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Effects Of Psidium Guajava Crude Leaf Methanol-Extract On Lowering Blood Sugar Levels In Rat

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Abstract. Blood sugar levels, or blood glucose levels, are crucial for overall health and are regulated by the pancreas through insulin. Normal blood sugar levels range between 70-99 mg/dL when fasting and up to 140 mg/dL two hours after eating. Abnormal blood sugar levels can suggest a variety of health issues, including hypoglycemia (low blood sugar levels caused by excess insulin, certain drugs, or illnesses such as diabetes) and hyperglycemia (high blood sugar levels associated with diabetes). Regular blood sugar monitoring is necessary, especially for diabetics. Guava, a tropical fruit, includes a variety of phytochemicals that have been linked to pharmacological benefits such as antibacterial capabilities. This research uses an extraction process involving solid-liquid extraction or maceration, with methanol being the optimal solvent. The extract yields 9.51%. Wistar rats are used to investigate its antidiabetic efficacy. The rats are divided into three groups: positive control, negative control, and extract treatment. Diabetes is induced by subcutaneous injection of Alloxan, followed by oral administration of the methanol extract. Blood glucose levels are assessed after fasting for 6-8 hours. The extract from dried Guava leaf powder yields a concentrated extract with a 9.51% yield. In vivo assessments showed a significant reduction in blood glucose levels in rats treated with guava leaf extract, suggesting potential anti-hyperglycemic effects. The phenolic compounds in guava leaves contribute to antioxidant and anti-hyperglycemic effects. The study highlights the potential therapeutic effects of guava mint leaves and their extract components for diabetes management and antioxidant health benefits.

Keywords: Blood Sugar Level, Diabetes, Guava Leaf

INTRODUCTION

Blood sugar level, or blood glucose level, refers to the concentration of glucose (sugar) in the blood. Glucose is the primary energy source for cells in the body and is obtained from the foods we consume, particularly carbohydrates (Russell et al., 2016). Maintaining blood sugar levels within a normal range is crucial for overall health. The body regulates blood sugar levels through insulin, a hormone the pancreas produces. After eating, blood sugar levels rise, prompting the pancreas to release insulin, which helps cells absorb glucose from the bloodstream for energy or storage. Between meals, when blood sugar levels drop, the pancreas releases glucagon, another hormone, to stimulate the liver to release stored glucose into the bloodstream to maintain normal levels (Proboningsih et al., 2020).

Normal blood sugar levels typically range between 70 and 99 milligrams per deciliter (mg/dL) when fasting (not eating for at least 8 hours) and up to 140 mg/dL two hours after eating. However, target ranges may vary depending on age, health conditions, and individual circumstances. Abnormal blood sugar levels can indicate various health conditions. Hypoglycemia refers to low blood sugar levels, often caused by excessive insulin, certain medications, or conditions such as diabetes. Hyperglycemia, on the other hand, refers to high

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blood sugar levels and is commonly associated with diabetes, both type 1 and type 2(Russell et al., 2016).

Individuals need to monitor their blood sugar levels regularly, especially those with diabetes, to manage their condition effectively and prevent complications. Monitoring can involve self-testing with a blood glucose meter or continuous glucose monitoring (CGM) devices, among other methods. Maintaining a balanced diet, regular exercise, and medication adherence are crucial for controlling blood sugar levels and promoting overall well-being(Lin et al., 2016).

Guava, scientifically named Psidium guajava L., is a tropical fruit with various commercial uses due to its delicious taste, flavor, and perfume(Rajput & Kumar, 2021). The substance includes a wide range of phytochemicals such as polysaccharides, alkaloids, glycosides, vitamins (including four times more vitamin C than citrus fruits), essential oils, minerals, enzymes, proteins, flavonoids, tannins, and saponins(Díaz-De-Cerio et al., 2016). Its different parts have been shown to have various pharmacological benefits, including the antibacterial properties of leaves, fresh fruit, and tea made from leaves for treating conditions like diarrhea, dysentery, and diabetes mellitus. The leaves and bark of the Guava tree, including phenolic chemicals, have a long history of medical usage that remains relevant today(Díaz-de-Cerio et al., 2017).

Several studies have investigated the impact of Psidium guajava leaf extracts, including methanol extracts, on blood sugar levels in rats. Some potential effects observed in these studies: Antihyperglycemic activity: Some research suggests that Psidium guajava leaf extracts may possess antihyperglycemic properties, which can help lower elevated blood sugar levels. These effects are often attributed to bioactive compounds such as flavonoids, polyphenols, and other antioxidants found in the leaves(Luo et al., 2019; Tella et al., 2022; Zhu et al., 2020). Improved insulin sensitivity: Insulin sensitivity refers to how effectively cells respond to insulin(Luo et al., 2019). Studies have indicated that Psidium guajava leaf extracts may improve insulin sensitivity in rats, leading to better glucose uptake by cells and, consequently, lower blood sugar levels(Lin et al., 2016; Tella et al., 2022). Protection of pancreatic beta cells: Pancreatic beta cells produce insulin. Damage or dysfunction of these cells can contribute to insulin resistance and elevated blood sugar levels(Mazumdar et al., 2015). Some research suggests that Psidium guajava leaf extracts may protect pancreatic beta cells, potentially preserving their function and aiding in blood sugar regulation. Reduction of oxidative stress: Oxidative stress, characterized by an imbalance between antioxidants and reactive oxygen species (ROS) in the body, is associated with various complications of diabetes(Luo et al.,

2018, 2019). Psidium guajava leaf extracts contain antioxidants that may help reduce oxidative stress and mitigate its detrimental effects on blood sugar regulation.

Considering the significance of guava, it is essential to evaluate its many components for their antidiabetic properties. The current study focused on extracting guava's leaves. The methanol extracts from feedstuffs were assessed for their capacity to treat diabetes by analyzing people with diabetes using point-of-care testing. The results of this study will determine guava's effectiveness as an antidiabetic agent for medication development.

METHOD

This research describes the tools and materials used. The equipment used includes various glassware such as beakers, measuring cylinders, vials of different sizes, Erlenmeyer flasks, round-bottom flasks, measuring flasks, and glass funnels. Additionally, it involves maceration vessels, a TLC chamber, watch glass, pipettes, tweezers, spatula, Buchner funnel, vacuum pump, rotary vacuum evaporator, analytical balance, digital scale, a set of vacuum liquid chromatography (VLC) equipment, a set of thin-layer chromatography (TLC) tools, dropping plates, and capillary tubes. The ingredients needed for compound isolation include 2 kg of guava leaves as the sample, methanol, distilled water, aluminum foil, and aluminum silica gel 60 GF254 TLC plates.

The extraction process involved solid-liquid extraction or maceration. Methanol was selected as the optimal solvent for the maceration process after initial testing showed it to be the most effective in producing the highest yield without causing decomposition of the target chemicals at room temperature. 2 kg of powdered guava leaves were soaked in 19 L of methanol, making a concentrated extract with a yield of 9.51%.

Wistar rats are utilized in a study to investigate antidiabetic efficacy. The rats are separated into three groups: positive control, negative control, and extract treatment, each consisting of 4 rats. The rats have a 3-day acclimation period before the trial. Diabetes is induced by subcutaneously injecting Alloxan, followed by oral administration of the methanol extract from Guava leaves (100 mg/ kg body weight) after 7 days. A glucometer assesses Blood glucose levels on the 7^{th},14^{th}, and 21^{st} days after fasting for 6-8 hours. The study seeks to determine Guava leaf extract's lowering blood sugar level properties in Wistar rats.

RESULT AND DISCUSSION

Compounds are extracted from guava leaves using solid-liquid extraction or maceration. The method selected maceration, is favored for its capacity to attain the highest

possible yields. The maceration method offers several benefits for extracting bioactive compounds from plant materials like guava leaves: Simple and accessible, Cost-effective, Preservation of delicate compounds, Versatility, Ease of scale-up, Compatibility with natural and organic practices, and Customization(Huang et al., 2021). Methanol has been determined as the optimal solvent for maceration due to its efficiency in time, high sample capacity, and ability to avoid the decomposition of target chemicals at ambient temperature, as indicated by initial testing. Methanol has a high solubility for many phytochemicals, allowing for efficient extraction and a high yield of target compounds. Approximately 2 kg of dried Guava leaf powder is macerated with 19 L of methanol, and a concentrated extract is obtained with a 9.51% yield.

The in vivo assessment examined the plant extracts' efficacy in reducing blood glucose levels using POCT (Point-of-Care Testing) methods for evaluating blood glucose levels to provide rapid and convenient measurements. Blood glucose levels were measured on days 0, 7, 14, and 21. The study demonstrated a notable reduction in blood glucose levels on the seventh day in the treatment group compared to the negative control, with additional enhancement on the fourteenth day and twenty-first day. The positive control (glibenclamide) and treatment group showed lower average blood glucose levels than the negative control group, suggesting the possible anti-hyperglycemic impact of the methanol extract from guava leaves. The studies indicate a feasible approach using plant extracts to control diabetes, highlighting the health advantages of natural chemicals. Some authors report that guava leaf extract can lower blood glucose levels in rats (Lin et al., 2016; Mazumdar et al., 2015; Tella et al., 2022). The phenolic compounds like quercetin, kaempferol, gallic acid, ellagic acid, catechins, and procyanidins that may spread in different amounts contributed antioxidant and anti-hyperglycemic effects (Aly et al., 2022; Bagri et al., 2016; Huang et al., 2021; Luo et al., 2018, 2019; Mazumdar et al., 2015; Shabbir et al., 2020)

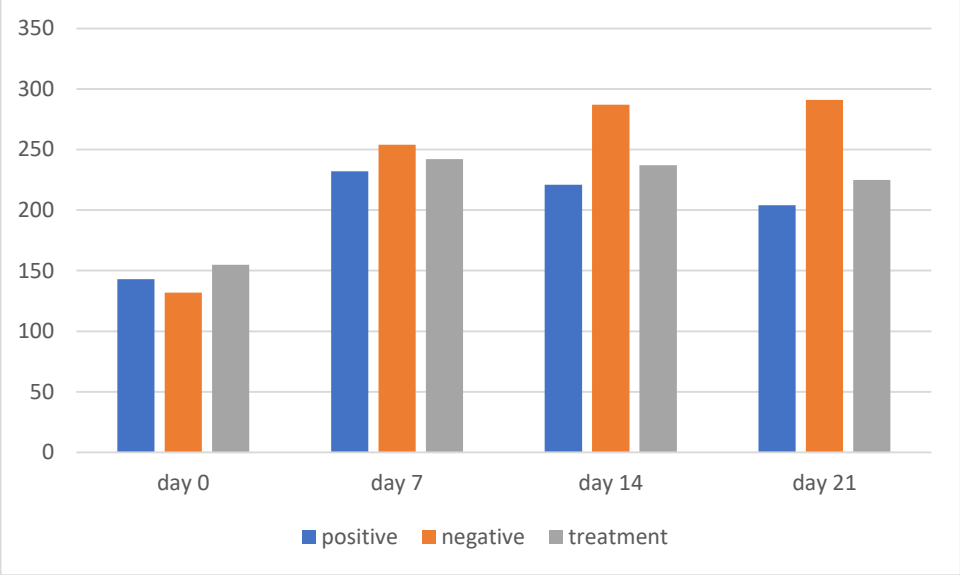

Figure 1. Blood Sugar Levels in Different Treatment Groups

The in vivo assessment showed that the methanol extract of Guava leaves has a promising anti-diabetic impact, indicated by a notable decrease in blood glucose levels in rats. Guava leaf extract restored glycogen synthase activity, which had been suppressed by diabetes, along with reduced glycogen phosphorylase activity and increased glycogen levels. Guava leaves' antidiabetic benefits may be connected with the presence of phenolic compounds and triterpenoids, which have also led to the amelioration of pancreas damage (Tella et al., 2022). The study emphasizes the potential therapeutic effects of Guava mint leaves and their extracted components for managing diabetes and promoting antioxidant health benefits.

CONCLUSION

The guava leaves have potential activity for lowering blood glucose levels; it was seen on the fourteenth day after treatment that rats had lower blood glucose significantly compared to seven days before and after treatment. The methanol extract can be used as an efficient method to yield more extract and bind major phenolic compounds from guava leaves.

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