Potential effects of Mudga (Vigna radiata L. Wilczek) as a dietetic food and medication for diabetes

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ABSTRACT

The green gram (Vigna radiata L. Wilczek), also known as Mudga in Sanskrit, is regarded by Ayurvedic science as the best pulse and one of the healthiest foods that may be regularly consumed to maintain health. Diabetes is a chronic lifestyle condition that may be controlled with diet, exercise, and contemporary medications like insulin and oral hypoglycaemic medicines. In Ayurvedic medicine, green grams are advised as both a dietetic food and a medication for diabetes. The phytochemistry of Vigna radiata, or mung beans, demonstrates its antidiabetic qualities, and a number of research using green gramme extracts have validated the capacity of mung bean to control insulin resistance and reduce blood glucose levels.

Key words: Antidiabetic activity, Diabetes, Mudga, Mung bean

INTRODUCTION

The third most significant pulse crop in India is green gram, (Vigna radiata L. Wilczek), which is highly prized as a grain legume. It is also referred to as Mung bean in English. Mung bean is a highly digestible, low-fat, high-protein food that also has a considerable number of minerals and vitamins. Nearly 80% of the total land planted with crops is used for its cultivation, which occurs mostly during India’s rainy season (kharif).[¹] The green gram’s Indian origins are supported by archaeological evidence and the discovery of Vigna radiata var. sublobata, a closely related species. It was discovered in the 4500-year-old Harappan culture, in evidence from 3500-year-old Karnataka, and in a portion of 1600-year-old Madhya Pradesh.[²] Green gram, in Sanskrit, is called Mudga. One of the first pulses that humans are aware of is the Mudga, which is also widely referenced in ancient texts. Green gram is regarded as the best pulse and one of the greatest foods that may be eaten regularly to preserve health, according to traditional Ayurvedic medicine.

Diabetes is a chronic lifestyle disease that is managed with food, exercise, and modern treatments like insulin and oral hypoglycaemic drugs. Most Asian countries, as well as those in Africa and South America, use Mung bean seeds in traditional medicine to treat conditions including diabetes mellitus.

Green gram is recommended as a meal in Ayurvedic science as well as a medicine for diabetes. The antidiabetic properties of Vigna radiata (Mung beans) are shown by their phytochemistry.[³] Several studies that have used extracts from green gram have also confirmed the Mung beans’ ability to lower blood glucose levels and regulate insulin resistance.
Prayoga (Utility) of Mudga in Ayurveda and Prameha Roga (Diabetes)

One of the most significant pulses since the Vedic period is Mudga. Nearly every Purana mentions Mudga and its many uses, including in Homa and Yajna ceremonies, as a food, medicine—both internal and external.[4]

Mudga is considered the finest pulse in Ayurveda and is a member of the Shami Dhanya Varga (Pulses) family.[5] Most Ayurvedic writers include Mudga as the first of the Shami Dhanya Varga. It is listed by Acharya Sushruta as one of the Sarva Prani Pathya Ahara Varga, a set of food items regarded as both among the finest and dietary items suitable for all animals.[6]

Additionally, according to Acharya Charaka, Mudga is Nityasevaneeya, or food that should be eaten every day to sustain good health.[7,8] It is the ideal pulse to utilise for soup preparation since it is naturally Laghu (light) in digestion.[9] But because the pulse is a recognised Vatakara (aggravates Vata, the bodily humor), it must be ingested with an eye towards amount.[10]

Ayurvedic lexicons highlight the regular use of Mudga in meals as a means of preserving health. According to Ayurvedic literature, it is Pathya (Conducive) for diabetes and can be eaten after being prepared into a variety of foods. Mudgakulmasha is half-baked grains of Mudga, which are Guru (Heavy for digestion), Ruchya (imparts taste), Vibandhakrut (constipative), Vataala (aggravates Vata, the bodily humor) and Pittashleshmaghna (Pacifies Pitta), one of the regulatory factors of the body that is responsible for digestion and metabolism and Kapha, one of the regulatory factors of the body responsible for body fluids and keeping the body constituents cohesive in properties and action and it mitigates diabetes.[11] Mudga-Amalaki Prayoga (intake of Mung bean and Indian Goosberry) is mentioned as a medicinal preparation for treating diabetes by Ayurveda physicians.[12]

Antidiabetic activities of Mung beans

Mung beans have a lot of study being done on them because of their potential in medicine and food. A variety of experiments are used to identify antidiabetic actions of Mung beans.

Table 1: Antidiabetic activities of Mung beans

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<tr>
<th>SN</th>
<th>Objective of the study</th>
<th>Results and conclusion</th>
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<tbody>
<tr>
<td>1.</td>
<td>To assess Antidiabetic Activity of Mung Bean or Vigna radiata (L. Wilczek) Seeds in Alloxan-Induced Diabetic Mice</td>
<td>The plant Vigna radiata has considerable antidiabetic properties in its methanolic extract that are comparable to those of the widely used medication Glibenclamide. Therefore, V. radiata appears to be a useful natural antidiabetic. In diabetic mice, the methanol extract of V. radiata seeds also restored liver glycogen and insulin levels and controlled lipid profiles, AST, ALT, and glycated haemoglobin, indicating its potential benefits in mitigating some of the effects of diabetes.[13]</td>
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<td>2.</td>
<td>To assess Antidiabetic, antioxidant and antimicrobial activity of Mung beans extract (natural or sprouted state)</td>
<td>In diabetic rats, the ethanolic extract of Mung beans, whether raw or sprouted, reduced blood glucose levels in a dose-dependent way. By enhancing their lipid profile and markedly reducing their urea levels, the extracts also helped diabetic rats to mitigate complications; the effects were much more noticeable when sprouted Mung beans were used.[14]</td>
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<td>3.</td>
<td>To assess Antidiabetic activity of Mung bean extracts in diabetic KK-Ay mice</td>
<td>In type 2 diabetic mice, the antidiabetic effects of Mung bean sprout (MBS) and Mung bean seed coat (MBSC) extracts were studied. For five weeks, KK-Ay mice received oral administrations of MBS and MBSC. MBS (2 g/kg) and MBSC (3 g/kg) were reported to significantly enhance glucose tolerance and raise insulin immunoreactive levels while also lowering blood glucose, plasma C-peptide, glucagon,</td>
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<td>4.</td>
<td>To assess if polyphenol extracts from germinated Mung Beans can improve type 2 Diabetes in Mice by regulating intestinal microflora and inhibiting inflammation</td>
<td>To identify hypolipidemic and hypoglycaemic potential of raw, boiled, and sprouted Mung beans (Vigna radiata L. Wilczek) in rats.</td>
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<td>5.</td>
<td>To assess Anti-diabetic activities of vitexin and isovitexin from Mung bean soup</td>
<td>Insulin and fasting plasma glucose levels are suppressed by Mung bean protein. As a result, it could suppress insulin resistance, which is a factor that leads to metabolic syndrome.</td>
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<td>6.</td>
<td>To assess if Mung bean seed coat water extract restores insulin sensitivity in insulin-resistant HepG2 cells</td>
<td>Natural (MBN) and sprouted (MBG) Mung bean extracts showed anti-diabetic activity in Wistar rats by reducing blood glucose levels.</td>
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<td>7.</td>
<td>To assess anti-diabetic effects of Mung bean sprouts (in vitro study)</td>
<td>Blood glucose levels were shown to be negatively linked with the amount of Mung beans added to rice meals; the levels were highest in volunteers who consumed only rice meals, and they began to decline as the proportion of Mung beans increased. Blood glucose levels were shown to be negatively linked with the amount of Mung beans added to rice meals; the levels were highest in volunteers who consumed only rice meals, and they began to decline as the proportion of Mung beans increased.</td>
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<td>8.</td>
<td>To identify naturally occurring exosome-like nanoparticles have anti-diabetic properties.</td>
<td>Hypoglycaemic effect was identified in sprouted Mung bean fed rats.</td>
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<td>9.</td>
<td>To assess improvement of glucose metabolism via Mung bean protein consumption using Glucodianimal isolated Mung bean protein in Japan</td>
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<td>10.</td>
<td>To assess the effect of natural and sprouted Mung bean extracts grown in Burkina Faso on the metabolism and overall health status of diabetic Wistar rats</td>
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<td>11.</td>
<td>To identify the effect of mixing rice with Mung bean in different food meals on postprandial blood glucose level in healthy adults</td>
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<td>12.</td>
<td>To identify the effect of Munghurt Lactobacillus acidophilus from</td>
<td>In alloxan-induced diabetic rats, Munghurt Lactobacillus acidophilus had the impact of lowering blood glucose levels,</td>
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Green Beans on the blood Glucose levels in Alloxan-induced Diabetic Rats and there were complementary processes between Gilbenclamide and Munghurt Lactobacillus acidophilus in lowering blood glucose level.[24]

13. To identify if Mung bean peptides promote glucose uptake via Jak2 activation in L6 myotubes By enhancing glucose absorption and activating Jak2 in muscle cells, Mung beans are a potentially beneficial functional diet for preventing hyperglycaemia and type 2 diabetes.[25]

14. To assess anti-hyperglycaemic effects of fermented and nonfermented Mung bean extracts on Alloxan-induced diabetic mice The effects of fermented and nonfermented Mung bean extracts on normoglycemic, glucose-induced, and alloxan-induced hyperglycaemic states have been studied. In both glucose- and alloxan-induced hyperglycaemic rats, the anti-hyperglycaemic activity of nonfermented Mung bean extract was further enhanced by fermented Mung bean extract. Normal mice did not have a hypoglycaemic impact from fermented Mung bean extracts, whereas mice with hyperglycaemia brought on by alloxan and glucose had a considerable drop in blood sugar levels. In the fermented Mung bean-treated group of alloxan-induced hyperglycaemic mice, there was a substantial improvement in insulin secretion and antioxidant level as determined by malonaldehyde (MDA) tests. These findings suggested that in alloxan-treated mice, fermentation using Mardi Rhizopus sp. strain 5351 inoculums might augment the anti-hyperglycaemic and antioxidant benefits of Mung beans.[26]

15. To investigate the hypoglycaemic and antioxidant effect of Mung bean coat An in vitro study using a 95% ethanol extract of Moong bean coat (MBC) showed a 48.6% reduction of yeast α-glucosidase activity. This inhibition was 1.4 times greater than that of acarbose at 0.5 mg/mL. For seven weeks, five-week-old db/db mice were given either the AIN-93G diet or a diet that contained 1% MBC extract. The homeostasis model evaluation for insulin resistance, blood glycated haemoglobin and serum glucose levels, and insulin resistance were all considerably (p<0.01) lower in the MBC group mice than in the control group mice. As a result, MBC may be useful in lowering hyperglycaemia and enhancing antioxidant levels in people with type 2 diabetes.[27]

**DISCUSSION**

Given that diabetes is a chronic lifestyle issue, research into new and alternative treatments for the disease is still gaining a lot of attention. It is advised that diabetes patients engage in physical exercise and individualised dietary management to improve their glycaemic control. Furthermore, improved oral agents have been suggested for complementary and alternative medicine in the form of plant-based foods and spices that are frequently used in traditional medicine to treat diabetes. Because of their low glycaemic indices, whole grains, legumes, and cereals - which provide energy in Asian cuisine - have also been proposed as possible antidiabetic foods in addition to herbs. Because of its high fibre content and low glycaemic index, Mung beans have been suggested as an alternate meal for diabetes people among all other types of seeds.[26] From the Ayurvedic point of view, Mudga possesses Laghu (light for digestion) Ruksha (dry) properties, Kapha-Pitta Dosahara in action (pacifies Kapha, one of the regulatory factors of the body responsible for body fluids and keeping the body constituents cohesive and Pitta Doshas, one of the regulatory factors of the body that is, responsible for digestion and metabolism)[5] and may contribute in the management of diabetes.
Due to their nutrients and bioactive substances, plain or sprouted Mung beans have a range of pharmacological qualities, such as antibacterial, antioxidant, and antidiabetic effects. By assisting in the maintenance of an equilibrium between oxidants and antioxidants, flavonoids and polyphenols, two types of phytochemicals found in both plain and sprouted seeds, can help the body fight oxidative stress. A healthy diet is essential for maintaining this equilibrium, which helps avoid chronic illnesses like diabetes that are brought on by oxidative damage.[14] Additional study is required to comprehend the molecular processes of the bioactive substances present in Mung beans. But as several studies have demonstrated, Mung beans may have anti-diabetic properties. A study on mice with type 2 diabetes has demonstrated the preventive effects of germinated Mung bean polyphenol extract. The reason for this was because germinated Mung bean polyphenol (GMP) has the ability to control intestinal flora imbalance and regulate species diversity in diabetic mice, in addition to regulating Firmicutes, Bacteroidetes, and Proteobacteria.[16] Another research demonstrated the ability of Mung bean soup containing vitexin and isovitexin to suppress the production of advanced glycation end products and the enzymes that metabolise carbohydrates, alpha-amylase and alpha-glucosidase.[17] In another study, rats given sprouted Mung beans were shown to have higher levels of both alpha-amylase and alpha-glucosidase inhibitory activity, which evaluated the potential antidiabetic properties of Mung beans.[18] Mung bean protein had an inhibitory impact on insulin resistance,[21] and in healthy people, meals containing Mung beans also shown a drop in postprandial blood sugar levels.[23] Likewise, fermented Mung bean extracts have demonstrated superior antihyperglycemic action, which might be attributed to their higher GABA concentration and free amino acid content.[26] Additionally, studies have extracted and identified the Mung bean’s active peptides, which have been shown to enhance glucose absorption and clarify how they work in L6 myotubes. The active peptides HTL, FLSSTEAQQSY, and TLVPNPDGRDSY were separated and identified. The glucose transporter 4 (GLUT4) was encouraged to relocate to the plasma membrane by these peptides. Adenosine monophosphate-activated protein kinase was activated by the tripeptide HTL to enhance glucose absorption, whereas the PI3K/Akt pathway was stimulated by the oligopeptides FLSSTEAQQSY and TLVPNPDGRDSY. Furthermore, through their interaction with the leptin receptor, these peptides stimulated the phosphorylation of Jak2.[25] In light of all of these, Mung beans provide a viable functional dietary option for preventing type 2 diabetes and hyperglycaemia.

CONCLUSION

Mung beans have been suggested as a possible antidiabetic agent, and several scientific studies have supported this claim. It may thus be included into a variety of antidiabetic drugs and is a potential functional food for the prevention of hyperglycaemia and type 2 diabetes.

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