PHILIPPINE SCIENCE HIGH SCHOOL WESTERN VISAYAS
Doña Lawaan H. Lopez Campus
Iloilo City

EFFECT OF ONE-WEEK CONSUMPTION OF BITTER GOURD ON THE GLUCOSE LEVEL OF DIABETIC PERSONS

A Research Paper Presented to the
Faculty of Philippine Science High School Western Visayas
Iloilo City

In partial fulfillment
of the requirements in
Science Research II

By

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French Neco S. Tupas

February 2004

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APPROVAL SHEET

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Abstract

This One Group Pretest-Posttest study in a Non-randomized Design determined the effect of one-week consumption of bitter gourd in the glucose level of diabetic persons. The treatment process included initial glucose test of the subjects and the final glucose test after one-week consumption of bitter gourd. The effectiveness of the treatment was determined by posttesting the said parameter. In analyzing the data gathered from this study, the mean and standard deviation, as well as the paired sample t-test, set at 0.05 alpha level of significance, was employed.

The results of this study showed significant decrease on the glucose level values of the diabetic subjects. The process proved to be effective in reducing glucose level of the subjects.

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EFFECT OF ONE-WEEK CONSUMPTION OF BITTER GOURD ON THE GLUCOSE LEVEL OF DIABETIC PERSONS

Chapter 1

Introduction to the Study

Background to the Study

Poverty has been plaguing our country for many years. Likewise, it degrades the value of the Philippine Peso, which greatly affects the nation's financial system and economic performance. Our country has been suffering a lot economically and to lessen the stigma caused by poverty, people should learn to look for proper substitutes for medicine. In order to lessen the impact of poverty, conducting a research on possible alternatives for costly medicines, particularly, to fight the diabetes mellitus, will not only help boost up the economy but will also allow the extensive use of herbal plants.

Already known as an alternative in fighting diabetes, the bitter gourd is rich in essential vitamins and minerals, especially Vitamin A, B1, B2, C, Iron, Calcium, Phosphorus, Copper, Potassium and especially insulin, the pancreatic hormone that controls the amount of glucose and the rate at which the

glucose is absorbed, the one responsible for maintaining human's glucose level. Bitter gourd also contains compounds like glycosides, saponins, alkaloids, reducing sugars, phenolics, oils, and free acids, including methionine.

In people with diabetes, glucose builds up in the bloodstreams instead of being taken into and used by the cells, leading to hyperglycemia. Hyperglycemia is a sickness where patients have abnormally high levels of glucose in the blood. Eventually, hyperglycemia leads to damaged blood levels, which in turn, may cause eye disease, heart disease, peripheral autonomic neuropathy, which is nerve damage in the limbs and internal organs, and diabetic nephropathy, which is a kidney disease. The major danger with diabetes, however, is not the disease itself, but the complications that can arise if insulin levels are not maintained at a constant level.

Bitter gourd is very abundant in our country making it a cheap and economical vegetable, and considering its nutritional content; it proves to have a lot of curative potential. And it is being produce commercially either, in the form of a tea or tablets. It is also already known to people that bitter gourd is an effective alternative, but still denied by medicine world.

In this study, the researchers determined the effect of bitter gourd in the glucose level of a diabetic person in terms of one-week consumption of the said fruit.

The independent variable of this study is the fruit of bitter gourd while the dependent variable is the glucose level of the diabetic subjects.

Figure 1 shows the relationship between the independent and dependent variables of the study.

Statement of the Problem and the Hypothesis

This study determined the effect of one-week consumption of bitter gourd in the glucose level of the diabetic subjects.

Specifically, it determined and compared the

1. blood glucose level values of the subjects with diabetes (a) before treatment, and (b) after one week of treatment; and

2. significant difference in the blood glucose level values of the subjects with diabetes (a) before treatment, and (b) after one week of treatment.

It was hypothesized that there is no significant difference in the glucose level values of the diabetic subjects (a) before treatment, and (b) after one week of treatment.

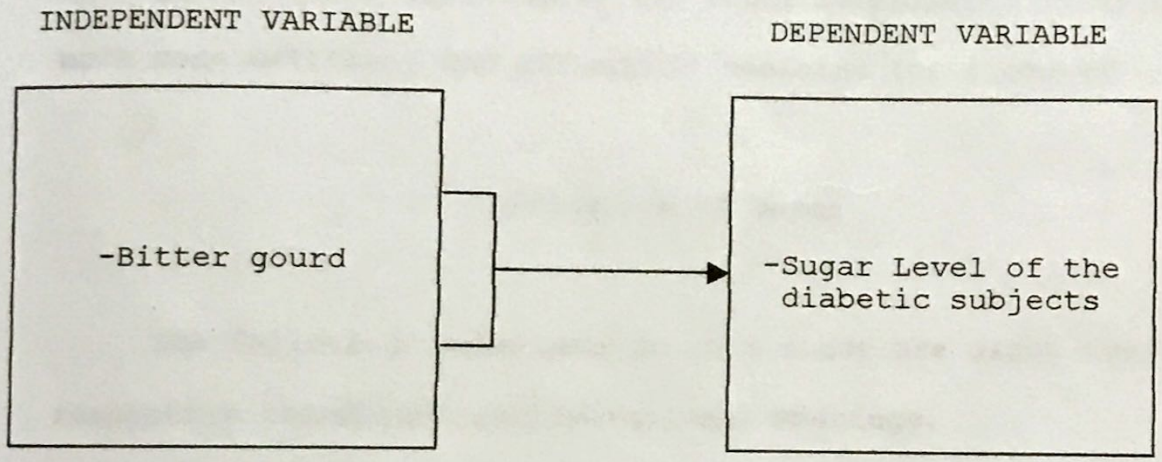

Figure 1. Effect of one-week consumption of bitter gourd on the glucose level of diabetic persons.

Significance of the Study

The implication of the effect of consuming bitter gourd for one week on the glucose level assures a reasonable alternative for those costly and highly commercialized drugs and treatments. It also gives diabetic persons a pain-free treatment. This study also provides the opportunity for other researchers to find a much more efficient and affordable medicine for diabetes.

Definition of Terms

The following terms used in this study are given their respective conceptual and operational meanings.

Consumption- the act or process of consuming (Webster's New Dictionary and Roget's Thesaurus, 1991).

In this study, "consumption" referred to the one week eating of the bitter gourd.

Diabetic- a person who either does not produce enough insulin (type 1 diabetes) or cannot use insulin properly (type 2 diabetes), or both to regulate the glucose in the human body. Someone who has a disorder in which too much sugar builds up in the blood (Grolier Illustrated Dictionary John Grisewood, 1990).

In this study, "diabetic" referred to the subjects that are suffering from diabetes.

Effect- something brought about by a cause or agent; result (Webster's New Dictionary and Roget's Thesaurus, 1991).

In this study, "effect" referred to the change in the glucose levels of the subjects after treatment.

Glucose- a sweet substance. Gives our body energy more quickly. Helps the brain and red blood cells function properly (Grolier Encyclopedia, 1991).

In this study, "glucose" referred to the substance that were measured on the study.

Scope and Delimitation of the Study

This study determined the effect of one-week consumption of bitter gourd in the glucose level of persons with diabetes.

This one-group pretest-posttest study in a non-randomized design employed the mean and standard deviation as descriptive statistical tools, while the paired sample t-test, set at 0.05 alpha level of significance, was employed as inferential statistical tool.

The treatment process consisted of three phases, namely, pretesting, treatment, and posttesting. In pretesting, we took

the subjects for a glucose test. While in the treatment, we let the subjects eat the bitter gourd. And after treatment, we took the subjects for the last glucose test.

The study did not attempt to determine the insulin content of the bitter gourd compared to commercial drugs. This is because it needs higher grade of technology and very tedious processes.

We assumed that cooking the bitter gourd and the addition of several ingredients did not affect the contents that are essential in changing the values of the glucose level of the subjects. This study was conducted in the Philippine Science High School Western Visayas laboratory, West Visayas State University Medical Center Clinical Laboratory, and Villareal Medical Clinic on the months of January and February 2004.

Chapter 2

Review of Related Literature

This chapter consists of 3 topics, namely, (1) Bitter gourd (2) Insulin (3) Diabetes (4) Glucose Test.

Bitter Gourd

Bitter gourd or bitter melon grows in tropical areas, including parts of the Amazon, East Africa, Asia, and the Caribbean, and is cultivated throughout South America as a food and medicine. It is a slender, climbing annual vine with long-stalked leaves and yellow, solitary male and female flowers borne in the leaf axils. The fruit appears as a warty gourd, usually oblong and resembling a small cucumber. The young fruit is emerald green, turning to orange-yellow when ripe. At maturity the fruit splits into three irregular valves that curl backwards and release numerous brown or white seeds encased in scarlet arils. The Latin name *Momordica* which means, "to bite" (referring to the jagged edges of the leaf, which appear as if they have been bitten). All parts of the plant, including the fruit, taste very bitter.

In the Amazon, local people and indigenous tribes grow bitter melon in their gardens for food and medicine. They add the fruit and/or leaves to beans and soup for a bitter or sour flavor; parboiling It first with a dash of salt may remove some of the bitter taste. Medicinally, the plant has a long history of use by the indigenous peoples of the Amazon. A leaf tea is employed for diabetes; as a carminative for colic; topically for sores, wounds, and infections; internally and externally for worms and parasites; as an emmenagogue; and as an antiviral for measles, hepatitis, and feverish conditions.

In Brazilian herbal medicine, bitter melon is used for tumors, wounds, rheumatism, malaria, leucorrhea, inflammation, menstrual problems, diabetes, colic, fevers, worms, to induce abortions, and as an aphrodisiac. It is also employed topically for skin problems, vaginitis, hemorrhoids, scabies, itchy rashes, eczema, and leprosy. In Mexico the entire plant is used for diabetes and dysentery; the root is a reputed aphrodisiac. In Peruvian herbal medicine, the leaf or aerial parts of the plant are used to treat measles, malaria, and all types of inflammation. In Nicaragua the leaf commonly is used for stomach pain, diabetes, fevers, colds, coughs, headaches, malaria, skin complaints, menstrual disorders, aches and pains, hypertension, infections, and as an aid in childbirth.

Many *in vivo* clinical studies have demonstrated the relatively low toxicity of all parts of the bitter melon plant laboratory animals has been reported when extracts are injected intravenously or intraperitoneally (with the fruit and seed demonstrating greater toxicity than the leaf or aerial parts of the plant). Other studies have shown ethanol and water extracts of the fruit and leaf (ingested orally) to be safe during pregnancy. The seeds, however, have demonstrated the ability to induce abortions in rats and mice, and the root has been documented with a uterine stimulant effect in animals. The fruit and leaf of bitter melon has demonstrated an *in vivo* antifertility effect in female animals; in male animals, it was reported to affect the production of sperm negatively.

Bitter melon contains an array of novel and biologically active phytochemicals including triterpenes, proteins and steroids. In numerous studies, at least three different groups of constituents found in all parts of bitter melon have clinically demonstrated hypoglycemic properties (blood sugar lowering) or other actions of potential benefit against diabetes mellitus. These hypoglycemic chemicals include a mixture of steroidal saponins known as charantins, insulin-like peptides, and alkaloids. The hypoglycemic effect is more pronounced in the fruit of bitter melon where these chemicals are in greater

abundance. To date, close to 100 *in vivo* studies have demonstrated the blood glucose-lowering effect of this bitter fruit. The fruit has also shown the ability to enhance cells' uptake of glucose, to promote insulin release, and potentiate the effect of insulin.

Leaf extracts of bitter melon have clinically demonstrated broad spectrum antimicrobial activity. Various water, ethanol, and methanol extracts of the leaves have demonstrated *in vitro* antibacterial activities against *E. coli*, *Staphylococcus*, *Pseudomonas*, *Salmonella*, *Streptobacillus*, *and Streptococcus*; an extract of the entire plant was shown to have antiprotozoal activity against *Entamoeba histolytica*. The fruit and its juice demonstrated the same type of antibacterial properties and, in another study, a fruit extract has demonstrated activity against the stomach ulcer-causing bacteria *Helicobacter pylori*.
Over the years scientists have verified many of the traditional uses of this bitter plant that continues to be an important natural remedy in the natural health practitioner's medicine chest. Bitter melon capsules and tinctures are becoming more widely available in the U.S. and are employed by natural health practitioners for diabetes, viruses, colds and flu, and psoriasis. Concentrated fruit or seed extracts can be found in

capsules and tablets, as well as whole herb/vine powders and extracts in capsules and tinctures.

All though bitter gourd is that helpful in curing many diseases, it has also its contraindications. Bitter melon traditionally has been used as an abortive and has been documented with weak uterine stimulant activity; therefore, it is contraindicated during pregnancy.

This plant has been documented to reduce fertility in both males and females and should therefore not be used by those undergoing fertility treatment or seeking pregnancy. The active chemicals in bitter melon have shown in animal studies to be transferred through breast milk; therefore, it is contraindicated in women who are breastfeeding.

All parts of bitter melon (especially the fruit and seed) have demonstrated in numerous *in vivo* studies that they lower blood glucose levels. As such, it is contraindicated in persons with hypoglycemia. Diabetics should check with their physicians before using this plant and use with caution while monitoring their blood glucose levels regularly.

Although all parts of the plant have demonstrated active antibacterial activity, none has shown activity against fungi or yeast. Long-term use of this plant may result in the die-off of

friendly bacteria with resulting yeast/candida opportunistic overgrowth. Cycling off the use of the plant (every 30 days for one week) may be warranted, and adding probiotics to the diet may be beneficial if this plant is used for longer than 30 days.

The fruit and seed of bitter melon have demonstrated (in animal studies) to lower blood cholesterol levels. Persons on medications to lower blood cholesterol should monitor their cholesterol levels (http://www.rain-tree.com/bitmelon.htm).

Insulin

Insulin is produced by the pancreas, a small organ near the stomach that also secretes important enzymes that help in the digestion of food. Insulin allows glucose to move from the blood into cells, where it is used for fuel.

Insulin is a hormone produced by beta cells in the pancreas. It has three important functions. It allows glucose to pass into cells, where it is used for energy. It suppresses excess production of sugar in the liver and muscles and suppresses breakdown of fat for energy. In the absence of insulin, blood sugar levels rise because muscle and fat cells are not able to utilize glucose for energy. They signal the body that they are "hungry". The liver then releases glycogen, a form

of stored glucose. This further increases the blood sugar level. When the blood sugar level reaches about 180 mg/dl, glucose begins to spill into the urine. Large amounts of water are needed to dissolve the excess sugar, resulting in excessive thirst and urination. Without glucose for energy, the body begins to metabolize protein and fat (Webster's New & Roget's Thesaurus, 1991).

Diabetes

Diabetes is a disease in which the body cannot regulate the amount of sugar (glucose) in the blood. The liver from the foods you eat produces glucose in the blood. In a healthy person, a hormone called insulin regulates the blood glucose level. People with diabetes either does not produce enough insulin (type 1 diabetes) or cannot use insulin properly (type 2 diabetes), or both.

In diabetes, glucose in the blood cannot move into cells, and stays in the blood. This not only harms the cells that need the glucose for fuel, but also harms certain organs and tissues exposed to the high glucose levels.

There are two kinds of diabetes, Type 1 and Type 2. Type 1 diabetes is where the body stops producing insulin or produces

too little insulin to regulate blood glucose level. It is typically recognized in childhood or adolescence. It used to be known as juvenile-onset diabetes or insulin-dependent diabetes mellitus. The beta cells of the pancreas produce little or no insulin, the hormone that allows glucose to enter body cells. Once glucose enters a cell, it is used as fuel. Without adequate insulin, glucose builds up in the bloodstream instead of going into the cells. The body is unable to use this glucose for energy despite high levels in the bloodstream, leading to increased hunger. In addition, the high levels of glucose in the blood causes the patient to urinate more, which in turn causes excessive thirst. Within 5 to 10 years after diagnosis, the insulin-producing beta cells of the pancreas are completely destroyed, and no more insulin is produced.

People with type 1 diabetes generally require daily insulin treatment to sustain life.

Type 2 diabetes is where the pancreas secretes insulin, but the body is partially or completely unable to use the insulin. This is sometimes referred to as insulin resistance. Some people with type 2 diabetes also have a problem with not secreting enough insulin. At least 90% of diabetes cases are type 2. It is typically recognized in adulthood, usually after age 45 years. It used to be called adult-onset diabetes mellitus, or non-

insulin-dependent diabetes mellitus. These names are no longer used because type 2 diabetes does occur in younger people, and some people with type 2 diabetes need to use insulin. It is usually controlled with diet, weight loss, exercise, and oral medications. More than half of all people with type 2 diabetes require insulin to control their blood sugar at some point in the course of their illness. A main component of type 2 diabetes is insulin resistance at the level of the fat and muscle cells. This means the insulin produced by the pancreas cannot connect with cells to let glucose inside and produce energy. This causes hyperglycemia or high blood glucose.

To compensate, the pancreas produces more insulin. The cells sense this flood of insulin and become more resistant, resulting in high glucose levels and often times high insulin levels.

A person with type 2 diabetes often does not require insulin injections. The primary treatment is exercise and diet. Type 2 diabetes usually occurs gradually. Most people with type 2 diabetes are obese at the time of diagnosis. However, the disease can also develop in lean people, especially the elderly. Genetics play a large role in type 2 diabetes and family history is a risk factor. However, environmental factors (such as a low

activity level and poor diet) can increase a person's risk for type 2 diabetes.

Complications of diabetes

Both forms of diabetes ultimately lead to high blood sugar levels, a condition called hyperglycemia. Over a long period of time, hyperglycemia damages the retina of the eye, the kidneys, the nerves, and the blood vessels.

Damage to the retina from diabetes (diabetic retinopathy) is a leading cause of blindness.

Damage to the kidneys from diabetes (diabetic nephropathy) is a leading cause of kidney failure.

Damage to the nerves from diabetes (diabetic neuropathy) is a leading cause of foot wounds and ulcers, which frequently lead to foot and leg amputations.

Damage to the nerves in the autonomic nervous system can lead to paralysis of the stomach (gastroparesis), chronic diarrhea, and an inability to control heart rate and blood pressure with posture changes.

Diabetes accelerates "atherosclerosis", missing a meal, doing more exercise than usual, drinking too much alcohol, or taking certain medications for other conditions. It is very

important to recognize hypoglycemia and be prepared to treat it at all times. You can faint or have a seizure if blood sugar level gets too low.

Diabetic ketoacidosis is a serious condition in which uncontrolled hyperglycemia over time creates a buildup in the blood of acidic waste products called ketones. High levels of ketones can poison you. This typically happens to people with type 1 diabetes that is not controlling their blood sugar. Hyperosmolar hyperglycemic nonketotic syndrome is a serious condition in which the blood sugar level gets very high. The body tries to get rid of the excess blood sugar by eliminating it in the urine. This increases the amount of urine significantly and often leads to dehydration so severe that it can cause seizures, coma, even death. This syndrome, sometimes called diabetic coma, typically occurs in people with type 2 diabetes who are not controlling their blood sugar.

Diabetes Symptoms:

The extra stress can cause diabetic ketoacidosis. Symptoms of ketoacidosis include nausea and vomiting. Dehydration and often-serious disturbances in blood levels of salt follow.

Without treatment, ketoacidosis can lead to coma and death. Symptoms of type 2 diabetes are often subtle and may be

attributed to metabolizing fat, partially or completely, as a fuel source. This process requires the body to use more energy. The end result is feeling fatigued or constantly tired.

Unexplained weight loss: People with diabetes are unable to process many of the calories in the foods they eat. Thus, they may lose weight even though they eat an apparently appropriate amount of food.

Excessive thirst (polydipsia): A person with diabetes develops high blood sugar levels. The body tries to counteract this by sending a signal to the brain to dilute the blood, which translates into thirst. The body encourages more water consumption to dilute the high blood sugar back to normal levels.

Excessive urination (polyuria): Another way the body tries to get rid of the extra sugar in the blood is to excrete it in the urine. It can also lead to dehydration because excretion of sugar carries a large amount of water out of the body along with it.

Excessive eating (polyphagia): If the body is able, it will secrete more insulin in order to try to deal with the excessive blood sugar levels in diabetes and also the body's resistance to the action of insulin in type 2 diabetes. One of the functions of insulin is to stimulate hunger. Therefore, higher insulin levels lead to increased hunger and eating. Despite increased

caloric intake, the person may gain very little weight and may even lose weight because a person with diabetes can use only a small portion of the food calories as fuel.

Poor wound healing: High blood sugar levels prevent white blood cells, which are important in defending the body against bacteria and also in cleaning up dead tissue and cells, from functioning normally. When these cells do not function properly, wounds take much longer to heal and become infected more frequently.

Infections:

Certain infection syndromes, such as frequent yeast infections of the genitals, skin infections, and frequent urinary tract infections, may result from suppression of the immune system by diabetes. They can also be an indicator of poor blood sugar control in a person known to have diabetes.

Altered mental status: Agitation, unexplained irritability, inattention, extreme lethargy, or confusion can all be signs of very high blood sugar, ketoacidosis, or hyperosmolar hyperglycemia nonketotic syndrome.

Blurry vision: This symptom is not specific for diabetes but is frequently present with high blood sugar levels.

Glucose Test

A glucose test measures the amount of sugar (glucose) in the blood. This test is used to evaluate blood glucose levels. It may be used to diagnose or screen for diabetes and to monitor control in patients who have diabetes. Most dietary carbohydrate eventually ends up as glucose in the blood. Excess glucose is converted to glycogen for storage by the liver and skeletal muscles after meals. Glycogen is gradually broken down to glucose and released into the blood by the liver between meals. Excess glucose is converted to triglyceride for energy storage. Glucose is a major source of energy for most cells of the body. Some cells (for example, brain and red blood cells), are almost totally dependent on blood glucose as a source of energy. The brain, in fact, requires that glucose concentrations in the blood remain within a certain range in order to function normally. However, concentrations of glucose that is less than about 30 milligrams per deciliter (mg/dL) or greater than about 300 mg/dL can result to confusion or unconsciousness. The major hormone regulating glucose concentration in the body is insulin (although other hormones such as glucagon, epinephrine, and cortisol also affect it). Glucose levels are measured most commonly to diagnose diabetes or to monitor adequacy of diabetic control. Diabetes is

a very common disease, affecting about 2% of the general population, that results from insulin deficiency or insensitivity by the body to the level of insulin present. People with type 1 diabetes require daily injections of insulin to control their disease. Injection of too much or too little insulin can be dangerous because there is a limited range of blood sugar levels in which the brain can function normally.

Chapter 3

Research Design and Methodology

This study determined the effect of one-week consumption of bitter gourd in the glucose level of the diabetic subjects.

Specifically, it determined and compared the human blood glucose level values of the subjects with diabetes before treatment and after one week of treatment and significant difference in the human blood glucose level values of the subjects with diabetes before treatment and after one week of treatment.

It was hypothesized that there is no significant difference in the glucose level values of the diabetic subjects before treatment, and after one week of treatment.

The Research Design

This study determined and compared the effect of one-week consumption of bitter gourd in the glucose level of our diabetic subjects. The glucose level was measured using the glucose test, which was conducted at chosen medical laboratories.

Each subject underwent the glucose test before treatment. After the first glucose test, the subjects were compelled to

consume 100 grams of cooked bitter gourd that will determine the effect on the glucose level. This treatment was applied to the subjects every day in the same given hour of the day. The treatment continued for the whole week, and after the treatment, the subjects underwent another glucose test. After determining the data, it was compared for analysis. Data gathered was analyzed using paired sample t-test.

Materials and Equipment

The materials used in this study were fresh fruits of bitter gourd, knife, chopping board, frying pan, weighing scale, vegetable oil, onions, garlic, and salt. The researchers provided these materials.

The medical laboratory used vials or syringes, slides, and other glucose test equipment.

General Procedures

This study involved the following phases:

First Glucose Test

The diabetic subjects underwent the first glucose test. The subjects took the fasting glucose test in the morning because the preparations needed for the glucose test included fasting on the part of the subjects. The preparation needed for the glucose test was an NPO order.

Preparations

The materials and equipment needed were prepared and set for the experimentation and testing.

The bitter gourd (whole), garlic, and onions were washed in clean water.

The knife, chopping board, and frying pan were sterilized.

The bitter gourd was chopped and then only 100 grams was weighed out of the chopped bitter gourd.

Chopped onions and garlic were added in appropriate to the food.

Cooking of the Bitter gourd

A small amount of vegetable oil was placed in the frying pan and heated. After the oil has been heated, chopped garlic and onions were added. Then it was sautéed until the garlic became golden brown. Next 100 grams of chopped bitter gourd was added. It was cooked for 3 minutes.

Serving of the Bitter Gourd

After cooking the bitter gourd, it was served to the subjects. The treatment or serving of the bitter gourd was at lunchtime, about around 12:30 p.m-1:00 p.m. The subjects underwent this treatment for 1 week.

Second Glucose Test

The subjects underwent the second fasting glucose test after a week treatment of consuming the bitter gourd in the given time and processes.

Comparison

The glucose level results of each subject from the first test and second test were compared statistically.

Statistical Data Analysis

Data gathered from this study were treated statistically, with the mean and the standard deviation as descriptive statistical tools, and the paired sample t-test, set at 0.05 alpha level of significance, as inferential statistical tool.

The mean was employed to express the average of all the pretest and posttest fasting glucose values while the standard deviation was employed to determine the spread of the individual values from their means.

The paired sample t-test was employed to determine the significant difference in the initial and final fasting glucose value of the subjects.

Chapter 4

Results

This study aimed to determine the effect of one-week consumption of bitter gourd on the glucose level of diabetic persons. It further determined and compared the initial glucose level and the final glucose level of the diabetic subjects after treatment.

It was hypothesized that there is no significant difference in the glucose level values between the initial and final glucose level of the diabetic subjects.

The researchers were able to design a bitter gourd treatment process for the diabetic subjects. The design involved three phases, namely pretesting, treatment, and posttesting. The pretesting measured the initial glucose level of the subjects. The actual treatment process involved the preparation and cooking of the bitter gourd. Posttesting involved the measurement of the final glucose level of the same subjects. The design was successful that it yielded significant decrease in the glucose level values of the diabetic subjects.

Effectiveness of one-week consumption of bitter gourd treatment process for diabetic persons

The treatment process had successfully reduced the glucose level of the diabetic subjects as marked changes in the final fasting glucose test.

Data are presented in Table 1.

The mean pretest value for the glucose level was 6.3264 mmol/L while the mean posttest values was 5.4136 mmol/L.

Data are presented in Table 1.

Difference in the pretest and posttest glucose level values

The paired sample t-test showed that there was a significant difference in the mean pretest and posttest values for the glucose level of the subjects, as reflected by $t(8) = 0.000$, $p < .05$. Because .000 is lower than .05 the null hypothesis was rejected.

Data are presented in Table 2.

Table 1

Means of pretest and posttest of the glucose level values

Test	N	Mean	S.D
Pretest glucose level	11	6.3264 mmol/L	2.1626
Posttest glucose level	11	5.4136 mmol/L	1.6793

Table 2

Paired Sample t-test of the significant difference in the glucose level values before and after treatment

Test	N	Mean	t-value	df	Significance
Pretest	11	6.3264 mmol/L	9.632	21	.000
Posttest	11	5.4136 mmol/L			

Chapter 5

Summary, Conclusions and Recommendations

This study determined the effect of one-week consumption of bitter gourd in the glucose level of the diabetic subjects.

Specifically, it determined and compared the blood glucose level values of the subjects with diabetes before treatment and after one week of treatment. It also determined and compared the significant difference in the blood glucose level values of the subjects with diabetes before treatment and after one week of treatment.

It was hypothesized that there is no significant difference in the glucose level values of the diabetic subjects before treatment, and after one week of treatment.

Summary

The findings of this study are summarized as follows:

1. The researchers were able to determine the glucose level values of the diabetic subjects before treatment, which gave a mean value of 6.3264 mmol/L, and also a mean value of 5.4136 mmol/L after one week of treatment.

2. There is a significant difference in the human blood glucose level values of the diabetic subjects before treatment and after a week of the treatment.

Conclusions

The diabetes treatment process designed by the researchers was able to reduce the glucose level of the diabetic subjects in a micro-scale basis.

The results of this study showed significantly reduced glucose level of the diabetic subjects. The process proved to be effective in reducing the glucose level.

Based on the results, bitter gourd could be a potential medicine for reducing the glucose level of diabetic patients.

Recommendations

The one-week consumption of bitter gourd treatment process designed by the researcher in a micro-scale basis proved to be effective in reducing the glucose level of diabetic patients. It is recommended that such design be endorsed to medical companies,

medical laboratories, and hospitals for large-scale industrial application and modification.

With some minor modifications and improvement, the same process could be very effective given a small amount of time.

Further improvement should be focused, especially in the number of subjects.

REFERENCES

de Guzman- Ladion, Herminia (1985). Herbs and its medicinal value Healing wonders of Herbs: Guide to the Effective Use of Medicinal Plants. Manila, Philippines: Philippine Publishing House

Webster's Revised Unabridged Dictionary. (1913). New York: Longman Inc.

Webster's New & Roget's Thesaurus United States of America. (1991). Manila, Philippines: Thomas Nelson Inc., Publishers

Grolier Illustrated Dictionary John Grisewood. (1990). USA: Grolier Inc.

Bitter gourd www.cucurbitaceae.com
www.rain-tree.com/bitmelon.htm

Diabetes www.diabetes.com

Glucose test www.medicallab.com
www.medtech.com