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A REVIEW ON FORMULATION AND EVALUATION OF ANTIDIABETIC COMPRESSED TABLET LOZENGES (BITTER MELON)

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ABSTRACT

Diabetes mellitus, a global health concern, particularly prevalent in India, necessitates innovative treatment approaches. Bitter melon (**Momordica charantia**), renowned as "vegetable insulin," offers a promising natural solution due to its hypoglycemic properties. To enhance bioavailability and reduce gastrointestinal irritation, chewable lozenges present an ideal dosage form. These solid dosage forms, designed to dissolve slowly in the mouth, extend drug retention time, facilitating both local and systemic therapeutic effects. The unique combination of bitter melon's phytochemical richness and the advantages of lozenge formulation offers a potential strategy for managing diabetes mellitus. Numerous pre-clinical and clinical studies have supported the efficacy of bitter melon, and its incorporation into chewable lozenges can provide a convenient and effective treatment option.

Keywords: Chewable Lozenges, Diabetes Mellitus, Hypoglycaemia, Momordica Charantia.

I. INTRODUCTION

Diabetes mellitus has a long history, with early descriptions dating back to ancient Egypt and India. The term "diabetes" was coined in the 1st century AD, and the term "mellitus" (meaning "honey-sweet") was added in the 17th century to describe the sweet taste of diabetic urine. In the 19th century, the role of the pancreas in diabetes was discovered, leading to the identification of insulin in the early 20th century. The discovery of insulin revolutionized the treatment of diabetes, allowing people with the condition to live longer and healthier lives.

Diabetes Mellitus: A Closer Look

Diabetes mellitus, often simply called diabetes, is a chronic condition that affects how your body regulates blood sugar (glucose). Glucose is your body's primary source of energy, derived from the food you eat. To use this energy, your body needs a hormone called insulin.

Insulin's Role

Insulin, produced by the pancreas, acts like a key that unlocks your cells, allowing glucose to enter and provide energy. In people with diabetes, this process is disrupted.

II. TYPES OF DIABETES MELLITUS

There are primarily two main types of diabetes mellitus:

Type 1 Diabetes:

- Autoimmune Disorder: In type 1 diabetes, your body's immune system mistakenly attacks and destroys the insulin-producing cells in your pancreas.
- Insulin Dependence: As a result, your body can't produce enough insulin, and you'll need to take insulin injections or use an insulin pump to manage your blood sugar levels.

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Type 2 Diabetes:

- Insulin Resistance: In type 2 diabetes, your body either doesn't produce enough insulin, or your cells don't respond effectively to the insulin your body does produce (insulin resistance).
- Lifestyle Factors: This type is often linked to lifestyle factors like obesity, physical inactivity, and family history.
- Other Types of Diabetes
- Gestational Diabetes: This type develops during pregnancy and usually resolves after childbirth. However, it increases the risk of developing type 2 diabetes later in life.
- Other Specific Types: There are less common forms of diabetes caused by specific genetic conditions or other medical issues.

Symptoms of Diabetes

- The signs and symptoms of diabetes can vary, but some common ones include:
- Frequent Urination: You may find yourself needing to urinate more often, especially at night.
- Increased Thirst: Your body may feel dehydrated due to increased urination, leading to excessive thirst.
- Extreme Hunger: Even after eating, you may feel constantly hungry.
- Unexplained Weight Loss: In some cases, particularly with type 1 diabetes, you may lose weight without trying.
- Blurred Vision: High blood sugar can affect the lens of your eye, causing temporary vision problems.
- Slow-Healing Sores: Cuts and wounds may take longer to heal due to impaired blood flow.
- Fatigue: Feeling tired and weak can be a symptom of diabetes.

Complications of Diabetes

- If left untreated or poorly managed, diabetes can lead to serious health complications:
- Heart Disease: High blood sugar can damage blood vessels and increase the risk of heart attack and stroke.
- Kidney Disease: Diabetes can damage the kidneys, leading to kidney failure and the need for dialysis or a kidney transplant.
- Nerve Damage (Neuropathy): Nerve damage can cause numbness, tingling, and pain in your hands, feet, and other parts of your body.
- Eye Damage (Retinopathy): High blood sugar can damage the blood vessels in the retina, potentially leading to blindness.
- Amputation: Poor blood flow to the extremities, often due to nerve damage, can increase the risk of infections and amputations.

Managing Diabetes

- Healthy Eating: A balanced diet with controlled carbohydrate intake can help regulate blood sugar levels.
- Regular Exercise: Physical activity helps improve insulin sensitivity and lowers blood sugar.
- Medication: Depending on the type of diabetes, you may need medication like insulin or oral medications to manage blood sugar.
- Regular Monitoring: Checking your blood sugar levels regularly helps you track your condition and make necessary adjustments to your treatment plan.

Living with Diabetes

- Living with diabetes requires dedication and commitment, but it's possible to manage the condition and live a healthy life. By following your doctor's advice, making healthy lifestyle choices, and staying informed, you can take control of your diabetes and reduce your risk of complications.

Bitter melon (Momordica charantia)

Bitter melon (Momordica charantia) is a plant that has been used for centuries to treat diabetes. It's packed with nutrients and special compounds that help control blood sugar levels.

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Momordica charantia: A Versatile Plant

Synonyms:

- Karela
- Balsam Pear
- Bitter Apple
- Bitter Gourd
- Bitter Melon
- Bitter Squash

Biological Source:

The whole plant, including the fruits, leaves, and seeds, is used for medicinal purposes.

Family:

Cucurbitaceae (Gourd family)

This family includes other well-known plants like cucumbers, pumpkins, and zucchini.

Chemical constituents :

Momordica charantia, or bitter melon, is a rich source of various bioactive compounds that contribute to its medicinal properties. Some of the key chemical constituents include:

1. Polysaccharides:

These complex carbohydrates have been linked to immune-modulatory and anti-inflammatory effects.

2. Proteins and Peptides:

Momordins and Momorcharins: These proteins belong to the ribosome-inactivating protein (RIP) family and exhibit cytotoxic and antitumor properties.

MAP30: Another RIP with potential anti-cancer and anti-viral activities.

MC lectin: A lectin with immunomodulatory properties.

3. Terpenoids and Saponins:

Cucurbitanes and Cucurbitacins: These compounds have been associated with anti-diabetic, anti-inflammatory, and anti-cancer effects.

4. Flavonoids and Phenolic Compounds:

These antioxidants protect cells from oxidative damage and have anti-inflammatory properties.

5. Other Compounds:

Essential oils: Contribute to the plant's characteristic bitter taste and have antimicrobial properties.

Fatty acids, amino acids, and sterols: Essential nutrients for various bodily functions.

It's important to note that the specific chemical composition of bitter melon can vary depending on factors like growing conditions, maturity stage, and part of the plant used.

The synergistic action of these compounds contributes to the diverse pharmacological activities of bitter melon, making it a valuable plant in traditional and modern medicine.

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Uses:

Momordica charantia, commonly known as bitter melon or bitter gourd, has been used for centuries in traditional medicine for various health benefits. Here are some of its key uses:

Diabetes Management

- Insulin-like Action: It contains compounds that mimic the action of insulin, helping to lower blood sugar levels.
- Improved Insulin Sensitivity: It enhances the body's sensitivity to insulin, allowing cells to use glucose more effectively.
- Reduced Sugar Absorption: Bitter melon slows down the absorption of sugar from the intestines into the bloodstream.
- Stimulates Insulin Production: It promotes the pancreas to produce more insulin, aiding in blood sugar regulation.
- Other Potential Uses:
- Antioxidant Properties: Bitter melon contains antioxidants that protect cells from damage caused by free radicals.
- Anti-inflammatory Effects: It may help reduce inflammation in the body.
- Immune-Boosting: Bitter melon can strengthen the immune system.
- Skin Health: It may help treat skin conditions like acne and eczema.
- Digestive Health: Bitter melon can aid in digestion and may help alleviate constipation.
- Important Considerations:
- Consult Your Doctor: While bitter melon has shown promise in managing diabetes and other health conditions, it's essential to consult with your healthcare provider before using it, especially if you're already on medications.
- Potential Side Effects: Bitter melon can cause side effects like digestive issues, low blood sugar, and allergic reactions in some individuals.
- Not a Replacement for Medication: Bitter melon should not be used as a sole treatment for any health condition. It should be used as a complementary approach under medical supervision.

Remember, bitter melon is not a magic cure. It's best to combine it with a healthy diet, regular exercise, and prescribed medications for optimal health management.

Here's how bitter melon works

- Boosts insulin production: It stimulates the body to produce more insulin, a hormone that helps regulate blood sugar.
- Improves insulin sensitivity: It makes the body more responsive to insulin, allowing it to use sugar more effectively.
- Slows sugar absorption: It reduces the rate at which sugar is absorbed from the intestines into the bloodstream.
- While bitter melon is generally safe, it's important to be aware of the following:
- Pregnant women: Should avoid bitter melon as it may harm the unborn baby.
- Allergies: People allergic to gourds and melons may experience allergic reactions to bitter melon.
- Glucose-6-phosphate dehydrogenase deficiency: Individuals with this condition should avoid bitter melon seeds.

If you're considering using bitter melon to manage diabetes, it's best to consult with a healthcare professional to discuss its potential benefits and risks.

Medicated Chewable Lozenges

Imagine a tasty candy that's not just a treat but also a medicine! That's what gummy lozenges are These lozenges are made with a special type of jelly, called gelatin. Inside this jelly, there's medicine. Instead of swallowing a pill, you chew this candy-like medicine.

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Why gummy lozenges ?

- Kid-Friendly: They're perfect for children who might not like swallowing pills.
- Easy to Take: No need for water, just chew and enjoy!
- Quick Action: The medicine gets absorbed quickly into your body.



How are they made?

- First, the medicine is mixed with the melted jelly. Then, it's poured into molds or spread out on a flat surface to set. Once it cools down, you have the gummy lozenges, ready to be enjoyed!

III. ADVANTAGES & DISADVANTAGES OF LOZENGES

	Advantages	Disadvantages
1.	Enhanced patient compliance and convenience, particularly in pediatric and geriatric populations.	Inadvertent ingestion of lozenge dosage
2.	Suitable for administration to patients with dysphagia or swallowing difficulties.	Aldehyde candy bases are incompatible with certain therapeutic agents, such as benzocaine.
3.	Does not necessitate water intake for administration.	Risk of accidental consumption by pediatric populations due to similarity to candy.
4.	Exhibits both local and systemic effects via the oral cavity.	Inconsistent drug distribution within saliva can compromise local therapeutic efficacy.
5.	Improved patient adherence and satisfaction.	Limited suitability for heat-sensitive drugs.

Saponin's Mechanism of Action in Diabetes Mellitus

Saponins, found in many plants, can help lower blood sugar and cholesterol levels. They work by improving how the body uses insulin and regulates blood glucose.

Bitter melon, a plant rich in saponins, is particularly effective in managing diabetes. It helps:

- Increase insulin production: Stimulates the pancreas to produce more insulin.
- Improve insulin sensitivity: Makes the body more responsive to insulin.
- Reduce sugar absorption: Slows down the absorption of sugar from the intestines.

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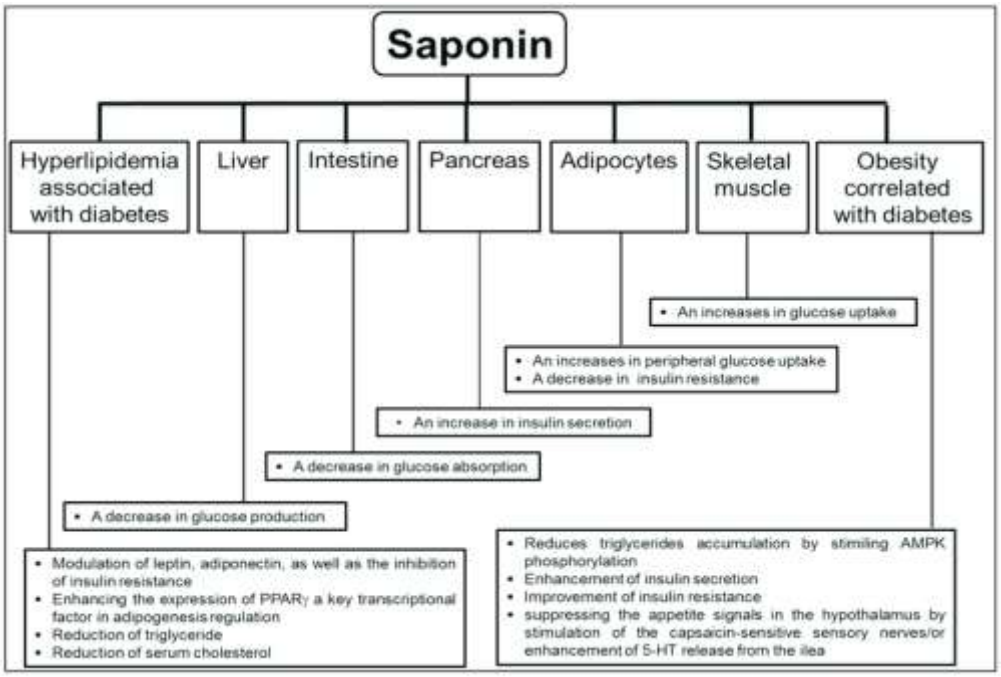
- Protect cells from damage: Acts as an antioxidant to reduce oxidative stress.

Overall, saponins and bitter melon have the potential to be valuable tools in managing diabetes, but it's always best to consult with a healthcare professional before making any dietary or medicinal changes.



Medicinal Properties of Bitter Melon

Bitter melon (Momordica charantia) is a plant with many health benefits. It has been used in traditional medicine for centuries to treat various conditions.

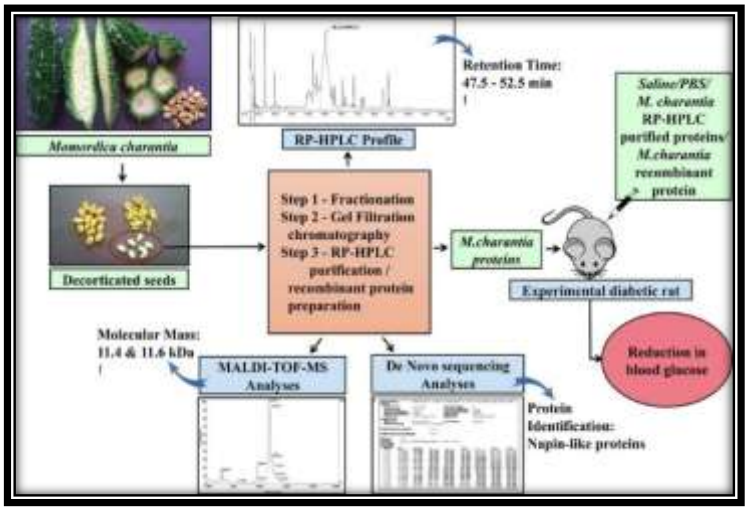
Here are some of the key benefits of bitter melon:

- Boosts immunity: It can help strengthen the immune system and fight off infections.
- Lowers blood sugar: It helps regulate blood sugar levels, making it beneficial for people with diabetes.
- Reduces cholesterol: It can help lower cholesterol levels.
- Fights cancer: Some studies suggest that bitter melon may help prevent and fight certain types of cancer.
- Anti-inflammatory: It can help reduce inflammation in the body.

While bitter melon offers many potential health benefits, it's important to consult with a healthcare professional before using it, especially if you are taking any medications or have underlying health conditions.

Antidiabetic or Hypoglycaemic Activity of Momordica charantia

Bitter melon (Momordica charantia) has been used for centuries to manage diabetes.



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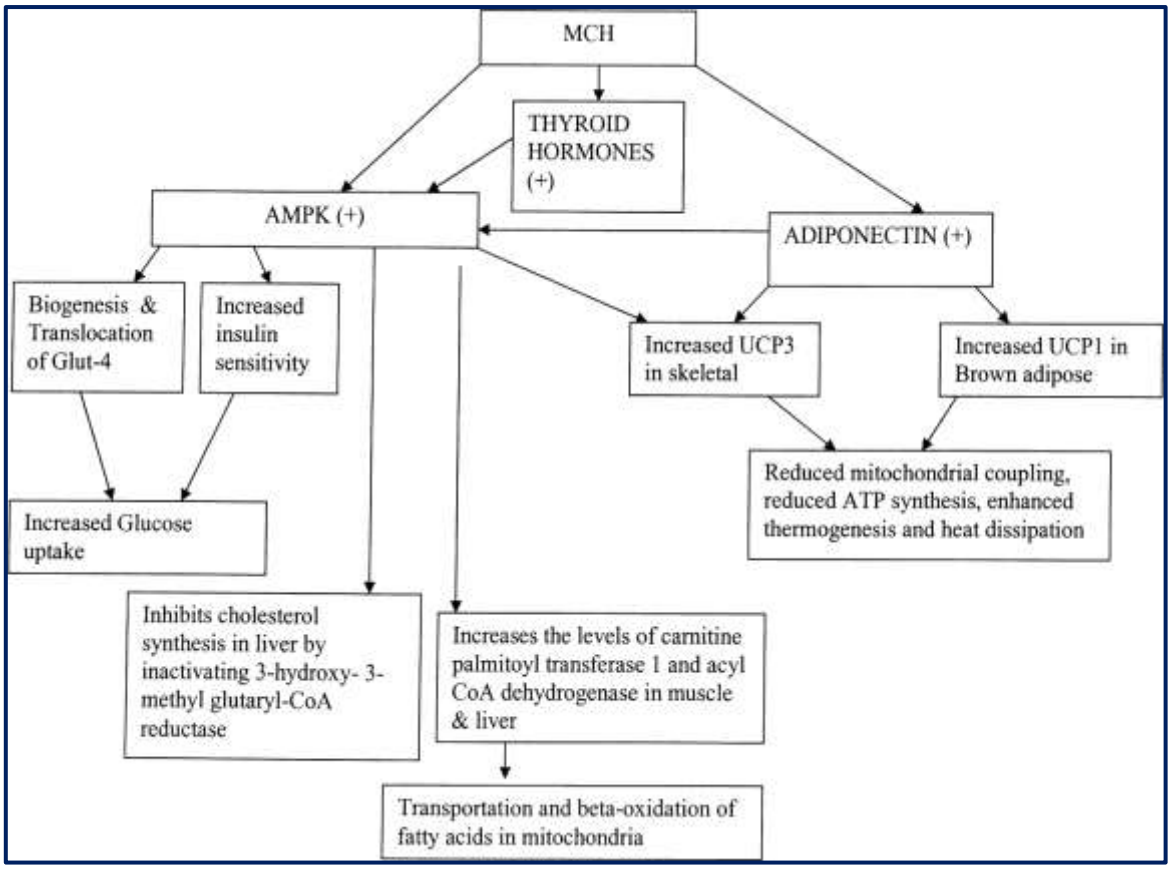
While scientists aren't entirely sure how it works, they've identified a few possible mechanisms:

- Insulin-like Effect: Some components of bitter melon can mimic the effects of insulin, helping to lower blood sugar levels.
- Improved Insulin Sensitivity: Bitter melon can make the body more responsive to insulin, allowing cells to use sugar more effectively.
- Reduced Sugar Absorption: It can slow down the absorption of sugar from the intestines into the bloodstream.
- Increased Insulin Production: It may stimulate the pancreas to produce more insulin.

While these mechanisms are still being studied, bitter melon has shown promise in helping manage diabetes. However, it's important to consult with a healthcare professional before using it as a treatment, as it may interact with other medications.

Mechanism of Action of Momordica charantia

Modes of Action of Momordica charantia in Diabetes Management



Momordica charantia (bitter melon) exerts its anti-diabetic effects through several mechanisms:

➢ Insulin-like Activity:

- Stimulates insulin secretion from pancreatic beta cells.
- Enhances insulin sensitivity in peripheral tissues.
- Glucose Metabolism Regulation:
- Inhibits gluconeogenesis (production of glucose from non-carbohydrate sources) in the liver.
- Promotes glucose uptake and utilization by cells, particularly in muscle and adipose tissue.
- Activates enzymes involved in glycolysis and the pentose phosphate pathway.

➢ Lipid Metabolism Regulation:

- May reduce lipid levels by inhibiting lipid synthesis and promoting lipid breakdown.

➢ Antioxidant Effects:

- Protects cells from oxidative damage, which can contribute to diabetic complications.

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➢ Other Potential Mechanisms:

- May inhibit the absorption of glucose from the intestines.
- May modulate inflammatory pathways.

By targeting these multiple mechanisms, bitter melon can help regulate blood sugar levels and improve overall metabolic health in individuals with diabetes.

Selection Criteria for Formulation of Chewable Lozenges:

- Selection of suitable drug candidates.
- Selection of appropriate drug carrier excipients.

Method of Preparation for Medicated Chewable Lozenges:

Melting and Mold Technique:

a. Melt the PEG.
b. Mix the melted PEG with other ingredients.
c. Pour the mixture into molds.
d. Let the mixture cool and harden into lozenges.

Heating and Congealing Technique :

a. Make the syrup: Heat sugar and water to a specific temperature.
b. Add medicine and other ingredients: Once the syrup is thick, add the medicine and other ingredients.
c. Add plasticizer (if needed): After a certain time, add a plasticizer to make the lozenges softer.
d. Pour into molds: Pour the mixture into molds.
e. Cool and dry: Let the lozenges cool and dry in the molds.
f. Remove lozenges: Take the lozenges out of the molds.

Marketed Supplements of Bitter Melon To Treat Diabetes

Sr.No.	Product Name	Description	Product
1.	Himalaya organic bitter melon capsules..	Support glucose metabolism and blood sugar level.	
2.	Himalaya Karela Metabolic Wellness Tablets.	maintain healthy glucose levels.	
3.	Indian Herbal Valley Karela Powder.	Maintaining healthy blood sugar levels and healthy lipid levels.	

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4.	The tea trove Organic Bitter Melon Tea.	Helps in regulating blood sugar levels.	
5.	Aramacs Bitter Gourd Oil	Purifies blood, activates spleen & liver & good for diabetes.	
6.	Snackwise Bitter Gourd (Karela) Chips		
7.	Taste Good Karela Biscuit	Maintain blood sugar	

IV. CONCLUSION

This text discusses the use of bitter melon (Momordica charantia) to treat diabetes. Diabetes is a growing health problem worldwide, and traditional medicines like bitter melon offer a natural solution.

- Bitter melon has many health benefits, including:
- Lowering blood sugar: It helps control blood sugar levels.
- Improving insulin sensitivity: It makes the body more responsive to insulin.
- Reducing cholesterol: It can help lower cholesterol levels.
- Boosting immunity: It strengthens the immune system.
- Anti-inflammatory effects: It reduces inflammation in the body.
- Bitter melon can be made into lozenges, which are easy to take, especially for children and older adults. These lozenges offer several advantages:
- Easy to use: No need for water.
- Quick action: The medicine starts working quickly.
- Reduced side effects: Less likely to cause stomach upset.
- Improved patient compliance: Easier to take regularly.

Overall, bitter melon lozenges are a promising natural approach to managing diabetes. However, more research is needed to fully understand their benefits and ensure their safety and effectiveness.

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