



Single plant drugs advocated as functional food and medicine in diabetes (*prameha*) in the *brhatrayee* of Ayurveda: A review

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Abstract

Diabetes is a metabolic disorder, primarily characterized by increased blood sugar levels, polyuria and polyphagia. The drugs prescribed in diabetes; insulin or oral hypoglycemic drugs may have one or more side effects, necessitating a constant search for novel drugs with minimal or no side effects. Healthy diet, physical activity and optimal body weight are the pillars in the management of diabetes. In Ayurveda, '*prameha*' can be correlated to diabetes, considering the similar clinical presentations. Though the treatment for *prameha* has been extensively dealt with in the *samhitas* (classical textbooks of Ayurveda), there are also several single drugs specifically mentioned. This unique review from the ayurvedic aspect was done to understand the intensity with which this traditional system of Indian medicine signifies the role of single drugs (plant source) in the management or treatment of diabetes, either as a functional food or as medicine. Analyzing the four classical ayurvedic textbooks- collectively called as *brhatrayee*, only eleven single drugs were mentioned as potential agents for *prameha*. Out of these eleven, six can be categorized as functional food and can be consumed on a regular basis, while the remaining five are medicines to be consumed under medical supervision. The concept of 'functional food' is grabbing attention. The drugs mentioned in the classical texts attribute to this aspect, as the biologically active components, not only helps to enhance health but also reduces the complications that can arise due to diabetes, specifically diabetes being a lifestyle disorder where food plays a significant role.

Keywords: Diet, Lifestyle disorder, *Samhita*, Treatment

1. Introduction

The number of people affected with diabetes is increasing by leaps and bounds globally. It is estimated that approximately 220 million are diabetic and annually death due to diabetes is approximately 1.5 million in the year 2019 according to the World Health Organisation. The incidence of diabetes is rapidly increasing and causes severe complications (Cloete, 2022). According to Ayurveda, '*prameha*' is considered as one among the *astamahagada* (eight major diseases). This implies that the disease must be managed or treated with care or can prove to be fatal to the patients. Similar to modern

theories, Ayurveda also advocates lifestyle and diet management as the first option in this condition and then proposes formulations and therapies that can be used when the symptoms are severe. Susruta samhita specifically mentions polyuria as the primary diagnostic criteria (Susruta, 2005). Though there are 20 different types of *prameha* mentioned in the texts ie., *Kaphaja*-ten, *pittaja*-6 and *vataja*-4 (caused by *kapha*, *pitta* and *vata* respectively), the application of the single drugs is mentioned generally. This implies that they can be consumed as such or used as a combination processed

with other drugs in the most suited form to get an equally significant therapeutic benefit as that of formulations. The clinical presentation of the patient also must be taken into consideration before prescribing them.

1.1. Ayurvedic management of *prameha*

Ayurveda advocates an individualized approach to the management of diseases. There are several factors like *dosha*, *agni*, *prakṛti* and *bala* of the patient to be taken into consideration. Hence the classical text offers such a wide range of treatment options starting from simple single drugs (which is easy to procure and consume even by an individual) to formulations and purificatory therapies (advocated by the physician). The most apt will be decided upon, by the physician. But there is still unawareness about the therapeutic potential of Ayurveda especially in the management of lifestyle disorders like *prameha* and the demand for evidence of therapeutic efficiency of traditional medicines that are already in use by the public for ages adds to the challenges. In a scenario where no compromise in the diet or lifestyle are made but rather prefer consuming medicines, the potential risks are higher. Incorporating simple drugs into our daily food chart along with regularized activity routine can make preventing/managing *prameha* easier.

Physical activity, dry massages, application of the pastes of certain drugs that would basically initiate the reduction of fat are being recommended for a diabetic (Agnivesa, 2006; Vagbhata, 2016). The *pramehi* (person afflicted with *prameha*) must be identified as *sthula* (obese) or *kṛsa* (emaciated). The treatment options are *apatarpana* (denourishing) for the *sthula* and *santarpana* (nourishing) for the *kṛsa*. Palliative and purificatory methods should be selected taking into consideration the presentation of the patient and the type of *prameha* diagnosed (Vagbhata, 2005). The primary focus of management is to break the pathogenesis. The main causative factor of *Prameha* is the vitiation of *kapha dosha* and *medas* (translated as fat). The *kleda* (translated as moistness) increases thus leading to the manifestation of *prameha*. This is caused due to lack of physical activity, day sleep, excess consumption of sweet and unctuous products (Agnivesa, 2006). Hence all the single drugs or formulations chosen would primarily be to initiate *rukṣa guna* so as to reduce the *kapha* and *kleda* (Vagbhata, 2016).

The clinical benefits to be gained by following these interventions in the better management of diabetes are;

- a) To keep the blood sugar level in control
- b) Maintain the quality of life and energy level

c) Avoid the future complications that would ensue in chronic diabetic cases

2. Materials and methods

The *brhatrayee* (the four major classical textbooks, *astanga sangraha* (AS) and *astanga hrdaya* (AH) authored by Acarya Vagbhata, *caraka samhita* (CS) authored by Acarya Agnivesa and *susruta samhita* (SS) authored by Acarya Susruta) were thoroughly read and the single plant drugs mentioned in these texts for *prameha* were noted down. They were categorized as functional food and as medicine. The published research on anti-diabetic activity of these drugs were cross-checked through databases like Dhara, PUBMED and Google Scholar and tabulated.

3. Results and discussion

On reviewing the *brhatrayee*, for identifying the single drugs of plant source, the result was only eleven plant drugs. *Lasuna* is mentioned only by Vagbhata both in AH and AS, but *palandu* is mentioned only in AS. *Ikshvaku* is unique to AS just as *dhatri* is to AH. *Madanaphala* has been mentioned as a specific *vamaka dravya* for *prameha*, while *varahakanda*, *tuvaraka* and *bhallataka phala* is mentioned only by SS. *Guggulu* is common in AS & SS, while *haritaki* is unique to AS and CS. Out of these, *haridra* gains an important place in all the *samhitas* except CS. Though some can be basically categorized as functional food, according to Ayurveda, they also serve as an *aushadha*. But drugs like *guggulu*, *haritaki*, *madanaphala*, *tuvaraka* and *bhallataka phala* are significantly *aushadha* and should be used as propagated by the classical texts or as advised by the physician. From the analysis of the *guna*, in some, the *samprapti vighatana* is done by the *ushna-tikshna* while in some the *sukshma* and *vyavayi guna* plays the primary role.

3.1. Importance of ayurvedic medicinal plants in diabetes

Prameha is of three types, depending upon the extent and type of *dosa* involved in the pathogenesis. That is *sadhya* (curable), *yapya* (in control) and *parityajya* (to be rejected) (Vagbhata, 2005). In the *sadhya* and *yapya* conditions, the single plant drugs mentioned as functional food supported with physical activity will be very beneficial. Sometimes specific methods of processing of the drugs would be mentioned that helps achieve the therapeutic target even better. As they are specifically indicated for *prameha*, the possible mode of action would be maintaining the blood sugar levels, suppressing the progression of the disease or to address the associated complaints. For eg, an analytical and *in-vivo* study proved that when wheat was kept soaked in *triphalaka kasaya* and then dried, powdered, and used (as mentioned in *prameha cikitsa* of AH), it was found to

have eliminated the allergic content gluten, the glycemic index is the same with a better desirable nutritional profiling (Sujithra *et al.*, 2020). Here, though wheat is the food preferred over rice for a diabetic, when processed as mentioned by the classical text, the results were much more therapeutically significant. The antioxidant activity of these drugs will help replenish the tissues that are weak from impaired sugar metabolism. In the *parityajya* category, intense formulations and treatments including purificatory measures must be resorted to, under medical supervision. Susruta mentions that *prameha* is *yapya*. This means that with strenuous efforts in adhering to a strict diet and lifestyle the disease can be managed. This undoubtedly implies that the drugs that can serve as functional food can be incorporated into our daily diet and that as medicine to be taken with a physician's guidance.

3.2. The single plant drugs mentioned in management of *prameha* (Table 1)

3.2.1. *Lasuna* (*Allium sativum* L.): The bulb is the recommended part to be used. This is extremely *tikṣṇa* and *uṣṇa*, but *snigdha* at the same time. So, this attributes to the peculiar property of combating the *kapha* and *kleda* in a *pramehi*, at the same time is strengthening also. This is specifically indicated in *prameha* (Vagbhata 2005). The interesting fact is that *astanga sangraha* mentions that *lasuna* must be mixed with other drugs and consumed. Both on account of the palatability and the penetrating property, it is not possible to consume *lasuna* alone. In a diabetic, this is advised to be consumed with *srestha* (*triphala*- a combination of fruits of *amalaki* (*Phyllanthus emblica* L.); *haritaki* (*Terminalia chebula* Retz. & Willd) and *vibhitaki* (*Terminalia bellirica* (Gaertn.) Roxb.) The anti-diabetic activity of *A. sativum* is already published. In the treated diabetic group, the diabetic rats were supplemented with either onion or garlic extract or with single components. The results suggested that that the single component and onion extract consumption may be effective for lowering body weight and plasma glucose concentrations (Kook *et al.*, 2009).

3.2.2. *Palandu* (*Allium cepa* L.): The bulb is recommended to be habitually used in food as this is *shita* and *snigdha*. This gives strength to the eyes, is very nourishing and increases the body stamina. This is specifically beneficial for diabetic (Vagbhata, 2016). The extracts of *A. cepa* are found to be very effective in lowering the blood sugar levels (Kook *et al.*, 2009). From the ayurvedic perspective, this can be consumed raw, as to promote the nourishment to the tissues that are in a depleted condition (*dhatu shaithilyata*).

3.2.3. *Guggulu* (*Commiphora wightii* (Arn.) Bhandari):

The resin is a very potent medicine. Though it has a slimy nature, on internal administration, it is *sukṣma* and does *srotosodhana*. This is also a *rasayana*, hence can support the tissues that are weak owing to the defective absorption of sugar into the cells. This is indicated in several diseases caused by *kapha*, including *prameha* (Vagbhata, 2016). Research shows that the guggulipids and guggulsterone present in *guggulu* has potent anti-inflammatory activity, is beneficial to lower the cholesterol, obesity and blood sugar levels (Kunnumakkara *et al.*, 2018). Susruta samhita explains in detail about how *guggulu* has to be consumed; in the morning along with the decoctions prepared from *triphala*, *daruharidra* (*Berberis aristata* DC.), *patola* (*Trichosanthes dioica* Roxb.) and *kusha* (*Desmostachya bipinnata* Stapf). Another option suggested is to consume with alkali or hot water to increase the therapeutic potential. After this is digested, the *pathyahara* to be followed is food along with vegetable and meat soup. This must be continued for 1 month, to get the desired health benefits in a *pramehi* (Susruta, 2005).

3.2.4. *Haritaki* (*Terminalia chebula* Retz. & Willd):

The fruit is *ruksha* and *laghu* and also acts as a *rasayana*. Hence it can restore the strength of the depleted tissues in a *pramehi*. This in general helps alleviate the diseases caused by aggravation of *kapha* and *vata*. The positive effect on the clarity of sense organs is specifically mentioned (Agnivesa, 2006). The anti-diabetic activity of fruits of *T. chebula* is well researched and proven. The results indicate that water extract of *T. chebula* not only improves the glucose tolerance but also brings down fasting blood glucose in diabetic rats (Murali *et al.*, 2004). In practice, the *curna* of this fruit can be consumed with honey, so that the *ruksha guna* can be balanced by the *snigdha guna* of honey.

3.2.5. *Haridra/rajani* (*Curcuma longa* L.): This is declared as the best drug to combat *prameha*. In fact, susruta samhita mentions that regular use of *haridra* can give relief from sixteen types of *prameha* (excluding the 4 *vataja* type) (Susruta, 2005). Curcumin present in *haridra*, in the past few decades has caught the public attention because of its therapeutic effect in lowering the blood sugar levels. In animal models, it was found that curcumin extract delays development of diabetes, improves functions of β -cell, prevents death of β -cell, decreases the resistance of insulin, and hyperlipidemia (Pivari *et al.*, 2019). This being a household spice with beneficial therapeutical effects, this can be resorted to on a regular basis. This is best consumed with honey or can be consumed with *amalaki svarasa*.

3.2.6. Varahakanda (*Dioscorea alata* L.): The tuber is the part consumed. This is very effective in reducing the aggravated *kapha*. Hence it will be beneficial for a *pramehi*. At the same time, this is rejuvenative and strengthening also (Susruta, 2005). In the tuber, the higher amylose and total dietary fiber (TDF) content have the capacity to reduce the blood sugar levels and is beneficial to health-conscious individuals who are prone to having a slow rate of absorption. At the same time the low sodium and high potassium with TDF contents plays a preventive role in the management of associated chronic diseases (Duffie *et al.*, 2013). This can be cooked and consumed just like the normal yam.

3.2.7. Madanaphala (*Randia dumetorum* Lam.): The fruit is *ushna*, *laghu*, *sukshma*, *vyavayi* and *vikashi* (Garg *et al.*, 2019). This drug is significantly known as the best *vamaka dravya*. Caraka mentions that the seeds of this plant should be made into a paste and consumed along with meat soup to initiate spontaneous *vamana* without causing weakness to the patient to alleviate the aggravated *kapha*. This is a purely therapeutic drug and is not a functional food. No published papers on the antidiabetic activity of *madanaphala* (seeds) could be obtained. Rather than directly reducing the blood sugar levels, the effect is to pacify the aggravated *kapha* and *kleda*, the causative factors for *prameha*.

3.2.8. Dhatri (*Phyllanthus emblica* L.): This is declared as the best drug for a *pramehi* (Vagbhata, 2005). This fruit is a store house of nutrients and has excellent rejuvenative and therapeutic properties. The quercetin in the fruit is proven to have anti-diabetic activity (Srinivasan *et al.*, 2018). In practice, the *svarasa* of *amalaki* can be consumed daily. The combination of *nisha* (*haridra*) and *amalaki* has been proven to be a potent antidiabetic drug.

3.2.9. Ikshvaku (*Cucurbita lagenaria* L.): It is an important finding that *ikshvaku* has been stated as the best drug for a *pramehi* amongst all the other options available (Vagbhata, 2016). In a particular context, it is mentioned that after a discussion amongst *rshis*, finalizing which drug is the best indicated for a specific disease, *ikshvaku* was the ideal drug of choice for *prameha* (Agnivesha, 2006). Research has proven that the seeds and the pulp of the fruit have an anti-diabetic potential (Bhattacharya *et al.*, 2012). A clinical study conducted proved that this also has effect on reduction of diabetes induced hyperlipidemia (Katare *et al.*, 2013).

3.2.10. Tugaraka (*Hydnocarpus pentandrus* (Buch. Ham.) Oken) and Bhallataka phala (*Semecarpus anacardium* L.f.): *Tugaraka* and *bhallataka phala* possess *kashaya rasa* but are *katu paka*. It is extremely *ushna* and *tikshna*, thus will help in mitigating the aggravated *kapha* (Susruta, 2005). Both these fruits are purely medicine and must be taken only under a physician's supervision. Apart from the anti-diabetic potential that the fruits of *Hydnocarpus* depict, potential effect against the β -cell damage induced by oxidative stress was also studied (Rao and Mohan, 2017). The bark of *S. anacardium* has been proven to possess anti diabetic property (Ali *et al.*, 2015). The nut milk has multiple health benefits including hypoglycaemic activity (Kothai *et al.*, 2004). In practice, mostly *ksirapaka* of these drugs or as a *rasayana* are administered to the patients. As the drugs are *atyushna*, they are consumed with a suitable *anupana*; the most preferred being milk. As milk possesses *shita* and *snigdha* properties, the *ushna* of these drugs will not harm the body.

Table 1. Summary of the findings

Sl. No.	Scientific names	Name of the drugs	Classical text mentioned*	Recommended method of usage	Research published (dosage form)
1	<i>Allium sativum</i> L.	<i>Lasuna</i>	AH & AS	Functional food	Extract
2	<i>Allium cepa</i> L.	<i>Palandu</i>	AS	Functional food	Extract
3	<i>Commiphora wightii</i> (Arn.) Bhandari	<i>Guggulu</i>	AS & SS	Medicine	Extract
4	<i>Terminalia chebula</i> Retz. & Willd	<i>Haritaki</i>	AS & CS	Medicine	Extract
5	<i>Curcuma longa</i> L.	<i>Haridra /rajani</i>	AH, AS & SS	Functional Food	Extract
6	<i>Dioscorea alata</i> L.	<i>Varahakanda</i>	SS	Functional Food	Extract
7	<i>Randia dumetorum</i> Lam.	<i>Madanaphala</i>	CS	Medicine	-
8	<i>Phyllanthus emblica</i> L.	<i>Dhatri</i>	AH	Functional Food	Extract
9	<i>Cucurbita lagenaria</i> L.	<i>Ikshvaku</i>	AS	Functional Food	Extract
10	<i>Hydnocarpus pentandrus</i> (Buch. Ham.) Oken	<i>Tugaraka</i>	SS	Medicine	Extract
11	<i>Semecarpus anacardium</i> L.f.	<i>Bhallataka phala</i>	SS	Medicine	Extract

*AH- Ashtanga hridaya, AS- Ashtanga sangraha, CS- Caraka samhita, SS- Susruta samhita

4. Conclusion

Ayurveda can play a beneficial role, especially in managing lifestyle disorders like diabetes is very significant in the present scenario. Potent medicinal drugs that can serve as functional food when used regularly will help addressing the clinical condition. Though the classical texts have explained the treatments including *shodhana* in a vast expanse, throughout the *brhatrayee*, only eleven single drugs of plant origin have been specifically mentioned, indicating the fact that they present the possibility of controlling the disease. In the published research, mostly water or ethanolic extract of the sample is used to study the anti-diabetic effect *in-vitro* or *in-vivo*. Published data on making use of these as functional food itself or being administered as a medicine are scarce.

As diabetes primarily requires an organized diet and lifestyle, the simple drugs mentioned in the classical texts of Ayurveda can be used to gain the complete health benefits. Though some of these are also ingredients in therapeutic formulations, the mention as a single drug indicates that the application is very effective in this manner also. If these simple plant drugs could help avoid medication, where the dose must be increased when situation demands, then it should be considered as a better alternative. The clinical outcomes can be improved in diabetes, by using these medicinal plants that has been advocated since centuries. The therapeutic armamentarium can be strengthened by further studies in areas that are not explored. As the next step, clinical studies are warranted on effect of these potent drugs as such on the blood sugar levels, so the data can be used to develop potent and novel drugs.

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