

# Evaluation of Antioxidant Activity of Selected Decoctions used for Management of Diabetes Mellitus in Ayurveda Medicine

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## ABSTRACT

Diabetes mellitus is a common chronic disorder prevalent all over the world and antioxidant therapy for diabetes patients may be helpful in relieving their symptoms and complications. In present era people of developing countries and developed countries looking towards herbal medicine for manage diabetes mellitus, due to long term acceptability and safety of herbal medicine. In Ayurveda medical system, herbal antioxidants have been widely employed for management of various disease such as diabetes mellitus, cancer and heart diseases. With this background this research project was designed to evaluate the antioxidant activity of selected decoctions which are used for management of diabetes mellitus in Ayurveda medicine. Antioxidant potential was evaluated through 2, 2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging method. The results of this study revealed that the mean value of absorbance and scavenging activity as 0.291 and 59% for decoction of *Lipa Kandali* (LK), 0.313 and 56% for decoction of *Nisha Thripal* (NT), 0.292 and 58% for decoction of *Kathaka Khadhira* (KK), 0.422 and 40% for decoction of *Thriphala Kathakan* (TK) at 0.5µg/ml and 0.713 for control test. All tested antidiabetic decoctions were showed antioxidant activity. The antioxidant activity of the herbal pharmaceuticals is used to manage clinical features of diabetes mellitus as well as they are played an important role in the relief of long-term complications in diabetes mellitus by reducing the oxidative stress.

**KEYWORDS:** Diabetes mellitus, Antioxidant activity, Herbal decoctions

## INTRODUCTION

Ayurveda is science of life and derived from more than four thousand years back. It is based on observation of nature & human being. In Sri Lanka, there are four traditional medical systems which called as Ayurveda, Deshiya Chikitsa, Siddha and Unani, but generally refers all of them as Ayurveda (Perera, 2012). It had provided proven better treatment to the patients. This system passed through generation to next generation within their own families. In present era people of developing countries and developed countries looking towards traditional medicine for their health problems due to long term acceptability and also they are believing that herbal medicine is safety and free from adverse effects (Philomena, 2011). Recent time, they have been focused about the impact of traditional practices on management of certain non - communicable diseases (NCDs) such as diabetes mellitus, hypertension, hyperlipidemia, coronary heart disease and cancers. The combinations of different formulations and treatment approaches synergistically act together applying in curing and preventing from diseases (Ruknuddin, 2017).

Diabetes mellitus is a common chronic disorder prevalent all over the world. It has turned out to be the fastest growing disease and known as one of the biggest silent killers in the world which affects millions of people all over the world (Chaudhary and Tyagi, 2018). According to the WHO

definition, DM is metabolic disorder of multiple etiologies characterized by chronic hyperglycemia which is caused by disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. Improper Dietary habits, sedentary lifestyle, environmental and genetic factors are identified as the common causation of Diabetes mellitus. (Prabhat Kumar *et al*, 2015). Diabetes mellitus could be created serious complications in multiple organ systems of the body such as retinopathy, neuropathy, nephropathy, cardiovascular complications and ulceration. There are mainly two types of Diabetes mellitus have been identified as two types- type I or Insulin Dependent Diabetes Mellitus (IDDM) and type II or Non- Insulin Dependent Diabetes Mellitus (NIDDM) (Srikanth *et al*, 2015). The classical signs and symptoms of diabetes mellitus are polyuria (frequent urination), polydipsia (increased thirst) and polyphagia (increased hunger). Management and treatment of diabetes has been largely focused on control of hyperglycemia (Bajaj and Khan, 2012). For management diabetes, long term usage of allopathic drugs exhibits several side effects and complications to different organs of the body which ultimately lead to cardiovascular problems, liver disease, kidney disease and weight gain (Kalsi *et al*, 2017). Therefore, world is looking towards for alternative medicines in management of diabetes mellitus.

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After consideration of the similarities of clinical features and other signs *madhumeha* can be co related with diabetes mellitus. According to Ayurveda, *Madhumeha* has mentioned under the *prameha roga*. "Pra" meaning excess in both frequency & Quantity. *Prameha* meaning self-explanatory which means *Prabhutha muthra* & (turbid urine). There are 20 types of *pramehas* based on the color and substances which are passed in urine. *Madhumeha* is one of the important *pramehas* in Ayurveda. All types of *pramehas* where the patient pass honey like urine and entire body become very sweet known as *Madhumeha*. Ayurveda medical system has been emphasized on the exclusion of the etiological factors as the main principle therapeutic opinion (*Nidhana Parivarjana*). Two major components of Ayurvedic management of DM has been mentioned as *sanshodhan* (biocensing) and *sanshamana* (palliation). Regulation of diet, exercise and stress has been placed special emphasis along with use of herbal and herbo- mineral preparations. (Prabhat Kumar *et al*, 2015).

Oxidative stress has been created due to imbalance between radical- generating and radical-scavenging systems and its involved to pathogenesis of diabetes and other various health problems including cancer, cardiovascular disease, aging, liver and lung diseases (Rajendiran *et al*, 2018). Reactive oxygen is formed as results of numerous biological functions, exposure to UV light and entrance of foreign matters to the body of living organisms. Reactive oxygen species could be damaged to the cell by altering the structure, resulting in several mutations such as base modifications, base deletions, and chain breaks on the DNA and RNA. Any substances which is having antioxidant activity, it could be converted reactive oxygen species to non-toxic products and stop or eliminate the adverse effects of reactive oxygen species. These biological reactions are used to prevent some disorders, such as cardiovascular diseases, cataracts, diabetes and infections (Kaska and Mammadov, 2019). Thus, antioxidant therapy for diabetes patients may be helpful in relieving their symptoms and complications (Dewanjee *et al*, 2009). DPPH (2, 2-diphenyl-1-picryl-hydrazyl-hydrate) free radical method is an antioxidant assay based on electron-transfer which produces a violet solution in ethanol (Garcia *et al*, 2012).

In Ayurveda medical system, herbal antioxidants have been widely employed for management of various disease and also as rejuvenators for several centuries (Patel *et al*, 2013).

Many of medicinal plants that have substantial quantity of antioxidant components have been found to be useful for manage diabetes and its related complications (Dewanjee *et al*, 2009). In 2018, Rajendiran *et al*, had been reviewed about antidiabetic plants which possess antioxidants activity include *Nerium oleander* Linn., *Annona squamosa*, *Cynodon dactylon*, *Padina boergesenii*, *Allium sativum*, *Aloe vera*, *Syzygium cumini* Walp, *Mimosa pudica*, *Momordica charantia*, *Psidium guajava* and *Tectona grandis*. Nowadays people have been attempted to discover novel formulations for foods, cosmetics and herbal pharmaceuticals by using natural antioxidants. With this background this research project was designed to evaluate the antioxidant activity of selected decoctions which are used for management of diabetes mellitus in Ayurveda medicine. These findings will be provided addition information for further investigations of these decoctions, for understanding the efficacy of those as Ayurveda Pharmaceutical, as well as for preventing other oxidative stress mediated disorders except diabetes mellitus.

## MATERIALS AND METHODS

Following mentioned decoctions were selected to evaluate antioxidant activity.

### Decoction of *Lipakandali Himbutumuli* (LK)

Ingredients-: *Musa paradisiaca*, *Salacia reticulate*, *Santalum album*, *Sida alnifolia*, *Phyllanthus emblica*, *Tribulus terrestris*

### Decoction of *Nisha Thripal* (NT)

Ingredients-: *Terminalia chebula*, *Terminalia bellirica*, *Phyllanthus emblica*, *Cyperus rotundus*, *Curcuma longa*, *Coscinium fenestratum*, *Terminalia arjuna*, *Strychnos potatorum*

### Decoction of *Thriphala Khakan patha* (TK)

Ingredients-: *Terminalia chebula*, *Terminalia bellirica*, *Phyllanthus emblica*, *Strychnos potatorum*, *Cissampelos pareira var*, *Cyperus rotundus*, *Coscinium fenestratum*, *Curcuma longa*, *Cassia auriculata*, *Rubia cordifolia*, *Rubia cordifolia*

### Decoction of *Kathaka Kadhira Dhatri* (KK)

Ingredients-: *Strychnos potatorum*, *Acacia chundra*, *Calamus zeylanicus*, *Rubia cordifolia*, *Coscinium fenestratum*, *Curcuma longa*, *Cyperus rotundus*, *Cissampelos pareira var*, *Phyllanthus emblica*, *Mangifera indica*, *Terminalia chebula*

Selected five decoctions were prepared by according to *kashaya paribhasha* mentioned in *Sarangadhara Samhitha*. (Thripathi, 2015). The percentage of antioxidant activity (aa%) of each decoctions was assessed by DPPH free radical assay. DPPH radical at 0.01mM in MeOH was prepared. Diluted series of above mentioned decoctions were prepared as 0.5%, 0.1%, 0.01%, 0.001 % from 1% concentrated decoction samples. The suitable dilution concentration was identified as 0.5% for all decoctions. The control solution was prepared by mixing ethanol and DPPH radical solution. Then 2ml of 0.5% diluted decoction was mixed with 4ml DPPH solution and it was protected from light by covering the test tubes with aluminum foil and keep 20 minutes in dark. Absorbance were taken after 20 minutes. The scavenging activity percentage (AA%) was determined according to Garcia *et al*.

## RESULTS

The results of this study revealed that the mean value of absorbance and scavenging activity as 0.291 and 59% for decoction of *Lipa Kandali* (LK), 0.313 and 56% for decoction of *Nisha Thripal* (NT), 0.292 and 58% for decoction of *Kathaka Khadhira* (KK), 0.422 and 40% for decoction of *Thriphala Kathakan* (TK) at 0.5µg/ml and 0.713 for control test. All tested antidiabetic decoctions were showed antioxidant activity. Considering this results effectiveness of the antioxidant activity were flowed from higher to lower as decoction of *Lipa Kandali* (LK), Decoction of *Khathaka Khadhira* (KK), Decoction of *Nisha Thripal* (NT), Decoction of *Thiphala Khakan* (TK) respectively.

## DISCUSSION

In Ayurveda medical system clearly defined about *madhumeha* condition and its line of treatment. *Sushruta Samhitha* has described on features of *madhumeha*, its indicates, treatment and management protocols of this disease. This condition can be managed by giving comprehensive attention to four aspects which are *Nidan parivarjana* (exclusion of causative factors), *Ahara* (diet), *Vihara* (exercise) and *Aushadha* (medicine). In Ayurveda management protocol, the blood sugar level reduces slowly and progressively with continuous use of Ayurveda drugs

which are very safe because these drugs do not lead to hypoglycemic episodes anymore (Prabhaht Kumar *et al*, 2015). Among those Ayurveda pharmaceuticals, herbal decoction is one of important dosage forms using to manage *madhumeha* conditions. These herbal decoctions which are used in the management of *madhumeha*, have *katu* (pungent), *tikta* (bitter) and *kasaya* (astringent) *rasa* (taste). Because *katu*, *tikta* and *kasaya* *rasa* have potency to act against *madhura* *rasa*. As well as *tikta* and *kasaya* *rasa* are useful to manage excessive urination by using its *sthambhana* property (Prabhaht Kumar *et al*, 2015). This study was conducted with decoction of *Lipa*

*Kandali* (LK) which is a traditional decoction in Sri Lanka, and other four decoctions are common Ayurveda decoctions widely used for management of diabetes mellitus. Most of decoction recipes has only few numbers of plants. Same plants have been mentioned in many decoctions. Among those plants *Phyllanthus emblica* mentioned in all decoctions, *Terminalia chebula*, *Curcuma longa*, *Coscinium fenestratum*, *Cyperus rotundus* mentioned in 03 times.

Most of chronic diseases such as cancer, diabetes mellitus, neurodegenerative and cardiovascular diseases are characterized by an enhanced state with oxidative stress, which may result from the over production of reactive oxygen and it could be managed by decreasing antioxidant defenses (Pollyanna *et al*, 2014). In 2013, Patel *et al* had been reviewed that the antioxidant potency may be related to the presence of antioxidant vitamins, flavonoids and phenolic compounds present in the extracts. Natural antioxidants increase the antioxidant capacity of the plasma and reduce the risk of certain diseases like heart, cancer and diabetes. There are many synthetic antioxidants are available in the market, but many of adverse effects cases are reported due to them. Hence world is looking forward a need for more potent, less toxic antioxidants (Goveas *et al*, 2013). With this background, attention about the antioxidant activity of higher plants has been increased on the protective activity of these natural antioxidants against chronic disorders caused by oxidative process such as diabetes mellitus (Garcia *et al*, 2012; Nasri *et al*, 2015). Medicinal plants are being considered as easily available and potent source of antioxidants as they contain a mixture of different chemical compounds that may act individually or in synergy to cure disease and improve health.

Number of studies have been conducted to examine antioxidant activity of medicinal plants which are used to make above mentioned decoctions (Bhatt *et al*, 2013). In 2001, Khopde *et al* had been mentioned that the Ascorbic acid shows antioxidant, anti-inflammatory and anti - mutagenic properties. *Phyllanthus emblica* is an eminent plant for its rich vitamin C (Ascorbic acid) and polyphenol contents. These Ascorbic acid and polyphenol contents have been identified as responsible factors for antioxidant activity of *Phyllanthus emblica*. In 2003 Cheng *et al* had been evaluated for the antioxidant activity of *Terminalia chebula*. They had been demonstrated to exhibit antioxidant activity at different magnitudes of potency. The antioxidant activity of the Methanolic extract of *T. chebula* had been suggested to play a role in the relief of long-term complications in diabetes mellitus by reducing the oxidative stress. In 2013, Goveas *et al* had been mentioned that the antioxidant activity of *Coscinium fenestratum* might be occurred due to the presence of phenolic compounds and flavonoids. In 2007,

Nagulendran *et al* had been presented the study to indicate that *Cyperus rotundus* rhizomes extract can be used as a potential source of natural antioxidant. The overall antioxidant activity of *Cyperus rotundus* might be attributed to its polyphenolic content and other phytochemicals constituents. Combination of all the properties of these plants, many of herbal pharmaceuticals such as decoctions, pills, fine powders, pastes can be managed diabetes mellitus successfully in every way.

## CONCLUSION

The antioxidant activity of the herbal pharmaceuticals is used to manage clinical features of diabetes mellitus as well as play an important role in the relief of long-term complications in diabetes mellitus by reducing the oxidative stress.

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