

The Effect of Blended Vegetables on Fasting Blood Glucose Level

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Abstract: The research study focused to determine the effect of blended vegetables on the fasting blood glucose level. It sought to answer the following questions: (1) What is the fasting blood sugar level of the participants before the intake of the blended vegetables. (2) What is the fasting blood sugar level of the participants after the intake of the blended vegetables. The blood glucose levels were measured by the use of a glucometer. The results were statistically treated by using mean. The findings revealed that the blended vegetables was able to reduce the fasting blood glucose levels of the participants. Therefore, daily consumption of vegetables such as ampalaya and malunggay is beneficial to patients who are suffering from high blood glucose level.

Keywords: Ampalaya, Blood Glucose, Glucometer, Malunggay,

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I. Introduction

1.1 Introduction

The use of plants for treatment of diseases can be traced back in the ancient times when people use the extract of plants to cure illnesses. In the modern world, plants known to have medicinal properties are used as raw materials in the formulation of drugs for treatment of diseases.

Chronic diseases such as diabetes mellitus which show a significant increase is life threatening. According to Nishida, et.al (2004) changes in diet and lifestyle behavior contributes to the emergence of such chronic diseases like diabetes and hypertension. ^[1]

Diabetes mellitus is a chronic disease characterized by high levels of sugar in the blood (hyperglycemia) because of inadequate production and/or action of insulin, the hormone that regulates blood sugar levels. Uncontrolled diabetes leads to serious complications such as stroke, heart attack, end-stage kidney disease and diabetic retinopathy among others. ^[2]

In 2006, the World Health Organization (WHO) recommendation stated that a fasting blood glucose \geq 7.0 mmol/l (126 mg/dl) or 2-h plasma glucose \geq 11.1 mmol/l (200 mg/dl) as the diagnostic criteria for diabetes mellitus. Impaired glucose tolerance (IGT) result of fasting plasma glucose $<$ 7.0 mmol/l (126 mg/dl) and 2-h plasma glucose \geq 7.8 and $<$ 11.1 mmol/l (140 mg/dl and 200 mg/dl). Impaired fasting glucose (IFG) result of fasting plasma glucose of 6.1 – 6.9 mmol/l (110 – 125 mg/dl) and 2-h plasma glucose $<$ 7.8 mmol/l (140 mg/dl) if measured. The impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) or both as the diagnostic criteria for intermediate hyperglycemia ^[3]

The global report by the World Health Organization (WHO) states that an estimated 422 million adults were living with diabetes in 2014 compared to 108 million in 1980 and diabetes caused 1.5 million deaths in 2012. It was observed that the prevalence of diabetes has risen faster in low and middle income countries than in high-income countries. ^[4] According to the World Health Organization diabetes country files 2016, the prevalence of diabetes in the Philippines among males was 5.5 % and 6.1 % among females with a mean of 5.8 %.^[5]

Castillo (2018) said that the Philippines is considered one of the diabetes “hot spots” in the Western Pacific region, where the disease is already reaching epidemic proportions. ^[6] The International Diabetes Federation reported that the total cases of diabetes in adult reached 3,721,900 with a prevalence of 6.2 % among adults in 2017. ^[7] It is considered as the 6th leading cause of death among Filipinos based on the data from the 2013 Philippine Health Statistics. ^[2]

Asif (2011) mentioned that vegetables supply vitamins, minerals, and fiber. The best vegetable choices can be found to have low amounts of carbohydrates. The vegetables recommended for Type-2 diabetes diet include broccoli, lettuce, spinach, cabbage, asparagus, Brussels sprouts, cauliflower, radish, turnip, mushrooms, green peas, soybean sprouts, carrots, onions, peppers, green beans, eggplant, celery, cucumber, zucchini, tomatoes, chilies and vegetable juice. ^[9]

Malunggay known as horse-radish tree or Ben oil tree in English and whose scientific name is *Moringa oleifera* is a very useful plant and is rich in vitamins. It is grown all over the Philippines as a backyard tree and is available throughout the year. The leaves, flowers and fruits (that are pods) of malunggay are edible and Filipinos eat them as vegetable. Research study conducted by Dr. Lydia Marero of the Food and Nutrition Research Institute (FNRI) of the Philippines revealed that one hundred grams or one cup of cooked malunggay leaves contain 3.1 g protein, 0.6 g fiber, 96 mg calcium, 29 mg phosphorous, 1.7 mg iron, 2,820 mg beta-carotene, 0.07 mg thiamin, 0.14 mg riboflavin, 1.1 mg niacin and 53 mg ascorbic acid (Vitamin C). Malunggay has numerous reported medicinal properties, but only a few have been scientifically proven.^[10]

Ampalaya or bitter melon is a herbal plant popular for its bitter taste but contain medicinal properties and numerous health benefits to the body. Bitter melon or known as amplaya in the Philippines has a scientific name of *Momordica charantia*. This vegetable grows in tropical countries in Asia such as the Philippines. Its fruits has green flesh and has a pointed ends at length. Amplaya is an excellent source of calcium, phosphorous, folic acid, iron, vitamins A, B and C. This vegetable is very popular worldwide in treating diabetes for it contains compounds such as flavonoids and alkaloids. This mixture helps the body to produce more insulin which controls the blood sugar levels of the diabetic person. This vegetable was also considered by the Department of Health (DOH) as an alternative in treating certain diseases including skin disease, liver problems, HIV, diabetes, and other ailments.^[11] The main constituents of bitter melon which are responsible for the antidiabetic effects are triterpene, proteid, steroid, alkaloid, inorganic, lipid and phenolic compound.^[12]

According to Hendrick (2010), people who add more green leafy vegetables to their diet may significantly reduce their risk of developing type 2 diabetes.^[8] The study conducted by Maeda (2013) suggest that daily consumption of Green Smoothies confer beneficial effects and possibly reduce the risk of chronic disease.^[13]

1.2 Limitations

The participation in this research study was limited to healthy individuals whose fasting blood glucose level were above the reference range and volunteered to participate in this study. Thus, the study was dependent on a small sample of volunteers. Furthermore, the data collection was based on the subjects availability. Participants who were included in this study were not currently taking any medications to control high blood glucose level.

1.3 Problem Statement

The research study aims to determine the effect of the blended vegetables such as malunggay (*Moringa oleifera*) leaves and amplaya (*Momordica charantia*) fruit on the fasting blood sugar level of the participants. It sought to answer the following questions:

1. What is the fasting blood sugar level of the participants before the intake of blended vegetables?
2. What is the fasting blood sugar level of the participants after the intake of blended vegetables?

1.4 Significance of the Study

The findings of this study may give awareness to the public on the potential blended vegetables like malunggay (*Moringa oleifera*) and amplaya (*Momordica charantia*) vegetables to reduce the blood sugar level. This may also give encouragement to the farmers to plant more vegetables to answer the increasing demands that may be brought about by the findings of this study. This will provide idea to individuals who prefer to take alternative medicine to decrease their blood glucose level.

II. Methods

2.1 Participants

The study samples were recruited at barangay Sta. Cruz, Liloy, Zamboanga del Norte, Philippines. Purposive sampling design was used in the selection of the participants. Due to the limitations in this study, only three subjects for the experimental group were eligible to participate in the study. Whereas, three subjects were also assigned for the control group.

2.2 Research Design

Experimental research design was used in this study where the results of the pre-test and post-test results of the fasting blood glucose level were collected. The fasting blood glucose level was measured using accu-check glucometer.

2.3 Materials and Equipment

The equipment used in this study were the accu-check glucometer for measuring the blood glucose level, 70 % alcohol as disinfectant, sterile lancet and lancing device to prick the finger and obtain blood and

blender to blend the vegetables. The vegetables were freshly picked up from the backyard and immediately blended.

2.4 Procedure

The pre-test blood glucose level of the participants were taken early in the morning before breakfast using the accu-check glucometer. The finger was first cleansed with 70 % alcohol. After which a finger prick was done using a sterile lancet. The first drop of blood was removed with cotton and the next drop of blood was dropped to the glucose strip which was inserted in the glucometer. After a few seconds the results of the fasting blood glucose level was noted and recorded.

Once the fasting blood glucose was determined, the experimental group participants started the administration of the blended green leafy vegetables. The vegetables were freshly collected and processed using blender. The blended vegetables consisting of malunggay leaves (*Moringa oleifera*) and ampalaya (*Momordica charantia*) fruit were taken before breakfast and dinner. One (1) cup of the blended vegetables were given to the participants to consume before breakfast and dinner for three (3) days. On the other hand, the control group participants were not given any blended vegetables or no treatment given to the group.

After three (3) days, the post-test results of the participants fasting blood glucose level was again determined using the accu-check glucometer. The results were noted and recorded then analyzed using statistical methods.

2.5 Statistical Treatment

The results of the pre-test and post-test fasting blood glucose levels were determined using mean.

III. Results

Table 1 presents the descriptive results of the fasting blood glucose level of the participants before and after the administration of the blended vegetables.

Table 1
Mean Results of the Fasting Blood Glucose Level of the Participants

	Pre-Test mg/dL	Post-Test mg/dL	Difference mg/dL
Experimental Group	209	187.6	21.4
Control Group	93.3	93	0.3

The mean results of the pre-test fasting blood glucose level of the experimental group was 209 mg/dL, while the control group was 93.3 mg/dL. On the other hand, the mean post-test fasting blood glucose level of the experimental group was 186.7 mg/dL while the control group was 93 mg/dL. It also shows that the difference in the pre-test and post-test fasting blood glucose level of the experimental group was 21.4 mg/dL, whereas, the control group difference was 0.3 %. This means that the administration of the blended vegetables in the experimental group was able to reduce the blood glucose level of the participants. This implies that the blended vegetables that consisted of malunggay (*Moringa oleifera*) and ampalaya (*Momordica charantia*) has the potential in reducing the blood glucose level.

IV. Discussion

The aim of this study was to investigate the effect of blended vegetables on the blood glucose level of the participants. The results from this study provides preliminary data to suggest a beneficial effect of blended vegetables on the blood glucose level.

As presented in Table 1 on the mean result of the effect of the blended vegetables on the blood glucose level indicated that malunggay leaves (*Moringa oleifera*) and ampalaya (*Momordica charantia*) can reduce the blood sugar level as shown by the difference of the pre-test and post-test result of 21.4 mg/dl. The findings of this study coincides with the study conducted by Imai, Saeko et.al (2014) that supports the effectiveness of eating vegetables before carbohydrates on glucose excursions in the short-term and glycemic control in the long-term in patients with type 2 diabetes.^[14]

In a study conducted by Sagum, et al (2014) also revealed that the results of the serum blood glucose of the experimental group from moderately raised (5.8 mmol/L) to normal serum glucose (5.0 mmol/L).^[15] A similar study conducted on the effect of powdered leaf consumption of *Moringa oleifera* on diabetic rats also showed a hypoglycemic effect thus helps to increase the information over the popular use of *Moringa oleifera* and its safety.^[16]

However, the findings of this study disagree with the results of Taweetruchana, et.al (2017) which concluded that *Moringa oleifera* leaf capsule had no effect on glycemic control and adverse effects in T2DM. Interestingly, this study demonstrated that *Moringa oleifera* leaf had a tendency on blood pressure reduction in T2DM, and this result needs further investigation.^[17] The leaves of the *Moringa oleifera* plant used to prepare

the blended vegetable which was administered to the participants were freshly picked up and blended which might explain the effectiveness of *Moringa oleifera* in reducing the blood glucose level of the experimental group as revealed in the findings of this study. Moreover, the blended vegetable consisted with a combination of malunggay and ampalaya that might contributed to a greater difference in the pre-test and post-test fasting blood glucose results in the experimental group.

Numerous studies on the effect of bitter gourd or *Momordica charantia* demonstrated that bitter gourd extract administered orally lowered serum glucose in diabetic rodents. A moderate hypoglycemic effect was observed in some clinical trials. Currently, the efficacy of bitter gourd as a hypoglycemic therapeutic agent has not been substantiated based on evidence-based medicine, mainly because bitter gourd preparations have not been standardized and an inadequate number of subjects has been tested.^[18] Due to limited participants regarding the efficacy of bitter melon in lowering the blood glucose level, hence, related reviews mentioned that there is no substantial evidence to support the findings. In a study conducted by Selvakumar, et.al. (2017), it shows the significance of hypoglycemic effects of bitter gourd and Knol knol juices among type 2 diabetic patients. The researchers concluded that bitter gourd and Knol knol juice may be beneficial in diabetes patients to reduce the blood glucose level.^[19]

V. Conclusion

Plants such as vegetables are sources of nutrients that keep our body healthy and free from diseases. As revealed in the findings of this study, vegetables such as malunggay (*Moringa oleifera*) and ampalaya (*Momordica charantia*) showed potential in reducing the high levels of glucose in the blood as a result of unhealthy conditions like diabetes mellitus. With the increase in the incidence of diabetes and the growing concerns on the complications that may be brought about by this disease, people can choose to use natural remedies to cure the problem. This research study can be replicated by increasing the number of voluntary participants. An exact measurement on the ingredients of the blended vegetables is also recommended for future studies.

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