants contain amounts of HDL, which helps in the reduction of the blood cholesterol level of the guinea pigs. The guinea pigs in the experiment were fed with grass along with the different kinds of diets. We cannot easily see how effective ginger works because grass is fed to the guinea pigs, because without grass, their 'normal' diet, they would starve. And since their normal diet is vegetation, and most contain HDL, they can easily lower their blood cholesterol level by normal diet alone. But however, ginger provided a less effort in reducing the blood cholesterol level. The T-test had shown how ineffective ginger really is. There was a significant change of 0.002 in the blood cholesterol level after the administration of ginger.

Tables

Table 1 - Changes in the Blood cholesterol level on the Guinea pigs

Guinea pig:	Normal Diet:	High Cholesterol Diet:	Ginger:
1	3.66 mmol/L	6.33 mmol/L	1.48 mmol/L
2	6.04 mmol/L	6.02 mmol/L	1.43 mmol/L
3	6.19 mmol/L	4.53 mmol/L	0.34 mmol/L
average	5.2967 mmol/L	5.627 mmol/L	1.0833 mmol/L
Significant change according to the t-test		0.756	0.002

Statistical Data Analysis

Blood Cholesterol Level: Normal Diet vs. butter diet

Paired Samples Statistics

	Mean	N	Standard deviation	Standard Error Mean
Pair 1 Cholesterol	5.46167	6	1.09952	0.44888
Diet	1.50000	6	0.54772	0.22361

Paired Samples Correlation

	N	Correlation	Significance
Pair 1 Cholesterol Diet	6	0.164	0.756

Paired Samples Test

	Paired Differences					
	Mean	Standard Deviation	Standard Error mean	95% Confidence Interval of the difference		t
Pair 1 Cholesterol Diet	3.96167	1.14496	0.46743	2.76010	5.16323	8.475

Paired Sample Test

	Df	Significance (2-tailed)
Pair 1 Cholesterol Diet	5	0.000

Ginger Diet and blood cholesterol level in Guinea pigs

Paired Samples Statistics

	Mean	N	Standard deviation	Standard Error Mean
Pair 1 Cholesterol	3.35500	6	2.59403	1.05901
Diet	1.50000	6	0.54772	0.22361

Paired Samples Correlation

	N	Correlation	Significance
Pair 1 Cholesterol Diet	6	-0.959	0.002

Paired Samples Test

	Paired Differences				
	Mean	Standard Deviation	Standard Error mean	95% Confidence Interval of the difference	t

Pair 1 Cholesterol Diet	1.85500	3.12330	1.27508	-1.42270	5.13270	1.455

Paired Sample Test

	Df	Significance (2-tailed)
Pair 1 Cholesterol Diet	5	0.205

From the given results, we can see how much was increased in the blood cholesterol level during the 5-day application of high cholesterol (butter) diet. The t-test showed that after the high cholesterol diet, there was a significance of 0.756 in the blood cholesterol diet of the guinea pigs. This means that the guinea pigs experienced little change in their blood cholesterol level during the high cholesterol diet stage.

We can also from the results how much was decreased in the blood cholesterol level during the 5-day application of ginger diet. The t-test showed that the after the ginger diet, there was a significance of 0.002 in the blood cholesterol level of the guinea pigs. The results clearly show that ginger has little potential to reduce the blood cholesterol level of the guinea pigs.

CHAPTER V

Summary, Conclusion and Recommendation

A. Summary

Cholesterol is the most frustrating of health problems. Cholesterol is a fatty substance, which is closely related to the development of blocked arteries.

HDL is responsible for taking away the LDL that is deposited in the blood vessel walls. It is a form of cholesterol that contradicts LDL and serves as an anti-LDL. There is no definite way to determine whether you are in a safe zone from hypertension.

LDL, also known as the "bad cholesterol" or Low-density Lipoprotein is a factor that contributes to increased risks of stroke and other related heart problems.

Because it is of the 'right' size, acquiring the guinea pig's blood cholesterol level is easy unlike that of a white mice or smaller animals thus, making it suitable for the experiment. It is suitable also because such creature is easier to control than larger creatures like as rabbits.

Ginger, *Zingiber officinale*, is usually a golden (yellowish) medicinal herb that has a spicy scent and a flavor and looks like an amputated limb with 'bulby' fingers. It is an

effective medicine and a very potential herb that cures a variety of illnesses and certain conditions.

B. Conclusion

Based on the data gathered on the experiment, we can therefore conclude that ginger is not effective in reducing the blood cholesterol level of mammals. Ginger had decreased the blood cholesterol level of guinea pigs according to this data but it had only helped decrease the blood cholesterol level of the guinea pigs at such a low amount. Using statistical test, we had determined that the different diets have significant effect on the blood cholesterol level of guinea pigs.

C. Recommendation

We recommend that more ginger extract or root be used as an ingredient in foods rather than eaten raw. Although it may not be better than taking commercial drugs, but the use of a variety of commercial drugs are not always effective in reducing the fatal complications, because of side effects. Ginger, as a herb made into an ingredient to foods for consumption, is better than commercial drugs because such drugs are made out of juices of raw herbs that may include ginger. Ginger can be cultivated and can be obtained at cheap cost while the production of commercial drugs is quite expensive. Production of commercial drugs that is used in treating hypertension-related illnesses costs more than a

crop of ginger. Such drugs may not be effective and can even result to side effects. Why should people bother buying drugs that is not effective enough that can also result into side effects and, on top of that, also costs much? Ginger is cheaper, effective and provides no side effects. We recommend ginger as an alternative choice for people who want to spend less and reduce their blood cholesterol level in a healthy way. Ginger may be an ingredient to those drugs, and those drugs may contain a few extracts of ginger. Consuming ginger through some ways means taking a percent of the curing capacity that a medicine drug can provide. We are not trying to ruin the business of commercial drugs or anything, but we are recommending ginger as an alternative choice for people with illnesses that involve its healing capacity.

Although ginger had provided a little effect in the reduction of the blood cholesterol level of the guinea pigs, we recommend that future researchers increase the amount of ginger diet.

Literature Cited

BOOK AND SCIENCE JOURNALS

Bato Balani for Science and Technology Vol. 16 No. 2 SY 1996-97 Freshman. Investigatory Projects (Published)

Benowitz, Naal, 1992. "Antihypertensive Agents". Basic and Clinical Pharmacology. 5th ed. California, U.S.A.: Appleton and Lange, Prentice Hall International.

Cajigal, Aida. 1992. A handbook of Medicinal Plants. (Unpublished).

ENCYCLOPEDIAS AND MEDIAS

Grolier's Encyclopedia of Knowledge 1999 (Encyclopedia)

Grolier's Encyclopedia of Knowledge 1991 (Encyclopedia)

Collier's Encyclopedia (Encyclopedia)

Compton's Interactive Encyclopedia '99 (Media)

Brittanica Encyclopedia 1999(Encyclopedia)

Reader's Digest Reverse Dictionary (Dictionary/Encyclopedia)

Encarta Encyclopedia (Encyclopedia)

BROCHURES

Moreishi Herbal Food Products

Appendix

List of Tables:

Table 1.1- Normal Diet

Day 1		
Guinea Pig:	Diet fed:	Amount fed:
1	Grass	600 g
2	Grass	600 g
3	Grass	600 g
Day 2		
Guinea Pig:	Diet fed:	Amount fed:
1	Grass	600 g
2	Grass	600 g
3	Grass	600 g
Day 3		
Guinea Pig:	Diet fed:	Amount fed:
1	Grass	600 g
2	Grass	600 g
3	Grass	600 g
Day 4		
Guinea Pig:	Diet fed:	Amount fed:
1	Grass	600 g
2	Grass	600 g
3	Grass	600 g
Day 5		
Guinea Pig:	Diet fed:	Amount fed:
1	Grass	600 g
2	Grass	600 g
3	Grass	600 g

Table 1.2- High Cholesterol Diet

Day 1		
Guinea Pig:	Diet added:	Amount fed:
1	Butter	3.0 ml
2	Butter	3.0 ml
3	Butter	3.0 ml

Day 2		
Guinea Pig:	Diet added:	Amount fed:
1	Butter	3.0 ml
2	Butter	3.0 ml
3	Butter	3.0 ml
Day 3		
Guinea Pig:	Diet added:	Amount fed:
1	Butter	3.0 ml
2	Butter	3.0 ml
3	Butter	3.0 ml
Day 4		
Guinea Pig:	Diet added:	Amount fed:
1	Butter	3.0 ml
2	Butter	3.0 ml
3	Butter	3.0 ml
Day 5		
Guinea Pig:	Diet added:	Amount fed:
1	Butter	3.0 ml
2	Butter	3.0 ml
3	Butter	3.0 ml

Table 1.3- Ginger Diet

Day 1		
Guinea Pig:	Diet added:	Amount fed:
1	Ginger	3.0 ml
2	Ginger	3.0 ml
3	Ginger	3.0 ml
Day 2		
Guinea Pig:	Diet added:	Amount fed:
1	Ginger	3.0 ml
2	Ginger	3.0 ml
3	Ginger	3.0 ml
Day 3		
Guinea Pig:	Diet added:	Amount fed:
1	Ginger	3.0 ml
2	Ginger	3.0 ml
3	Ginger	3.0 ml
Day 4		
Guinea Pig:	Diet added:	Amount fed:
1	Ginger	3.0 ml
2	Ginger	3.0 ml
3	Ginger	3.0 ml
Day 5		
Guinea Pig:	Diet added:	Amount fed:
1	Ginger	3.0 ml
2	Ginger	3.0 ml
3	Ginger	3.0 ml