Medicinal plants prospective with anti diabetic activity: A review

Preety Raj, Ramesh Kumar Nirala, Kumari Anjana, Archana and KG Mandal

Abstract
Medicinal plants have a vast potential in the treatment of various ailments due to the presence of therapeutically important Phytochemicals. The therapeutic value of Indian medicinal plants is known since the ancient ages. Ayurveda, the oldest system of medicine recommends use of remedies, mainly based on medicinal herbs, for the treatment of a variety of diseases in man and animals. The herbal remedies are economical and within the reach of common man. It has been pointed out that about three-fourths of world’s population cannot afford the expensive products of western pharmaceuticals. Therefore, about 80 per cent of people living in developing countries are almost completely dependent on traditional means for their primary healthcare needs. The therapeutic value of Indian medicinal plants is well recognized and acknowledged all over the world. There has been an ever enhancing awareness globally to rely on natural remedies in place of the chemical drugs. More recently, the western multinational drug companies, taking leads from ayurveda and Indian folklore medicines, are diverting their R and D activities on Indian medicinal plants to find out the active principles, isolate and patent them. Diabetes is a serious metabolic disorder and several marketed medications are available to alleviate the symptoms of diabetes. However, these over the counter drugs are expensive and associated with several complications. Herbal medicines are gaining importance as they are cost-effective and also display improved therapeutic effects with lesser side effects. The present review includes the reports available on medicinal plants used for treating diabetes complications. The aim of the review is to categorize and summarize the available information on medicinal plants with anti-diabetic properties and suggesting outlooks for future research.

Keywords: Medicinal plants, phytochemical, antidiabetics, anti hyperglycemic

Introduction
Medicinal Plants are a source of large amount of drugs comprising to different groups such as antispasmodics, emetics, anti-cancer, antimicrobials, antidiabetic etc. A large number of the plants are claimed to possess the antibiotic properties in the traditional system and are also used extensively by the tribal people worldwide. It is now believed that nature has given the cure of every disease in one way or another. Plants have been known to relieve various diseases in Ayurveda. WHO has recently estimated that 80% of the populations of the developing countries rely on traditional medicine, mostly plant drugs, for their primary health care needs (Denoe and Bough, 1999) [4]. In India, the history of medicinal uses of plants dates back to 3500-1800 B.C. where in the Rig-Veda mentions a number of plants with different healing practices. A large part of the population depends even at the present time on the indigenous systems of medicine, ayurveda, Unani and Sidha. Diabetes mellitus (DM) is a chronic endocrine disorder which is characterized by high blood glucose levels that can interfere with carbohydrate, protein, and fat metabolism (Bastaki 2005) [5]. It is caused due to the deficit production of insulin by the β-Langerhans islet cells of the pancreas or due to defective insulin uptake in the peripheral tissues (Al-Goblan et al. 2014). An increase in the blood glucose level immediately after a meal triggers the release of insulin hormone from the pancreas. Insulin stimulates the liver to metabolize glucose and also stimulates the fat and muscle cells to remove glucose from the blood which results in a drop of blood sugar level to normal levels. If a person is diabetic, the blood sugar level remains high due to nil or ineffective production of insulin by the pancreas (Dean and McCrerye 2004) [5]. India has more than 61 million people living with diabetes and hence is considered to be the “capital of diabetes”. Effective treatment of diabetes and its associated complications still remains a major challenge for India due to several issues such as inadequate health care system, lack of proper facilities, etc. (Viswanathan and Rao 2013) [27]. Herbal formulations are favored over synthetic drugs to reduce the ill-effects of diabetes and its secondary complications due to lesser side effects and also being cost effective (Modak et al. 2007) [37].
The present review aims to summarize some of the important Indian medicinal plants with anti-diabetic activities.

**Common phytochemicals found in plant containing potent anthelmintic activity.**

a. Alkaloids  
b. Flavanoids  
c. Triterpenoids  
d. Phenols

**Method of extraction of phytochemicals**

The basic principle is to grind the plant material (dry or wet) finer, which increases the surface area for extraction thereby increasing the rate of extraction. Earlier studies reported that solvent to sample ratio of 10:1 (v/w) solvent to dry weight ratio has been used as ideal (Das et al., 2010) [6].

Extraction procedures

**A. Plant tissue homogenization**

Plant tissue homogenization in solvent has been widely used by researchers. Dried or wet, fresh plant parts are grinded in a blender to fine particles, put in a certain quantity of solvent and shaken vigorously for 5 - 10 min or left for 24 h after which the extract is filtered. The filtrate then may be dried under reduced pressure and redissolved in the solvent to determine the concentration. Some researchers however centrifuged the filtrate for clarification of the extract (Das et al., 2010) [6].

**B. Serial exhaustive extraction**

It is another common method of extraction which involves successive extraction with solvents of increasing polarity from a non polar (hexane) to a more polar solvent (methanol) to ensure that a wide polarity range of compounds could be extracted. Some researchers employ soxhlet extraction of dried plant material using organic solvent. This method cannot be used for thermo labile compounds as prolonged heating may lead to degradation of compounds (Das et al., 2010) [6].

**C. Soxhlet extraction**

Soxhlet extraction is only required where the desired compound has a limited solubility in a solvent, and the impurity is insoluble in that solvent. If the desired compound has a high solubility in a solvent then a simple filtration can be used to separate the compound from the insoluble substance. The advantage of this system is that instead of many portions of warm solvent being passed through the sample, just one batch of solvent is recycled. This method cannot be used for thermo labile compounds as prolonged heating may lead to degradation of compounds (Nikhal et al., 2010) [20].

**D. Maceration**

In maceration (for fluid extract), whole or coarsely powdered plant-drug is kept in contact with the solvent in a stoppered container for a defined period with frequent agitation until soluble matter is dissolved. This method is best suitable for use in case of the thermo labile drugs (Ncube et al., 2008) [19].

**E. Decoction**

This method is used for the extraction of the water soluble and heat stable constituents from crude drug by boiling it in water for 15 minutes, cooling, straining and passing sufficient cold water through the drug to produce the required volume (Remington, 2008) [23].

**F. Infusion**

It is a dilute solution of the readily soluble components of the crude drugs. Fresh infusions are prepared by macerating the solids for a short period of time with either cold or boiling water (Remington, 2008) [23].

**G. Digestion**

This is a kind of maceration in which gentle heat is applied during the maceration extraction process. It is used when moderately elevated temperature is not objectionable and the solvent efficiency of the menstrum is increased (Remington, 2008) [23].

**I. Percolation**

This is the procedure used most frequently to extract active ingredients in the preparation of tinctures and fluid extracts. A percolator (a narrow, cone-shaped vessel open at both ends) is generally used. The solid ingredients are moistened with an appropriate amount of the specified menstrum and allowed to stand for approximately 4 h in a well closed container, after which the mass is packed and the top of the percolator is closed. Additional menstrum is added to form a shallow layer above the mass, and the mixture is allowed to macerate in the closed percolator for 24 hr. The outlet of the percolator then is opened and the liquid contained therein is allowed to drip slowly. Additional menstrum is added as required, until the percolate measures about three-quarters of the required volume of the finished product. The marc is then pressed and the expressed liquid is added to the percolate. Sufficient menstrum is added to produce the required volume, and the mixed liquid is clarified by filtration or by standing followed by decanting (Handa, et al., 2008) [10].

**J. Sonication**

The procedure involves the use of ultrasound with frequencies ranging from 20 kHz to 2000 kHz; this increases the permeability of cell walls and produces cavitation. Although the process is useful in some cases, like extraction of rauwolfia root, its large-scale application is limited due to the higher costs. One disadvantage of the procedure is the occasional but known deleterious effect of ultrasound energy (more than 20 kHz) on the active constituents of medicinal plants through formation of free radicals and consequently undesirable changes in the drug molecules (Handa, et al., 2008) [10].

**Table 1:** Some of the common Medicinal plants having anti-diabetic activity.

<table>
<thead>
<tr>
<th>Medicinal Plants name</th>
<th>Parts used</th>
<th>Type of extract</th>
<th>Activity</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ailanthus glandulosa</td>
<td>Leaves</td>
<td>Alcoholic</td>
<td>Antidiabetic</td>
<td>Kumar R et al. 2012 [13]</td>
</tr>
<tr>
<td>Alpinia officinarum</td>
<td>Bark</td>
<td>Methanol</td>
<td>Antidiabetic</td>
<td>Kumar D et al. 2011 [14]</td>
</tr>
<tr>
<td>Berberis vulgaris</td>
<td>Root</td>
<td>Aqueous</td>
<td>Hypoglycemic</td>
<td>Meliani et al. 2011 [15]</td>
</tr>
<tr>
<td>Brassica juncea</td>
<td>Seed</td>
<td>Aqueous</td>
<td>Hypoglycemic</td>
<td>Thirumalai et al. 2011 [20]</td>
</tr>
<tr>
<td>Catharanthus roseus</td>
<td>Leaf/flower</td>
<td>Methanol</td>
<td>Hypoglycemic</td>
<td>Ohadoma et al. 2011 [21]</td>
</tr>
<tr>
<td>Chaenomeles sinensis</td>
<td>Fruits</td>
<td>Ethyl acetate</td>
<td>Antidiabetic</td>
<td>Sanchet et al. 2011 [24]</td>
</tr>
</tbody>
</table>
Future prospects

- There is need to screening of medicinal plants with reference to the phytoconstituents on the basis of research problem in mankind and animals.
- The 80% population of developing countries depends upon herbal medicine so marketing is too good
- To explore indigenous Traditional knowledge through medicine plants needs government support and establishment of biotechnology industry for proper implementation of herbal medicine
- Need of establishment and implementation of policy framework for the regulation and standardization of herbal medicines.

Conclusion

- Plant medicine are used as alternative methods to control diabetics condition
- Plant based antidiabetics are safe, economical, easily available in surrounding and it will be helpful us.
- It is eco-friendly and promotes biodiversity.

References

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