Preparation of a functional drink as an anti-diabetic green tea from *Glycyrrhiza glabra*

(This report presented in partial fulfillment of the requirements for the degree of Bachelor of Pharmacy)

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APPROVAL

This is notified that a Project report, Preparation of a functional drink as an anti-diabetic green tea from *Glycyrrhiza glabra***,** submitted by 183-46-223 to the Department of Pharmacy, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor of Pharmacy and approved as to its style and contents.

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DECLARATION

I hereby declare that, this project report is done by me under the supervision of **Prof. Dr. Sharif Mohammad Shaheen, The Head & Professor,** Department of Pharmacy, Daffodil International University, in partial fulfillment of the requirements for the degree of Master of Pharmacy. I am declaring that this Project is my original work. I also declare that neither this project nor any part thereof has been submitted elsewhere for the award of Master or any degree.

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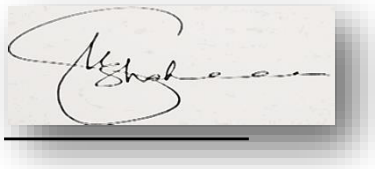

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SABRINA AKTER

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Dedicated to

Abstract

Everyone has desire to be fruitfully fight with metabolic disorders like Diabetes now a days but depending on synthetic drugs way no one can find irrevocable ways to solve it. Taking medicines is now everyday food like habit of many people, who suffer to treat serious diseases depending on only synthetic treatment so far. The aim of the study is to investigate the functionality as anti-diabetic activity of *Glycyrrhiza glabra* Linn (Yashtimadhu) roots from Bangladesh source (Asia) as an innovative way of taking everyday tea. Yashtimadhu roots is already reported having antioxidant acitivity and anti-diabetic activity of it's ethanolic fraction. Green tea form of Yashtimadhu roots have a new generation treatment in the form of tea on Diabetes Mellitus. Regarding Yashtimadhu roots as green tea shows magnificent results upon laboratory study on alloxan induced diabetic mice. Various concentrations of crude drug (w/v) of Glycyrrhiza (20 mg/ml, 30 mg/ml, 35 mg/ml, 40 mg/ml, 50 mg/ml) were administered orally in alloxan induced mice model. It has been found that 35 mg/ml to 40 mg/ml concentration showed a significant difference in lowering blood sugar level, comparing with that of an standard one. The above data showed that Glycyrrhiza glabra might work as quantal dose rather than a graded dose. There was no remarkable hypoglycemia even administering the high concentration beyond the above concentration.

Keywords: Yashtimadhu, *Glycyrrhiza glabra* Linn, Functional drink, Green tea, Diabetes.

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Chapter One
Introduction

1 Introduction

1.1 A functional beverage is a drink typically intended to convey a health benefit, usually as a panacea or a performance-enhancing substance. [1] A functional beverage also a nonalcoholic drink product and its formulation constituents may include one or more from the herbs, amino acids, vitamins, minerals, and crude vegetables or fruits categories.[2]

Functional drinks, however, are beverages with health benefits beyond their nutritional value, positively affecting one or more target functions in the body or mind to achieve an improved state of health and well-being. [3]

Figure 1: Green tea as functional beverage drink.

1.2 Green tea as a functional food for better health. Tea is the most popular drink after water, consumed everyday by millions of people around the world. Tea generally consumed in the forms of green, oolong, and black tea, all of which originate from the leaves of the plant Camellia sinensis, its known Green Tea. Green tea possesses significant antioxidant, anti-inflammatory, antimicrobial, antihypertensive, thermogenic properties. Increasing interest in its health benefits has led to the inclusion of green tea in the group of beverages with functional properties. [4]

Green tea is the healthiest beverage on the planet. It is loaded with antioxidants and nutrients that have powerful effects on the body. These include improved brain function, fat loss, a lower risk of cancer and many other impressive benefits.

Below are 10 health benefits of green tea that supported by studies.

- Green Tea Contains Bioactive Compounds That Improve Health
- Compounds in Green Tea Can Improve Brain Function and Make You Smarter
- Green Tea Increases Fat Burning and Improves Physical Performance

- Antioxidants in Green Tea May Lower Your Risk of Some Types of Cancer
- Green Tea May Protect Your Brain in Old Age, Lowering Your Risk of Alzheimer's and Parkinson's
- Green Tea Can Kill Bacteria, Which Improves Dental Health and Lowers Your Risk of Infection
- Green Tea May Lower Your Risk of Type 2 Diabetes
- Green Tea May Reduce Your Risk of Cardiovascular Disease
- Green Tea Can Help You Lose Weight and Lower Your Risk of Obesity
- Green Tea May Help You Live Longer [5]

Well, all types of tea come from the Camellia Sinensis, thought to be first discovered in China, but green tea is created from a specific process that separates it and its health benefits from the rest.

There are many other means in which we differ between different types of green tea, but here are a few different types of Japanese green tea.

1. Sencha

2. Gyokuro

3. Tencha

4. Matcha

5. Funmatsucha

6. Shincha etc. Lots of but in same process & same method.

Figure 2: Some Green tea dry leafs.

The polyphenol group of green tea catechins has been shown to lower blood sugars, as well as the polysaccharides in green tea EGCG may also help diabetics by mimicking the actions of insulin and inhibiting the liver's production of glucose, thus lowering blood sugar. **[**[6]**]**

Globally, there is an increasing need to consume health promoting foods and beverages as alternatives to synthetic drugs.

1.3 Medicinal plants & Bangladesh common uses herbal plants: "A medicinal plant is any plant which, in one or more of its organ, contains substance that can be used for therapeutic purpose or which is a precursor for synthesis of useful drugs." This definition of Medicinal Plant has been formulated by WHO (World Health Organization).

The plants that possess therapeutic properties or exert beneficial pharmacological effects on the animal body are generally designated as "Medicinal Plants".

It is revealed that even in the developed countries 25%, of the prescribed drugs come from plant sources and herbal medicines are used by about 75-80% of the world's population for primary health care because of their better cultural acceptability, better compatibility with human body and lesser side effects.

Plants and herbs have been the mainstay of treatment in many rural and tribal areas of Bangladesh for the immense availability of medicinal plants in this region. Nature and natural remedies are widely accepted by people around the world from ancient times. Barks, root, stem, flower, seed various parts of plants were used.

Bangladesh has very rich in Bio-diversity. It has more than 500 medicinal plants species (Yusuf *et al*., 1994). An alarmingly populous, but size-wise a very small country is rather unique in having diversified genetic resources in a wide range of habitats. Increasing population pressure and multifarious anthropogenic activities on the natural ecosystems are posing severe and serious threats to once dense and rich genetically diversified plant communities of this country. Loss of habitats from the wild forests as well as from the village groves, cultivated plains and wild lands are quite common in this country.

A broad genetic base has been replaced by a narrow one, and the old genetic diversity is disappearing both inside and outside of the ancient gene centers. This trend is inevitable with the need for highly efficient and uniform cultivars in advanced and sophisticated farming systems. There is no actual figure how many medicinal plants are used in Bangladesh. Chowdhury at SAARC workshop (held on 16-18 June, 2002) gave a brief idea about the amount of medicinal plants used annually in Bangladesh. A few of them are mentioned here: Ashwagondha (*Withania somnifera*)- 56,000 kg, Anantamul (*Hemidesmus indicus*)- 50,000 kg, Kurchi *(Holarrhena antidysenterica*)-1,00,000 kg, Gulancha (*Tinospora cordifolia*)-127,000 kg. According to Hamdard Laboratories (WAQF), in Bangladesh the annual demand for a few medicinal plants are- Satomuli (*Asparagas racemosus*)– 800

tons, Sarpagondha (*Rauvolfia serpentina*)– 1,000 tons, Ghritokumari (*Aloe vera*)– 24,000 tons, Kalomegh (*Andrographis paniculata*)– 1,000 tons (Hassan, 2003).

In Bangladesh there are about 297 Unani, 204 Ayurvedic and 77 Homeopatheic drug manufacturing industries where the medicinal plants are extensively used in both raw and semi– processed forms of medicine in various pharmaceutical dose formulations.

Scientific name	**Bengali name**	**English name**	**Used parts**	**Used as patent drugs**
Winthania somnifera Dunal	Ashwagandha	Winter Cherry	Root, Leaf, Fruit, Seed, whole plant	Syrup Masturin, Arq Ashwaganda. Magun Sohag Soonth
Aloe vera Tour. ex Linn.	Ghritokumari	Aloe	Leaf	Tablet Suranjan, Tablet Mudir, Syrup Belgiri
*Andrographis panniculata*Wall.ex Nees.	Kalomegh	Creat	Leaf, Stem, whole plant	Syrup Safi, Syrup Kurchi
Asparagus racemosus Willd.	Satomuli	Aspargus	Tuberous root, Leaf, Flower, Fruit	Tablet Abiaj, Khisandha, Ka-4, Sufoof Gigian
Plumbago zeylanica Linn.	Chita		Root	Majoon Falasefa, Syrup Kurchi
Adhatoda zeylanica Nees. (Syn. name- *A. vasica* Linn.)	Vasak	Vasaka	Leaf, Stem, Bark, Root, Flower	Syrup Saduri, Chawan Prash, Tablet Sualin, Syrup Ajaj
Rauvolfia serpentine (Linn.) Benth.	Swarpagandha	Snake root	Root	Syrup Mangurin
Glycyrrhiza glabra Linn.	Jastimodhu	Liqourice root	Root, Stem	Tablet Sualin, Mauol Hiat, Syrup Badian, Tablet Kafur

Table 1. Medicinal plant species listed by WHO which can be grown in Bangladesh commercially.

Herbal drugs are becoming popular because they are holistic in nature, able to look beyond the symptoms to the underlying systemic imbalance. When applied by the trained practitioners, herbal medicine offers very real and permanent

solution to very real problems. In fact, century old nature friendly medicare system has stood the test of time and holds promise for the present and the future.Cultivation of medicinal plants gives scope to improve the quality of the drugs. There is a growing demand today for plant-based medicines and health products, pharmaceuticals, food supplements, cosmetics etc. in the international market. [7]

1.4 Medicinal plants or herbal plants usage on Diabetes:

The usage of medicinal plants is traditionally rooted in Bangladesh and still an essential part of public healthcare. Recently, a dramatically increasing prevalence brought diabetes mellitus and its therapy to the focus of public health interests in Bangladesh. We conducted an ethnobotanical survey to identify the traditional medicinal plants being used to treat diabetes in Bangladesh and to critically assess their anti-diabetic potentials with focus on evidence-based criteria.

In total 37 medicinal plants belonging to 25 families were reported as being used for the treatment of diabetes in Bangladesh. The most frequently mentioned plants were *Coccinia indica*, *Azadirachta indica*, *Trigonella foenum-graecum*, *Syzygium cumini*, *Terminalia chebula*, *Ficus racemosa*, *Momordica charantia*, *Swietenia mahagoni*. [8]

1.5 Other plants: Other plants used traditionally throughout the globe to treat various diseases. Traditionally used medicinal plants are an essential part of the health sector in Bangladesh due to its abundance of a vast source of ethno-medicine. Rural people from developing country like Bangladesh are greatly dependent on traditional source of medicine. The prevalence of diabetes mellitus is increasing from recent years; therefore various researches are going on to discover better medicine to treat this disease. This study has focused on five plants which are *Andrographis paniculata*, *Ageratum conyzoides*, *Swertia chirata*, *Terminalia arjuna* and *Azadirachta indica* to find out their traditional formulation as anti-diabetic medicine and their pharmacological activity has also been explored through literature search.

There has been a great deal of research surrounding diabetes over the years, the fact that there are a large number of sufferers worldwide. Patients often struggle to make the necessary lifestyle changes to control blood sugar levels, and current medications have limitations and can have adverse gastrointestinal side effects. Clinical studies and research have often recommended the use of natural or herbal cure for diabetes, rather than relying solely on drugs. Traditional herbs may offer

a new option for managing blood sugar levels, either alone or in combination with other treatments. Some of the important herbs in this row include the following.

Bitter melon (*Momordica charantia***), Bitterwood (***Quassia amara***), Holy basil (***Ocimum sanctum***),** *Aloe vera* **and** *Aloe barbadensis,* **Garlic (***Allium sativum***), Cinnamon (***Cinnamomum***),** *etc. many other herbal plants.*

Active lifestyle and proper medical intervention can prevent progression to diabetes. Natural God gifted herbs that prevent diabetes have no ill side effects unlike the man-made market pharmaceuticals and food enhanced chemicals. Incorporating these herbs in our daily routine can surely help pre-diabetics stay healthy for longer time without progressing to type-2 diabetes & type-1 diabetes. [9]

1.6 Introducing Yashtimadhu (Glycyrrhiza glabra Linn):

Glycyrrhiza glabra (Eng. Name Liquorice) – a potent medicinal herb. There is an increasing demand for herbal medicines, health products, pharmaceuticals.

Glycyrrhiza glabra Linn is a plant used in traditional medicine across the world for its ethnopharmacological value. It is found to contain important phytoconstituents such as glycyrrhizin, glycyrrhizinic acid, glabrin A and B and isoflavones. It is effectively used as anti-inflammatory, anti-bacterial, anti-fungal, anti-diabetic, anti-viral, anti-ulcer, antitussive, anti-oxidant, skin whitening, anti-diuretic agent. The present article is an effort to compile the available literature on Glycyrrhiza glabra with respect to its traditional uses, bioactive constituents and pharmacologic activities.

Glycyrrhiza glabra Plant *Glycyrrhiza glabra roots*

Figure3: Glycyrrhiza glabra (Yashtimadhu) Plant & roots.

Glycyrrhiza glabra Linn is one of the most extensively used medicinal herb from the ancient medical history of Ayurveda. It is also used as a flavoring herb.

The word Glycyrrhiza is derived from the Greek term glykos (meaning sweet) andrhiza (meaning root). Glycyrrhiza glabraLinn, commonly known as 'liquorice' and 'sweet wood' belongs to Leguminosae family. Vernacular names for liquorice are Jeshthamadh(Marathi), Jothi-madh (Hindi), Yashtimadhu, Madhuka (Sanskrit), Jashtimadhu, Jaishbomodhu (Bengali), Atimadhuram, Yashtimadhukam (Telugu).

1.7 Scientific Classification of *Glycyrrhiza glabra:*

Kingdom: *Plantae*

Division: *Angiospermae*

Class: *Dicotyledoneae*

Order: *Rosale*

Family: *Leguminosae*

Genus: *Glycyrrhiza*

Species: *glabra Linn*

Glycyrrhiza glabra roots

A large number of components have been isolated from the liquorice roots. 40-50 percent of total dry material weight of Glycyrrhiza glabrais accounted by water-soluble, biologically activecomplex. Starches (30%), pectins, polysaccharides, simple sugars, gums, mucilage (Rhizome), amino acids, triterpene saponin, flavonoids, mineral salts, bitters, essential oil, fat, asparagines, female hormone estrogen, tannins, glycosides, protein, resins, sterols, volatile oils and various other substances are components of this complex

The primary active ingredient, Glycyrrhizin (glycyrrhizic acid; glycyrrhizinate) constitutes 10–25% of liquorice root extract. It is a saponin compound (60 timessweeter than cane sugar) comprised of a triterpenoid aglycone, glycyrrhetic acid (glycyrrhetinic acid; enoxolone) conjugated to a disaccharide of glucuronic acid. Glycyrrhizin and glycyrrhetic acid can exist in the 18α and 18β stereoisomer forms. Glycyrrhizin is considered to be the most common of the Asiatic folk medicines to be used as an anti-inflammatory agent on neutrophil functions including ROS (reactive oxygen species) generation.14Thus, Glycyrrhizinis considered as quenching agent of free radicals and also as blocking agent of lipid peroxidation chain reactions. Glycyrrhizin showed chemopreventive, antioxidant and antiproliferative activity when tested on animal model. [10]

Glycyrrhiza's name reflects its most popularly known claim to fame: "sweet root." Sweet and unctuous, licorice is supposed to have a cooling effect and helps balance vata and pitta. Apart from being a remedy unto itself, licorice also used in many herbal concoctions for its sweet flavor, helping mask other bitter herbs.

Licorice or *Glycyrrhiza glabra* Linn is so much more than just a distinctive flavored candy or flavoring agent. In use for generations in Iranian and Chinese traditional medicine and ayurveda, licorice or yashtimadhu can come in handy for all manner of ailments - including many which are increasingly relevant today like managing stress or treating gastric ulcers.

1.8 Benefits of Yashtimadhu roots (*Glycyrrhiza glabra* Linn):

There are more than 300 different compounds in licorice, some of which have antiviral and antimicrobial properties. Health benefits of this natural remedy of Licorice or *Glycyrrhiza glabra* Linn are given below of some:

- ✓ Fights Upper Respiratory Tract Infections
- ✓ Prevents Tooth Decay And Fights Oral Infections
- ✓ Helps Memory and Learning
- ✓ Eases Stress and Revitalizes the Brain
- ✓ Controls Diabetes Symptoms of Excessive Thirst and Hunger
- ✓ Reduces Menopausal Hot Flashes
- ✓ Counters Skin Problems and Improves Skin Tone
- ✓ Tackles Peptic Ulcers
- ✓ Keeps Your Heart in Good Shape
- ✓ Protects the Liver
- ✓ Eases Mucositis, a Side Effect Of Chemotherapy And Radiation
- ✓ *Skin inflammation and infection (Eczema)*
- ✓ *extract reduced nausea, stomach pain, and heartburn & treat Infection with bacteria called Helicobacter pylori can cause peptic ulcers in some people.*
- ✓ *Glycyrrhizin may help treat hepatitis C, a virus that infects the liver. Without treatment, hepatitis C can cause inflammation and long-term liver damage.*
- ✓ *Some research suggests that licorice may help kill bacteria in the mouth that cause tooth decay.*
- ✓ *Gargling a licorice solution for 1–15 minutes before surgery was as effective as a ketamine gargle in reducing the incidence and severity of POST (postoperative sore throat).*

- ✓ *Roots of Glycyrrhiza glabra being tonic, demulcent laxative emollient are used in genito-urinary diseases*
- ✓ *Medicinally, it is used internally for Addison's disease, Asthma, Bronchitis, Peptic ulcer, Arthritis, Allergic complaints and steroid therapy*
- ✓ *roots were also demonstrated to have antidepressant, hypotensive hepatoprotective, spasmolytic, memory strengthening activity. Licorice roots are used for its demulcent property.*
- ✓ *It is also useful in gout, asthma, sore throat, tonsillitis, flatulence, sexual debility, epilepsy, hyperdypsia, fever, coughs, skin diseases, swellings, acidity, leucorrhoea, bleeding, jaundice, hiccough, hoarseness, and vitiated conditions of vata dosha, gastralgia, cephalalgia, ophthalmopathy and pharyngodnia.*

- ✓ *Licorice is an important ingredient in medicinal oils for epilepsy, paralysis, rheumatism, haemorrhagic diseases. It is also used in the treatment of diarrhoea, fevers, fever with delirium and anuria.*

- ✓ *Liquorice decreases serum testosterone level in women and is beneficial in aplastic anemia. Since, liquorice extract is used in auto-immune conditions and has therapeutic benefit in immunodeficiency conditions like AIDS. Components of licorice root have both estrogenic and anti-estrogenic activity. [11]*

1.9 Phytochemistry of Yashtimadhu (*Glycyrrhiza glabra* Linn):

The roots of *Glycyrrhiza glabra* Linn.contain glycyrrhizin, which is a saponin that is 60 times sweeter than cane sugar; Flavonoid rich fractions include liquirtin, isoliquertin liquiritigenin and rhamnoliquirilin and five new flavonoids-glucoliquiritin apioside, prenyllicoflavone A, shinflavanone, shinpterocarpin and 1-metho-xyphaseolin isolated from dried roots. Isolation and structure determination of licopyranocoumarin, licoarylcoumarin, glisoflavone and new coumarin-GU-12 also isolated. Four new isoprenoid-substituted phenolic constituents – semilicoisoflavone B, 1-methoxyficifolinol, isoangustone A, and licoriphenone isolated from roots.

A new prenylated isoflavan derivative, kanzonol R was also isolated. The presence of many volatile components such as pentanol, hexanol, linalool oxide A and B, tetramethyl pyrazine, terpinen-4-ol, α-terpineol, geraniol and others in the roots is reported. Presence of propionic acid, benzoic acid, ethyl linoleate, methyl ethyl ketine, 2, 3-butanediol, furfuraldehyde, furfuryl formate, 1-methyl-2-

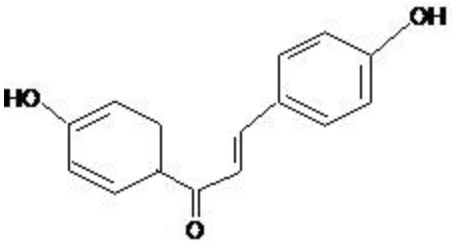
formylpyrrole, trimethylpyrazie, maltol and any other compounds is also isolated from the essential oil.

The Indian roots show various 2-methyliso - flavones, and an unusual coumarin, C liquocoumarin, 6 - acetyl- 5, hydroxy- 4 - methyl coumarin. Asparagine is also found. Glycyrrhizin (glycyrrhizic acid; glycyrrhizinate) constitutes 10–25% of licorice root extract and is considered the primary active ingredient. Glycyrrhizin is a saponin compound comprised of a triterpenoid aglycone, glycyrrhetic acid (glycyrrhetinic acid; enoxolone) conjugated to a disaccharide of glucuronic acid.

Both glycyrrhizin and glycyrrhetic acid can exist in the 18α and 18β stereoisomers. As a tribasic acid, glycyrrhizin can form a variety of salts and occurs naturally in licorice root as the calcium and potassium salts.

The ammoniated salt of glycyrrhizin, which manufactured from licorice extracts, is used as a food flavoring agent and specifications for this salt form have been established in the Food Chemicals Codex. Carbenoxolone (18-βglycyrrhetinic acid hydrogen succinate), an analog of glycyrrhetic acid, is used in the treatment of some alimentary tract ulcerative conditions, such as peptic ulcers.

Some Chemical Structures from *Glycyrrhiza glabra roots***:**



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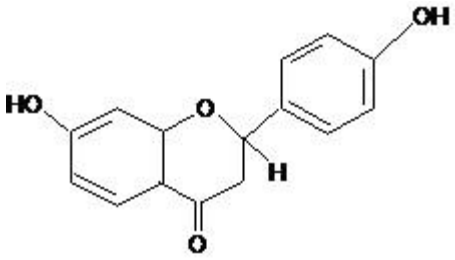

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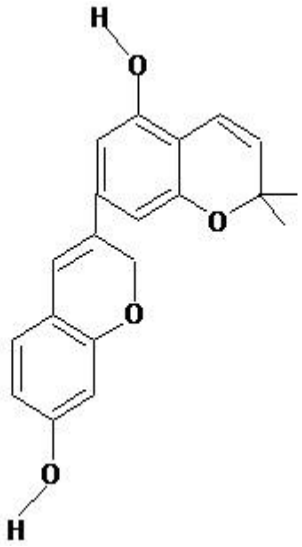

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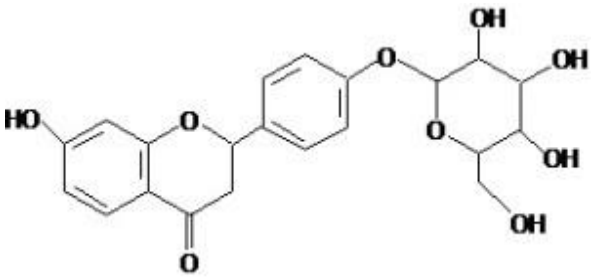

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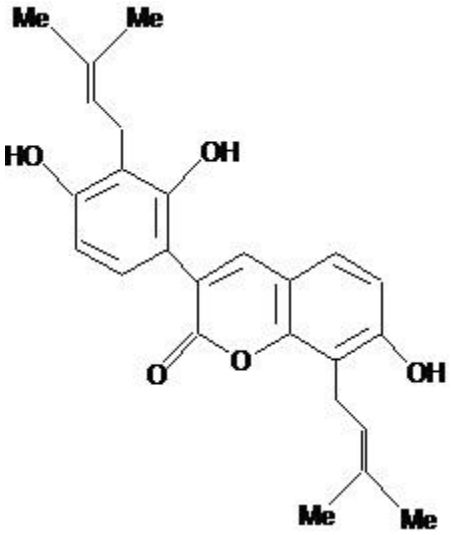

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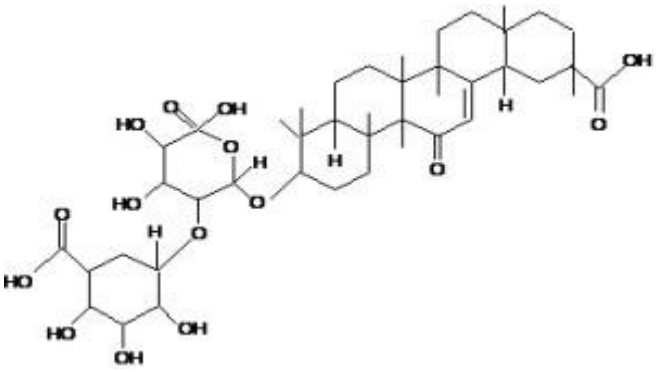


GLYCYRRHIZIN

Figure 4: Some common chemical structures of Glycyrrhiza glabra

Presence of chemical compounds indicates that the plant could serve as "lead" for development of novel agents for disorders in the coming years. In this regard, further studies need to carried out to explore Glycyrrhiza glabra Linn for its potential in preventing and treating diseases.

The Liquorice of medicine and commerce is derived from the sweet root of various species of Glycyrrhiza, a genus which contains about fourteen species, natives of warmer temperate countries in both the New and Old Worlds, ten of them having roots more or less sweet, but most of them not sufficiently so to be of use. Liquorice is one of the most commonly used herbs in Western herbal medicine. Liquorice has been used in medicine for more than 4000 years.

However, among the estimated 250,000-400,000 plant species, only 6% have been studied for biological activity, and 15% have been investigated phytochemically. This shows a need for planned activity guided phyto-pharmacological evaluation of herbal drugs. This article intends to provide an overview of the chemical constituents present in various parts of *Glycyrrhiza glabra* and their pharmacological actions.

Glycyrrhiza glabra Linnis one of the most widely used herb from the ancient medical history of Ayurveda, both as a medicine and also as a flavoring herb. *Glycyrrhiza glabra* Linn is commonly known as Yashti-madhu. *[12]*

1.10 Yashtinadhu (*Glycyrrhiza glabra* Linn) for Diabetes new way of treatment:

First, to know the Diabetes Mellitus (DM) is a metabolic disorder, which is greatly prevalent in Bangladesh, and the use of traditional medicinal plants for its treatment is very popular. Total 30 medicinal plants belonging to 18 families were accounted for the treatment of DM in Bangladesh. The most widely mentioned plants were, *Coccinia indica* (Telachuka), *Azadirachta indica* (Neem), *Trigonella foenum-graecum* (Methi), *Syzygium cumini* (Jam), *Terminalia chebula* (Horituki), *Ficus racemosa* (Joiggi dumur), *Momordica charantia* (Korolla), *Swietenia mahagoni* (Mahogany)., *Phyllanthus emblica* (Amloki), *Terminalia bellirica* (Bohera), *Tinospora cordifolia* (Gulancha lota), *Lagerstroemia speciosa* (Jarul), *Withania somnifera* (Aswagandha). Although a large number of traditional, medicinal plants being used for the treatment of DM in Bangladesh, extensive clinical intervention studies are essential prior to recommend their use to ensure proper public health outcomes. [13]

Diabetes is a disease in which your blood glucose, or blood sugar, levels are too high. Glucose comes from the foods you eat. Insulin is a hormone that helps the glucose get into your cells to give them energy. With type 1 diabetes, your body does not make insulin. With type 2 diabetes, the more common type, your body does not make or use insulin well. Without enough insulin, the glucose stays in your blood. You can also have prediabetes. This means that your blood sugar is higher than normal but not high enough to be called diabetes. Having prediabetes puts you at a higher risk of getting type 2 diabetes.

Over time, having too much glucose in your blood can cause serious problems. It can damage your eyes, kidneys, and nerves. Diabetes can also cause heart disease, stroke and even the need to remove a limb. Pregnant women can also get diabetes, called gestational diabetes. [14]

There are a few different types of diabetes:

Type 1 diabetes is an autoimmune disease. The immune system attacks and destroys cells in the pancreas, where insulin made. It is unclear what causes this attack. About 10 percent of people with diabetes have this type.

Type 2 diabetes occurs when your body becomes resistant to insulin, and sugar builds up in your blood.

Prediabetes occurs when your blood sugar is higher than normal, but it is not high enough for a diagnosis of type 2 diabetes.

Gestational diabetes is high blood sugar during pregnancy. Insulin-blocking hormones produced by the placenta cause this type of diabetes.

Symptoms of diabetes

-Diabetes symptoms caused by rising blood sugar.

General symptoms

The general symptoms of diabetes include:

- increased hunger
- increased thirst
- weight loss
- frequent urination
- blurry vision
- extreme fatigue
- sores that don’t heal

Symptoms in men

In addition to the general symptoms of diabetes, men with diabetes may have a decreased sex drive, erectile dysfunction (ED), and poor muscle strength.

Symptoms in women

Women with diabetes can also have symptoms such as urinary tract infections, yeast infections, and dry, itchy skin.

Type 1 diabetes

Symptoms of type 1 diabetes can include:

- extreme hunger
- increased thirst
- unintentional weight loss
- frequent urination
- blurry vision
- tiredness
- It may also result in mood changes.

Type 2 diabetes

Symptoms of type 2 diabetes can include:

- increased hunger
- increased thirst
- increased urination
- blurry vision
- tiredness
- sores that are slow to heal

It may also cause recurring infections. This is because elevated glucose levels make it harder for the body to heal.

Gestational diabetes

Most women with gestational diabetes don't have any symptoms. The condition is often detected during a routine blood sugar test or oral glucose tolerance test that is usually performed between the 24th and 28th weeks of gestation.

In rare cases, a woman with gestational diabetes will also experience increased thirst or urination. [15]

1.11 Focus on symptoms of diabetes uses of *Glycyrrhiza glabra (Yashtimadhu):*

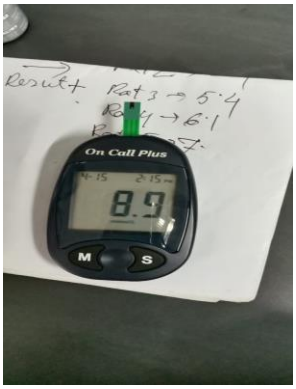
The root of Glycyrrhiza glabra is knows as liquorice. It has various medicinal uses. It is

cited as belonging to plants that reduce blood sugar levels. Liquorice can help to treat diabetes. It possesses hypoglycemic properties and its consumption helps in lowering glucose or sugar in blood. Alpha amylase method is used to demonstrate the Antidiabetic activity. The present study targets the potential use of Glycyrrhiza glabra which could be an alternative approach for many diseases such as Diabetes.

Diabetes mellitus commonly referred to as diabetes, is a group of metabolic diseases in which there are high blood sugar levels over a prolonged period. Symptoms of high blood sugar include frequent urination, increased thirst and increased hunger.

The root of *Glycyrrhiza glabra* is knows as liquorice root. It has various medicinal uses among them found that it reduce blood sugar levels. So, Liquorice can help to treat diabetes on our discussion project. [16]

Glycyrrhiza glabra roots green tea



Glucometer

Figure 5: *Glycyrrhiza glabra roots green tea & Diabetes glucometer test.*

New methodology of this root discussed on next chapter.

Chapter Two
Methodology

2 Materials & Methods of preparation of Yashtimadhu Green tea

2.1 Collection of Yashtimadhu root (*Glycyrrhiza glabra root):*

Glycyrrhiza glabra Linn. commonly known as Licorice/Liquorice, Sweet wood, Mulahatti and Yashtimadhu.

Yashtimadhu roots collected from locally market from Bangladesh to given up a new functional drink as act like Green tea to gather data on Diabetes activity.

Figure 6: *Glycyrrhiza glabra root*

2.2 Materials for preparing Yashtimadhu roots (*Glycyrrhiza glabra)* Green tea:

- Beaker
- Hot water
- Yashtimadhu roots (*Glycyrrhiza glabra)*sticks
- Weight balance

Weight balance

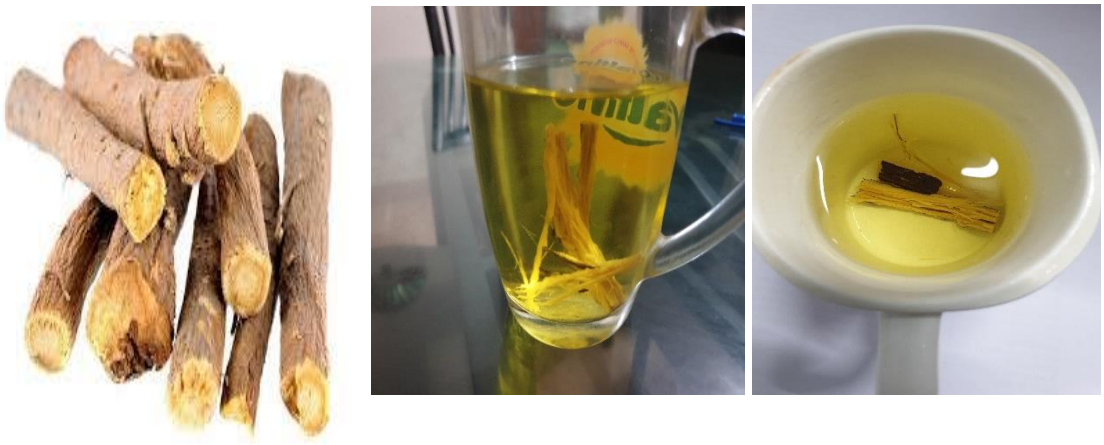
Beaker & Hot water

Yashtimadhu roots Green tea *Dry Glycyrrhiza glabra root*

Figure 7: Materials as Wt. balance, Beaker & Hot water, *Glycyrrhiza glabra root green tea & dry Glycyrrhiza glabra root.*

2.3 Preparation of Yashtimadhu roots (*Glycyrrhiza glabra root) Green tea:*

- First, added 100ml boil water in a beaker & then added 4gm of sticks of Yashtimadhu roots on that beaker & until wait for green color & cool.
- Second, after cool in room temperature we move further process on it.
- Third, collect 40mg/ml from that solution as green tea of Yashtimadhu roots for experiment on mice.
- On a similar manner different doses made to test over different times again & again like 20mg/ml, 35mg/ml, 40mg/ml, 50mg/ml etc. to identify more clear results.



Glycyrrhiza glabra root ***Glycyrrhiza glabra root Green Tea***

Figure 8: Preparation of Glycyrrhiza glabra root Green tea as functional drink.

2.4 Collection of mice for treating with Yashtimadhu roots (*Glycyrrhiza glabra)*:

- Collecting 15 mice on Laboratory to experiment further with Yashtimadhu roots.

2.5 Collection of Alloxan to give mice for Diabetes:

- We used Alloxen for Diabetes testing from our laboratory.

2.6 Alloxan- induced for Diabetes:

- Alloxan-induced diabetes, a common model for evaluating the glycemic-control potential of therapeutic compounds and plants extracts in experimental studies. Notably, alloxan is far less expensive and more readily available than streptozotocin. On this ground, one will logically expect a preference for use of alloxan in experimental diabetes studies.
- Alloxan which is chemically known as 5,5-dihydroxyl pyrimidine-2,4,6-trione is an organic compound, a urea derivative, a carcinogen and cytotoxic glucose analog.

- Alloxan is one of the common diabetogenic agents often used to assess the antidiabetic potential of both pure compounds and plant extracts in studies involving diabetes.
- Alloxan-induced diabetes is a form of insulin-dependent diabetes mellitus that occurs as a result of alloxan administration or injection to animals. It has been successfully induced in a variety of animal species; rabbits, mice, rats, monkeys, cats and dogs. Alloxan has been administer in single or multiple doses, through different routes (intraperitoneal, intravenous and subcutaneous); with single intraperitoneal administration, apparently the most employed mode. [17]

2.7 Alloxan induced calculation for inducing in mice::

- Alloxan given single dose by intraperitoneal route of administration on 10 mice to get Diabetes within 72hours.

- Calculation given below:

  1000gm mice give Alloxan ---------- 0.2gm
  1gm ” ” ” ---------- (0.2/1000) gm
  r35gm ” ” ” ---------- (0.2*35/1000) gm = 0.007gm = 7mg

- After 72hours we collected data of each mice have Diabetes type 1 with results we move further for measuring with using Yashtimadhu roots tea solution.

2.8 Preparation of Alloxan solution for inducing Diabetes on mice:

- Added 0.9% NaCl solution 0.5ml and 0.5ml water with 7mg to prepare Alloxan solution for each mice.

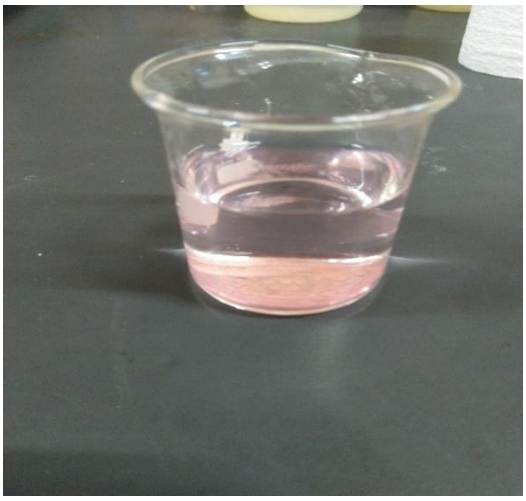


Figure 9: Alloxan solution

- After ready solution given to each mice intraperitoneal route for administration & wait until 72hours.

- After 72hours we collected data of each mice found with Diabetes type 1 with results we move further for measuring with using Yashtimadhu roots tea solution.

- Results & further discussion given on next chapter.

Chapter Three
Results & Discussion

3 Results & Discussion of Yashtimadhu (*Glycyrrhiza glabra)* Green Tea

- Differences between common Green tea & Yashtimadhu (*Glycyrrhiza glabra)* Green tea roots color given below for better performances & get well solution to treat Diabetes numerically.

Green tea (market product) ***Glycyrrhiza glabra root green tea***

Figure 10: *Glycyrrhiza glabra root Green tea & Green tea (Market product).*

3.1 Normal mice count for findings results of *Glycyrrhiza glabra root green tea*:

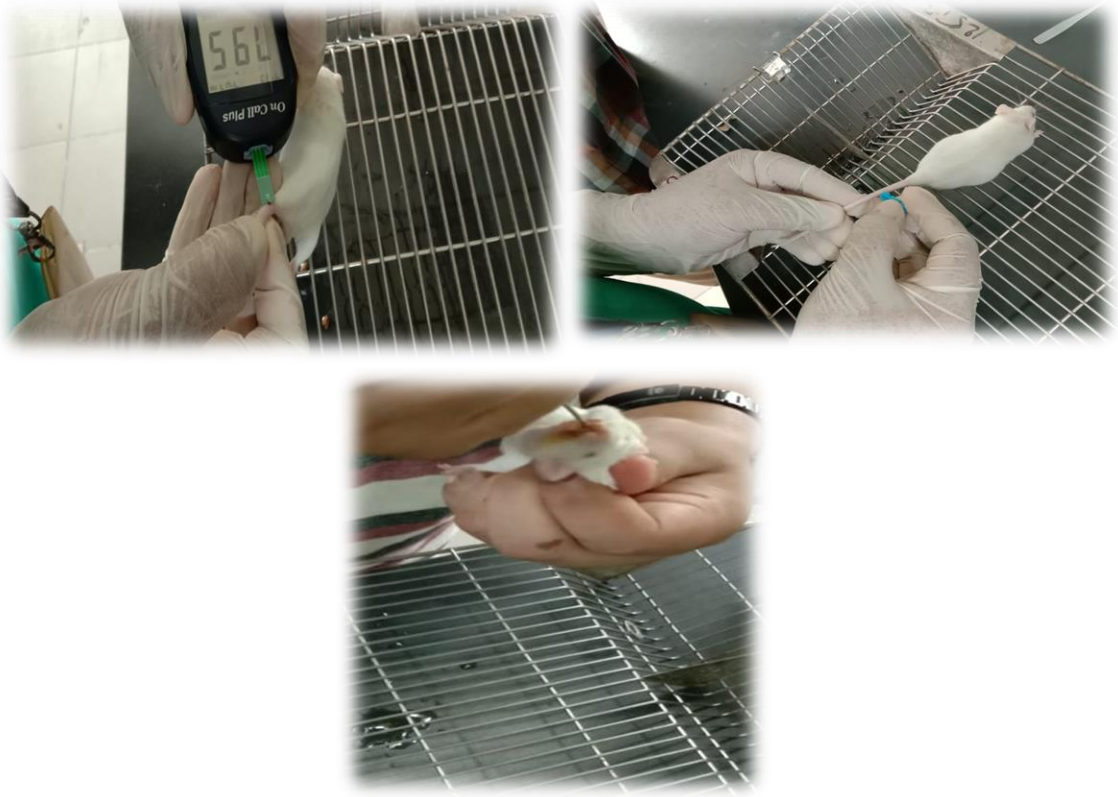
- Normal mice taken 5 mice a side with completely normal functioning without diabetes & also get their blood glucose level on check for data.

- Upto 7days they are completely normal in control with no diabetes on laboratory.

3.1.1 Glucometer measurement & feeding of Green tea mice process:

- Feeding wit feeding needle of Green tea of Yashtimadhu roots in lab & after 3hours in a day get the results of Blood Glucose level of Diabetes test up to 7 days in same manner.

- Some figures shown below of Yashtimadhu Green tea feeding with needle & mice-



Feeding needle for mice

Figure 11: Mice & Glucometer measurement of Blood glucose level (Diabetes) test.

-Pls see given below 5mice blood glucose level data respectively on a table.

SL no.	Without Diabetes as Normal mice (each 35 or 36gm)	Blood Glucose level test (mmol/L)
1	Mice1	5.5
2	Mice2	5.1
3	Mice3	5
4	Mice4	5.3
5	Mice5	5

Table no. 2: Normal mice blood glucose level (mmol/L).

3.2 Diabetic mice count results discussion:

- 5 mice were completely with diabetes type 1 after given Alloxan time count for 72hours & get all data of blood glucose level simultaneously.

- Given data results of 10mices diabetes type 1 after 72hours respectively below table.

SL no.	With Diabetes after 72hours (each 35 or 36gm)	Blood Glucose level test (mmol/L)
1	Mice1	9
2	Mice2	12
3	Mice3	8.1
4	Mice4	8.1
5	Mice5	11

Table no. 3: Diabetic mice blood glucose level (mmol/L).

3.3 Yashtimadhu roots green tea data analysis respectively with Glucometer:

3.3.1 Given dose as 40mg/ml each mice & get results from Glucometer respectively:

- By using a feeding needle to feed all mice respectively to collect the data by using Glucometer named as On call plus.

- Given Data serially on a table after given Yashtimadhu roots Green tea on mice respectively.

- First table given data exactly after 72hours & more time use of Yashtimadhu roots in 1st day.

- Here, in dose of 40mg/ml given data respectively up to 4days using of Green Yashtimadhu roots tea.

- Here, 3 days long activity on control by using Yashtimadhu green tea respectively daily using one time or two-timing feeding.

-All data given by each day divided using of Yashtimadhu on mice repeatedly each data shows better results than each day.

SL no.	With Diabetes Mice (each 35 or 36gm)	Blood Glucose level test of 72hours (mmol/L)	Yashtimadhu roots given after 72hours up to 1st day glucose level
1	Mice1	9	7.5
2	Mice2	12	8.1
3	Mice3	8.1	5.4
4	Mice4	8.1	6.1
5	Mice5	11	7

Table no. 4: 1st day after 72hours with Diabetes given data after using Yashtimadhu roots tea.

- After get results we not given any feeds to mice & after 20hours of fasting collect blood glucose level of mice on 2nd day.
- Using Yashtimadu at morning 9:30 am after 3hours get results given below on

SL no.	Diabetic Mice (each 35 or 36gm)	Blood Glucose level after 20hours(mmol/L) Fasting	After given Yashtimadhu roots 2nd day
1	Mice1	8.6	5.8
2	Mice2	8	6.1
3	Mice3	7.6	6
4	Mice4	7.2	5.9
5	Mice5	9	4.6

table respectively shown that after 20hours data & then using Yashtimadhu roots data for assuring & measuring results.

- Again, after 20 hours fasting measuring mice all were gain diabetes in results with glucometer.
- Then we given all mice Yashtimadhu 40mg/ml again at morning 9:30am preparing & given to them to get results.
- After 3hours at 2pm get the results which given on table of 2nd day using Yashtimadhu root tea.

Table no. 5: 2nd day after 20hours fasting & given Yashtimadhu roots Green tea results.

- 3rdday results simultaneously given data table also below. Here, again next day prepred green tea cool in room temperature & given mice just before we collect the fasting mice blood glucose level for confirming they have diabetes in control or not.
- Again prepare Green tea of Yashtimadhu roots, cool it & given by feeding needle to each of mice & get after 3hours of feeding results respectively on below table for better comparing.

SL no.	Diabetic Mice (each 35 or 36gm)	Blood Glucose level 3rd day data (mmol/L) Fasting	After given Yashtimadhu 3rd day
1	Mice1	8.1	6.6
2	Mice2	7.3	5.4
3	Mice3	7.1	5.9
4	Mice4	8.3	6
5	Mice5	8.9	6

Table no. 6: 3rd day of fasting & given Yashtimadhu roots Green tea results.

3.3.2 Given dose as 20mg/ml each mice & get results from Glucometer respectively:

- By using 40mg/ml 3days, data same mice & get results then on same mice we give lower dose than that to collect data respectively due to fix the amount of daily intake quantity of mice, which net weight as 35gm.

- 20mg/ml dose data given below on this dose we given on mice up to 2 days & results given below for better comparing.

SL no.	Diabetic Mice	Blood Glucose level 4^{th} day data (mmol/L) Fasting	After given Yashtimadhu on mice at 20mg/ml
1	Mice1	10	9.7
2	Mice2	9.3	8.9
3	Mice3	9.1	8.8
4	Mice4	10.2	9.6
5	Mice5	9.7	8.9

Table no.7: 4^{th} day of fasting & given 20mg/ml Yashtimadhu roots Green tea results.

- 20mg/ml dose data given below on this dose we given on mice up to 2nd day as 5th day & results given below for better comparing.

SL no.	Diabetic Mice	Blood Glucose level 5th day data (mmol/L) Fasting	After given Yashtimadhu on mice at 20mg/ml
1	Mice1	10.7	10.6
2	Mice2	11	8
3	Mice3	10.2	8.9
4	Mice4	10.1	8.9
5	Mice5	9	8.1

Table no. 8: 5th day of fasting & given 20mg/ml Yashtimadhu roots Green tea results.

3.3.3 Given dose as 30mg/ml each mice & get results from Glucometer respectively:

- After 20mg/ml dose data given below on this dose we given on mice up to 2 days & results given below for better comparing we again give 30mg/ml each mice on same mice & control over it by measuring each mice by Glucometer on same manner.
- All 2 days data given below respectively with fasting & Yashtimadhu in a day results.
- Here given table no is shown data of 6^{th} day fasting & using Yashtimadhu roots tea respectively results.

SL no.	Diabetic Mice	Blood Glucose level 6^{th} day data (mmol/L) Fasting	After given Yashtimadhu roots on mice at 30mg/ml
1	Mice1	9.9	8
2	Mice2	9	8.5
3	Mice3	10.2	9.2
4	Mice4	11	10
5	Mice5	10	8.2

Table no. 9: 6^{th} day of fasting & given 30mg/ml Yashtimadhu roots Green tea results.

- After 6th day data collected then we measure same dose given by next day 7th day respectively & shown data rsults below on table no.
- 7thday results of Yashtimadhu Green tea on a same manner measurement by Glucometer.

SL no.	Diabetic Mice	Blood Glucose level 7th day data (mmol/L) Fasting	After given Yashtimadhu roots on mice at 30mg/ml
1	Mice1	10	8.6
2	Mice2	9.1	8.2
3	Mice3	11	9.9
4	Mice4	8.9	9.2
5	Mice5	9.6	8

Table no. 10: 7th day of fasting & given 30mg/ml Yashtimadhu roots Green tea results.

3.4 Among all data of *Glycyrrhiza glabra in different doses comparison:*

- Despite of some results among 3 different doses more potent results get from 40mg/ml rest of the three doses as 40mg//ml, 30mg/ml & 20mg/ml. Yashtimadhu roots green tea effects must present on Diabetic mice shown above results proven that.

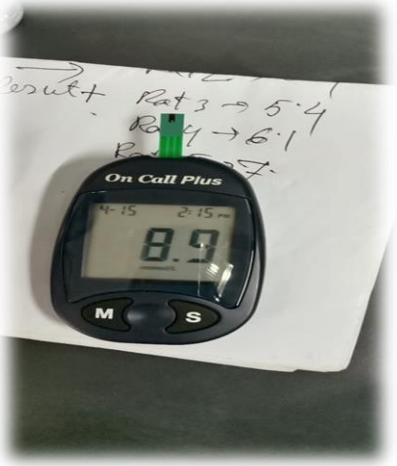
- All above results comparison among those 3days of 40mg/ml, 2days of 20mg/ml & 30mg/ml rest of the 2days in total 7days studies above taken on laboratory instead of one another comparing results finding better results of this new innovative tea.

- All above data we findings good effects on diabetes up on 40mg/ml each day if intake by mice then it shows potential effects upon diabetic mice & give more effective blood glucose level data upon study on it. Need more times to run it & surely we find a very effective results upon it for further studies.

SL no.	Diabetic Mice	Blood Glucose level 3days avg. data of 40mg/ml (3^{rd} day)	Blood Glucose level 2days avg. data 20mg/ml (5^{th} day)	Blood Glucose level next 2days avg. data 30mg/ml (7^{th} day)
1	Mice1	6.6	10.6	8.6
2	Mice2	5.4	8	8.2
3	Mice3	5.9	8.9	9.9
4	Mice4	6	8.9	9.2
5	Mice5	6	8.1	8

Table no. 11: Comparison data of 40mg/m, 20mg/ml & 30mg/ml Yashtimadhu roots Green tea.

-Some data figures given below of 40mg/ml of tea differences of Blood Glucose level of mice on lab test.



Diabetic Mice glucose level

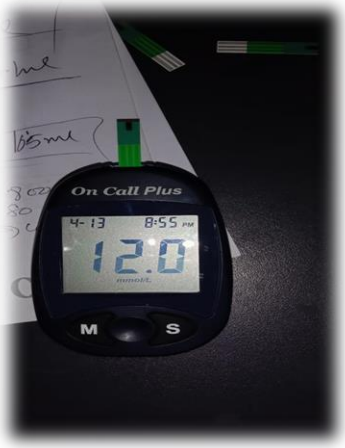
After 3hours feeding of Yashtimadhu tea

Diabetic Mice glucose level

After 3hours of tea (2nd day)

Figure12: 40mg/ml some Blood Glucose level data of Diabetic mice & Yashtimadhu tea

- Some results in 30mg/ml & 20mg/ml not reduce that amount blood glucose level.



Diabetic Mice glucose level

Random mice Glucose level on 7th day

Figure13: 30mg/ml & 20mg/ml some Blood Glucose level data of Diabetic mice & Yashtimadhu tea

Chapter Four
Conclusion

Conclusion

In conclusion, the present study shows that *Glycyrrhiza glabra Linn as Yashtimadhu roots in Bengali term have potent effects on Diabetes like metabolic disorder. Upon source from Asia continent of Yashtimadhu collecting from Bangladesh local source of these roots then uses in innovative formation just like a functional beverage as tea form to study on it up to 7 days on laboratory mice on room temperature. Now a days people also looking for alternative approach on using synthetic drugs & finding for functionally active compounds those gives better performance than a drug. Those are sufferings from metabolic disorders like Diabetes condition, knows ups & down of each system of their body & more complications day by day. Various studies already found in Yashtimadhu roots among all countries research institute or others but in innovative way of tea form as green tea form whose give potential & magnificent activity upon diabetes mice on laboratory tests.*

In this study shown above results by glucometer of Glycyrrhiza glabra Linn as Yashtimadhu roots

have potential activity on diabetic mice & give positive results upon study on it in tea form with normal drinking water. Hopefully more studies on it shows more better results in future & further studies on lab. Now minimum results shows that upon daily intake of Yashtimadhu roots as green tea at least 40mg/ml each day on mice lower the diabetic effects & give better effect as antidiabetic functional drink tea. Green tea form taken by mice shows potential effects after clinical trial it have shown better results than further hopefully soon.

Chapter Five
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