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ROLE OF NEUTRACEUTICALS AND LIFESTYLE MODIFICATION IN MADHUMEHA (DIABETIES-TYPE 2) – A REVIEW

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ABSTRACT

Ahara(Food), Nidra(Sleep) and Brahmacharya(Celibacy) are enumerated as the tripod of life and well being, imbalance in any one these may be the reason for disease is a primordial explanation of Ayurveda regarding health and disease. Concept of Ahara(Food) and Vihara(Activities) are essential factors for the maintenance of life. From ancient to modern times, the perspective to visualize the lifestyle disorders particularly Madhumeha (diabetes) has shifted from holistic to drug oriented. Therefore, until a few years ago, the revival of the holistic approach, the Ayurvedic diet and lifestyle were not being much focused. Diabetes mellitus is a well known clinical syndrome since antiquity. Ayurveda mainly focuses on role of diet in Prameha and Madhumeha, which is akin to Diabetes. Nutraceuticals are food or food products that provide health and medical benefits, including the prevention and treatment of disease. Traditional Indian diets are functional and used as food and medicine. Along with the module of diet, some exercises and yogasanas proves to be the warrior for the diabetes. Reviewing the current practices of diet and lifestyle including food habit, work, rest, exercises with important anti-diabetic properties of conventional system of medicine, accentuates the role of these in diabetes. The correlation and review further emphasizes the way to include or to evaluate more Nutraceuticals and lifestyle modifications for the diabetic population.

KEYWORDS: *Ahara*, Nutraceuticals, Diabetes mellitus, *Madhumeha*, *Prameha*, *Brahmacharya*.

INTRODUCTION

Ayurveda science of life an ancient scientific authentic system of medicine which is guiding the mankind with various basic needs to be followed in healthy life. It is also guiding mankind with various principles to be stay healthy and stay away from physical, mental, and spiritual illness throughout life. For these tripod of well being *Ayurveda* emphasizes on *Dinacharya* (Daily regimens), *Ratricharya*(Conducts of night), *Ritu charya* (Seasonal conducts), which keep the person healthy. Concept of *ahara* and *vihara* are very basic and essential factors for the healthy life.[1] these are emphasized in nutraceuticals and lifestyle management. It is also said that in both the conditions, of health and disease, the wholesomeness and the unwholesomeness is prime factor to be, as without proper diet, the use of any drug is futile.[2]

Diabetes mellitus is metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. Once regarded as single disease entity. Now seen as heterogeneous group of diseases, characterized by a state of chronic hyperglycemia resulting from a diversity of etiologies, environmental and genetic, acting jointly.

The underlying causes of diabetes the defective production or the action of insulin, a hormone that controls glucose, fat and amino acid metabolism. Characteristically diabetes is a long progression. Chronic hyperglycemia from whatever cause leads to a number of complications such as cardiovascular, renal, neurological, ocular, and other infections. India leads the world with maximum number of diabetic patients being termed as the "diabetes capital of the world". According to Diabetes Atlas 2019 published by the International Diabetes Federation, the number of people with diabetes in India currently around 77.9 million (20-79years) expected to rise 1.2billion by 2025 unless urgent preventive steps are taken.[3] The so called "Asian Indian Phenotype" refers to certain unique clinical and biochemical abnormalities in Indians which include increased insulin resistance, greater abdominal adiposity that is, higher waist circumference despite of lower body

mass index(BMI), lower adiponectin and higher high sensitive C-reactive protein levels. This phenotype makes Asian Indians more prone to diabetes and premature coronary artery disease. At least a part of this is due to genetic factors.[4]

As per WHO statistics in India diabetic Population is increasing rapidly. Research in India Suggests that, though earlier Indians were least prone to diabetes, now they are more prone due to the rapid change in irregular dietary pattern, change in lifestyle, stress, less exercises, most of the urban population depend on packed food, processed food. Indians are getting diabetes on an average around 10years earlier an in migrated Indians these incidences are 4 times higher.[5]

Treatment prevents some of its devastating complications, but does not usually restore normoglycemia or eliminate all the adverse consequences. The diagnosis is often delayed until complications present. Since current methods of treating diabetes remain inadequate, prevention is preferable.[6]

With the similarity in signs and symptoms the *Madhumeha* can be taken as diabetes mellitus. In some contexts the word *Prameha* has also been used synonymously.

The concept of nutraceuticals (Nutraceuticals are products, which other than nutrition are also used as medicine. A nutraceutical product may be defined as a substance, which has physiological benefit or provides protection against chronic disease) and life-style modifications were explained and followed in ancient classics. It has been explained that from the food the live sustains, the food is dependent on ecosystem. The quotation explains sustenance of life is relayed on food. The elements of life like, quality of health, longevity, intellect and intelligence, happiness, nourishment, physical and mental well being all are dependent on the food what you cosume.[7] The impact of *Pathyahara* on health and disease is well explained. Based on dose, season, raw materials, habitat were the person come from and the food grown, combination, mode of preparation, processing, all has impact of the health both physical and mental. *Madhumeha* being a *Yapya vyadhi*(maintainable disease), these *Pathyahara* and *Vihara* (life style) also help in maintaining the normalcy and in preventing complications.

MATERIAL AND METHODS

Search strategy and inclusion criteria

Diet and lifestyle related etiologies accountable for diabetes as mentioned in Ayurvedic treatises were rationally review along with recommendations of *Pathyahara* (wholesome diet), *Pathyavihara*(whole life style) as prevent strategies. The search was conducted in light of contemporary scientific supporting data available in electronic and internet media for possible justification and validation of these Ayurvedic principles. Publications in Pubmed, Scopemed, from original articles, review works are collected. Searches were not limited by date or place of publications but to publications in English language.

DISCUSSION

Madhumeha (diabetes mellitus), is the disease related with metabolism. Amongst the many dreadful conditions of metabolic disorders this stands first. Even though *Madhumeha*(diabetes mellitus) does not become fatal as and when it gets started, it will the precursor of many secondary complications.

Role of diet and lifestyle in diabetes - As precursor

The diet and lifestyle when it is improper it directly affects the metabolism. One if does not follow proper diet invites death inevitably.[8]

Role of diet in the prevention of diabetes

The person who takes wholesome diet with proper quantity and do the activities which promotes the health of *dhatus*(body elements) will never suffer from diabetes.[9] It can be presumed that, diabetes is mainly caused by the intake of newly harvested food grains without aging, improperly cooked and fatty foods, excessive intake of food contains starch, aquatic animal meat, milk and milk products without doing any physical activities. Thus it recommends wholesome diet suitable to all *dhatus*(Body tissues and elements). Simile has been explained in the context of diabetes- As the trees attract the birds for their nest and shelter, in the same way the person who eats the food in unacceptable way, and indolent are inclined to diabetes.[10]

Ayurveda enumerates 20 types of *Prameha* where all are origin from a complex pathology. All the body elements which are having liquid composition indulge in the pathology as primordial factor. Three basic morbid factors *Vata*, *Pitta*, *Kapha*, among these *Kapha* having liquidity in excess is the main *dosha(bahudravah shlehmah doshavishesha). Medas*(Adipose tissue), *Raktha*(blood), *Shukra*(semen), *Ambu*(body fluid), *Vasa*(muscle fat), *Lasika*(lymph), *Majja*(bone marrow), *Rasa*(plasma), *Ojus* (vital substance in the body), responsible for body immunity, *Mamsa*(muscular tissue) are considered as vitiated tissue elements(*dushya)* and *Mutravaha* and *Medovaha srotas* (channels) are the basic seat or location of the disease.

The dietary causes of Diabetes

The etiology of Diabetes, many diets were mentioned, namely, excessive use of curds, flesh of domestic animals, fatty meat of animals dwelling in aquatic region and marshy region, excessive consumption of milk and milk products and their preparations, river water during rainy season and flooded river, newly harvested grains, Pudding prepared out of jiggery, and cane products, as to summarize the food products yielding high calorie, takes longer time for digestion, gets delayed metabolism are the causative factors for Diabetes.[11]

Many researches proved that diabetes is increasing day by day due to change of dietary habits. In developing countries, it is specially considered due to intake increased calories. Recent studies suggest that milk protein have the strongest Diabetogenic effect. If cow or buffalo milk is introduced before the age of 2-3months is specifically associated with the presence of antibodies to bovine serum albumin and increase the risk of insulin-dependent diabetes mellitus. Researchers measured the levels of anti-BSA (bovine serum albumin) and anti-ABBOS (Specific part of the albumin protein) antibodies in the serum of these children. Antibodies that react to the ABBOS also react with a beta cell surface protein that may represent a target for autoimmune attack and ultimately causing insulin-dependent diabetes mellitus.[12]

The above dietary causes, the foods and drinks that increase *Medas*(adipose tissue) and *Mutra*(urine0 and diets that are sweet, sour, salty, fatty, not easily digestible, slimy, cold and alcoholic drinks such as beer and molasses are also considered as the causative factors. Latest research revealed that to prevent Diabetes one should avoid foods that cause rise in blood sugar levels. It has also proven that the belly fat with high level of blood triglycerides and decreased level of HDL (high density lipoprotein).[13]

WHO identified one particular type of Diabetes as Malnutrition- Relates Diabetes Mellitus, which is common in India. Most of len and thin young adults between 15 and 35 years age are affected with Diabetes, Which is often reported in Kerala and Orissa states. This type can be correlated to *krisha pramehi*. Thus suggests wholesome diet that is beneficial to all *dhatus*.

Contraindicated Diet (Apathya)

Some type of alcoholic preparations which are mentioned in *Ayurvedic* Pharmacological references such as *Sauviraka, shukata, Maireya*, and *sura*, milk, oil, ghee, sugarcane juice or sugar, jaggery, alkaline curd, grain cakes, sour substances, sour drinks, and meats of domestic, aquatic and swamp animals are contraindicated.

Researches proved that simple carbohydrate are broken down easily and increases blood glucose levels fast and which are the source of high calories. Hence simple sugars such as table sugar, candy, jam, cakes, and pastries are contraindicated.

Recommended diet (*Pathya*)

Aged cereals, such as *Shali* rice (variety of red rice)**,** *Shastika* rice,barley, wheat, *Shamyaka* (*Echinochoa frumentacea Linn*)**,** Kodo Millet**,** Preparations of Bengal gram, green gram, vegitables having bitter taste. *Atasi*(*Linum usitartissimum*) commonly known as flax seeds, which are enriched with Omega-3. Anti-diuretic and fatless meat of wild animals are *pathya*(beneficial) for diabetic patients. Among spices black pepper, Ginger and in salt Rock salt the recommended diet.[14]

Unwholesome life style

- Avoiding *Udwartana* (Body massage with medicated powders which reduces *kapha* and reduces body fat)
- *Vyayama varjana* (Avoiding or not performing exercises and strenuous physical activities)
- Inappropriate sleeping habits.[15]

These are some essential factors that influence the metabolism. The improper sleep pattern and life style influences the fat metabolism and carbohydrate metabolism and also on the glycemic index.

Preferred Life style and exercises[16]

- Early morning awakening
- Brisk walking/light exercise for 30min
- Massage/ swimming
- Yoga-*Asana(as Padmasana, Paschimottanasana, Suptavajrasana, Surta-Namaskar, Dhanurasana)*
- *Pranayama(Bhastrika, Anuloma-Viloma)*
- After lunch walking for 15min
- After dinner walking for 15min.

Various nutraceuticals and their role in Diabetes:

Cereals	*Raktha shali, Shasthika shali*,Wheat, *Yava, Kodrava, Nartaka*
Pulses	*Adhaki, kulattha,Mudga,*
Oils	*Atasi, Ingudi, Nikumbha,*
Vegetables	*Navapatola, Tnaduliyaka, Vatsaka, Masyakshi, Methika, Karavellaka, Palandu*
Spices	*Maricha, Lashuna, Upakunchika, Ardraka*
Fruits	Inidan gooseberry, *jambu/java plum, kapittha*

CEREALS

Rice: Rice is the seed of the grass species *Oryza glaberrima* (African **rice**) or *Oryza sativa* (Asian rice). As a cereal grain, it is the most widely consumed staple food for a large part of the world's human population, especially in Asia and Africa. Cooked, un enriched, white, long-grained rice is composed of 68% water, 28% carbohydrates, 3% protein, and negligible fat (table). In a 100 gram serving, it provides 130 calories and contains no micronutrients in significant amounts, with all less than 10% of the Daily Value (DV). Cooked, white, short-grained rice also provides 130 calories and contains moderate amounts of B vitamins, iron, and manganese (10–17% DV) per 100 gram amount. The medical value of various types of rice, such as Shashtika shali, Raktha shali, And parched rice have been documented in *Charaka Samhita* and *Sushrutha samhita*. *Navara* a type of Kerala rice widely used in as body enriching to exclude end toxins and free radicals. Colored rice(black and red) are rich in minerals

and polyphenols and have antioxidant properties. *Basumathi* rice has low glycemic index and re useful in weight- reducing diets.[17]

Raktha shali and *shastika* shali pacifies the vitiated *tridosha* and thus useful in diabetics. More than one year aged rice considered light for digestion and beneficial in Diabetics in comparison with new rice.[18]

Wheat

Wheat is a major ingredient in such foods such as bread, porridge, crackers, biscuits, muesli, pancakes, pasta and noodles, pies, pastries, pizza, polenta and semolina, cakes, cookies, muffins, rolls, doughnuts, gravy, beer, vodka, boza (a fermented beverage), and breakfast cereals. In 100 grams, wheat provides 327 kilocalories and is a rich source (20% or more of the Daily Value, DV) of multiple essential nutrients, such as protein, dietary fiber, manganese, phosphorus and niacin (table). Several B vitamins and other dietary minerals are in significant content. Wheat is 13% water, 71% carbohydrates, and 1.5% fat. Its 13% protein content is mostly gluten (75-80% of the protein in wheat). 00 g (3.5 oz) of hard red winter wheat contain about 12.6 g (0.44 oz) of protein, 1.5 g (0.053 oz) of total fat, 71 g (2.5 oz) of carbohydrate (by difference), 12.2 g (0.43 oz) of dietary fiber, and 3.2 mg (0.00011 oz) of iron (17% of the daily requirement); the same weight of hard red spring wheat contains about 15.4 g (0.54 oz) of protein, 1.9 g (0.067 oz) of total fat, 68 g (2.4 oz) of carbohydrate (by difference), 12.2 g (0.43 oz) of dietary fiber, and 3.6 mg (0.00013 oz) of iron (20% of the daily requirement).

Yava(Barley Hordeum vulgare L.)

Yava(Barley) which is high in fiber content(4gm in 100gm) among all relative grains, is highly recommended in Diabetic diet in different forms. *Ruksha*(dry), *Kaphashamaka*(Pacifies *kapha*) properties of *Yava* support its usage in Diabetes, were the condition *Bahudrava Shleshma* can be managed. Use of the mixture of whole wheat Atta and barley is considered *Kaphashamak* and is recommended for diabetes. In a 100-g serving, cooked barley provides 123 Calories and is a good source (10% or more of the Daily Value, DV) of essential nutrients, including, dietary fiber, the B vitamin, niacin (14% DV), and dietary minerals including iron (10% DV) and manganese (12% DV).[19]

In another study on adult diabetic rats with a diet containing barley had a modulating effect on the symptoms of diabetes. It was presumed by its very high content of chromium (5.69µg/g)

In charaka samhitha *Prameha chikitsa Yava* is indicated as both diet and medicine. Different recopies such as porridge, drink, decoction and pancake and soft bread *(pulaka*, and *roti*) made out of barley powder is the choice of diet and medicine. This usage of different kinds of millets helps in absorption and excretion of excessive water, which is coined as *kleda* in Ayurveda.[20] the classics texts of ayurveda gives more importance to the barley as part of diet and medicine, simplest form of barley, the powered barley can be licked with honey.

Kodrava (Paspolum scrobiculum* Linn.*)

This was considered as poor men's diet in ancient days. This is considered to be the best substitute of Kodo millet is a nutritious grain and a good substitute to rice or wheat in hilly region.

The grain is composed of 11% of protein, providing 9 grams/100 g consumed It is an excellent source of fibre at 10 grams (37-38%), as opposed to rice, which provides 0.2/100 g, and wheat, which provides 1.2/100 g. An adequate fiber source helps combat the feeling of hunger. Kodo millet contains 66.6 g of carbohydrates and 353 kcal per 100 g of grain, comparable to other millets. It also contains 3.6 g of fat per 100 g. It provides minimal amounts of iron, at 0.5/100 mg, and minimal amounts of calcium, and 27/100 mg. Kodo millets also contain high amounts of polyphenols, an antioxidant compound.[21]

***Nartaka(*Eleusine coracana L.Gaerth)**

The Finger millet commonly known as Naachni in North India and Ragi in South India. This is one of staple food used in Karnatka. This has not mentioned in any *samhithas* in the explanation of *aharavarga*, later down the line *nighantus* gives the explanation. *Shaligrama nighantu* explains the property as *laghu* (light of digestion), and blood purifier too.[22] The above mentioned properties of *narthaki* are helpful in treatment of *prameha* and *madhumeha* also.the seed coat is the rich source of dietary fiber (3.7gm%) and phenolic compounds and calcium (370mg/gm), the other nutritional values per 100gm is quoted as Protein 7.6gm, Fat 1.5gm, carbohydrate88gm, vitamin A 0.48mg, thiamine(Vit B1 0.33mg), Riboflavin (Vit B2 0.11mg), Niacin (Vit- B3) 1.2mg.[23] Of all the cereals and millets, finger millet has the highest amount of calcium (344 mg%) and potassium (408mg%). The cereal has low fat content (1.3%) and contains mainly unsaturated fat. 100 grams of Finger millet has roughly on an average of 336 KCal of energy in them. However, the millet also contains phytates (0.48%), polyphenols, tannins (0.61%), trypsin inhibitory factors, and dietary fiber, which were once considered as "anti nutrients" due to their metal chelating and enzyme inhibition activities (Thompson 1993) but nowadays they are termed as neutraceuticals. Being non-glutinous, finger millet is safe for people suffering from gluten allergy and celiac disease. It is non-acid forming, and hence easy to digest. Finger millet is rich in amino acids (Tryptophan, Threonine, Valine, Isoleucine and Methionoine). The Glycemic Index (GI) values were less for wheat and ragi-based foods. After the decortication process also, the glycemic index of ragi was lower than of the two rice products. Wheat based and finger millet based formulations are suitable as a

food supplement or meal replacer for non insulin dependent diabetes mellitus (NIDDM) subjects.

Pulses

Pulses are highly nutritious foods that are included as part of Canada's Food Guide to promote healthful eating, and they have established health benefits that can contribute to the dietary management of diabetes. A review of studies that have examined the effects of pulse consumption on health outcomes, integral to the management of diabetes, provides credible evidence for improvements in glycemic control, reduction of blood lipids and regulation of body weight. Results from acute feeding trials suggest that postprandial blood glucose response is significantly attenuated by a single pulse serving of between three-quarters and 1 cup. At lower doses, pulses attenuate postprandial blood glucose response more than similar amounts of starchy foods. Long-term pulse consumption of 5 cups per week appears to result consistently in improvements in glycemic control.[24]

***Adhaki* (Red Gram; Cajanus cajan Linn. Millsp.)**

Enumeration of *Adhaki* as the part of treatment in *prameha* in any samhitha is not seen. *Bhavaprakasha nighantu* explains the property of *adhaki* as which pacifies the vitiated body humors such as *pitta*, *kapha* and blood.[25] and considered as *antiobese*, *vatajanana* property which is more suitable in obese diabetes. The red gram commonly known as Toor dal, used in Indian subcontinent for preparing soups. It contains essential amino acids, dietary fibers 15gms/100gm. In a study conducted at AIIMS pharmacology department proved hypoglycemic and antihyperglycemic activity.[26]

Kuluttha* (Horse gram**: ***Dolichos biglorus. **Linn)**

Kullatha a prescribed diet for diabetics and used as one of the ingredients *Dhanvantari ghrita* and is used in Diabetic boils and abscess. It is considered Kaphavatashamak (Pacifies *vitiated kapha* and *vata*) hot in potency and acts as *Pittavardhak*. The *kulattha* is well known for its diuretic property. Based on these properties it is mainly indicated in *Kapha* and*Vata* varieties of *prameha* and *Medoroga* (Obesity). Horse gram seed contains carbohydrate (57.2% w/w), protein (22% w/w), dietary fiber (5.3% w/w), fat (0.50% w/w), calcium (287 mg), phosphorus (311 mg), iron (6.77 mg) and calories (321 kcal) as well as vitamins like thiamine (0.4 mg), riboflavin (0.2 mg) and niacin (1.5 mg) per 100 grams of dry matter. Its nutritional content is partly dependent on soil conditions and the weather. Its less appealing taste has led it to be not commonly eaten.[27] Scientists from the Indian Institute of Chemical Technology have found that unprocessed raw horse gram seeds not only possess antihyperglycemic properties, but also have qualities which reduce insulin resistance. The scientists made a comparative analysis between horse gram seeds and their sprouts and found that the seeds have greater beneficial effects on the health of hyperglycemic individuals. The majority of antioxidant properties are confined to the seed coat and its removal would not do any good. Raw horse gram seed is rich in polyphenols, flavonoids, and proteins, major antioxidants present in fruits and other food materials. The seed has the ability to reduce postprandial hyperglycemia by slowing down carbohydrate digestion and reducing insulin resistance by inhibiting protein-tyrosine phosphatase 1 beta enzyme.[28]

Mudga (Green gram: *Vigna radiate* Linn. / *Phaceolus radiates* Linn.)

Mudga is known to possess a unique property in initiating physiological effects in the human body Green gram, a principle pulse used as a daily food article, exhibits a potential to act against this. In this regard, Ayurveda recommends its use in daily diet and modern research also directs towards the same recommendation. The pharmacodynamics of mung in Ayurveda has been explained to be that as *Madhur*a (Sweet) and *Kashaya* (astringent) in taste, *Laghu* (light for digestion), *ruksha* (Dry), *sheetaveerya* (cold in potency), *katu vipaka* (post digestive transformation into pungency) and it exhibits *Kaphapittahara Vatakaratva* (pacifies *kapha* and *pitta* whereas aggravates *Vata*). It is known to be drushtiprasadaka9 (improves quality of vision).[29] Green gram is known for its high nutritional value. 100 g of it produces 334 Kcal of energy. 17 It is rich in carbohydrates (56.7 g/100 g) and is a very good source for minerals like Potassium (843 mg/100 g), Magnesium (127 mg/100 g), Calcium (124 mg/100 g), Phosphorus (326 mg/100 g) and Iron (4.4 mg/100 g). Vitamins like Carotene, Thiamine, Niacin, Riboflavin, Ascorbic acid and Folic acid are also present in Mung. It is considered one of the best sources for proteins and constitutes a number of essential amino acids such as Arginine, Histidine, Lysine, Tryptophan, Phenylalanine, Leucine, Isoleucine, Tyrosine, Valine, Threonine, Cystine and Methionine. Mung, hence is considered to be a substantive source of dietary proteins and carbohydrates. Mungbean provides significant amounts of dietary iron to plant based diets in developing countries where Mungbean is consumed. 18 Certain chemical components such as flavanoids (Flavones, isoflavones and isoflavonoids), phenolic acids (Gallic acid, Vanillic acid, Caffeic acid, Cinnamic acid, protocatechuic acid, Shikimic acid, p- hydroxybenzoic acid etc), and organic acids isolated from Mung in recent years, supports its health promoting action as mentioned in the classics.[30]

Oils

The recommended oils for diabetes are *Nikumbha(danti*: *Baliospermum montanum*), *Ingudi*,(*Balanites Aegyptica* Linn), *Sarshapa*(Musturd), and *Atasi*(*Linum usitatissimum*). These oils are pungent in nature and low quantities of these oils are sufficient in cooking to give desired taste and flavor.

Atasi *Taila*(Linseed oil)

Linseed oil, also known as flaxseed oil or flax oil (in its edible form), is a colourless to yellowish oil obtained

from the dried, ripened seeds of the flax plant (*Linum usitatissimum*). Linseed oil is an edible oil in demand as a dietary supplement, as a source of α-Linolenic acid, (an omega-3 fatty acid). In parts of Europe, it is traditionally eaten with potatoes and quark. It is regarded as a delicacy due to its hearty taste and ability to improve the bland flavor of quark. Raw cold-pressed linseed oil – commonly known as flax seed oil in nutritional contexts – is easily oxidized, and rapidly becomes rancid, with an unpleasant odour, unless refrigerated. Linseed oil is not generally recommended for use in cooking. Alpha linolenic acid (ALA) while bound to flaxseed ALA can withstand temperatures up to 175 °C (350 °F) for two hours.

The other two oils *Ingudi* and *Nikumbha taila* are not commonly available and not commonly used. Recent research proved that there has been alarming increase in the prevalence of diabetes and cardiovascular ailments in Indians. Earlier traditional cooking fats were condemned to be atherosclerogenic and replaced with refined multi branded refined vegetable and other seed oils presuming as "heart-friendly and diet friendly oil" because of their polyunsaturated fatty acid content. Unfortunately this has not been able to curtail the increasing incidences of diabetes and heart diseases. The current data on dietary fats indicate that is not just the presence of PUFA but the type of PUFA that is important.[31]

Vegetables

Vegetables supply vitamins, minerals, and fiber. The best vegetable choices can be found to have low amounts of carbohydrates. In *Ayurveda* while explaining the treatment of *prameha*, the green leafy vegetables which are having bitter and astringent flavor are more emphasized. The vegetables, *Navapatola* (*Trichosanthes dioica*) commonly known as pointed guard, *Tanduliyaka* (Amaranthus plant),*Vastuka*,(Chenopodium album) commonly known as wild spinach as goose foot. *Matsyakshi* (Alternnathera sessiles), with these all bitter vegetables such as *Mehitka*(*Trigonella foenum)*, *Karavellaka* commonly known as bitter guard,(*Momordica charantia*) are recommended. *Navapatola* is *Laghu*, *Deepana* and *pachana*, which is digestive and carminative. This pacifies *vitiated tridosha* hence, it is wholesome in diabetics. One xperimental studies on rats' aqueous extract of *Tricosanthus dioica* Roxb. Was proved for its anti hyperglycemic action.[32]

Navapatola is *laghu, Dipan* (appetizer), *Pachan* (digestive) and pacifies the vitiated *Tridosha*. Hence, it is wholesome in diabetics. *Tanduliyaka* is *Laghu*, *Ruksha*, *Kaphapittashamak* and *Vishaghna.* Decreases risk of cardiovascular disease. Diabetes is the pre disposing cause for cardiovascular and renal disorders when it becomes un controlled. By substituting Amaranthus as one of the dietary supplement one can prevent the fore coming complications of diabetes. Presence of lysine (an essential amino acid) along with vitamin E, iron, magnesium, phosphorus and potassium and vitamin C helps to fight against free radicals responsible for aging. Since it is very rich source of multi vitamins, minerals and other forms of micronutrients this also helps in prevention of Diabetic neuropathy. Mentholic extract of the stem of *Amarantus spinonus* Linn showed significant antidiabetic antihyperlipidemic effects on STZ- induced diabetic rats.

Matsyakshi* (*Alternanthera sessilis), *Alternanthera sessilis* is an aquatic plant known by several common names, including ponnanganni (in Tamil), ponnaganti aaku (in Telugu), honnagone (in Kannada), mukunuwenna (in Sinhala), sessile joyweed and dwarf copperleaf. It is used as a vegetable specially in Sri Lanka and some Asian countries. The plant is bitter, sweet, constipating and cooling in action. This is a non-toxic plant and eaten as vegetable and salad. The young shoots contain five percent protein and 16.7 mg (per 100 g) iron. Leaves also contain a good amount of alpha- and beta-tocopherols. The properties of This plant as explained as laghu, bitter and astringent in taste, Pacifies vitiated Pitta, Kapha and blood. This plant has proved promising results in eye disorders, hair fall treatment and wound healing. This is commonly used vegetable during monssons.

***Methika* (*Trigonella foenum*)**

This is one among the popular green herb which is part of diet in India. Irrespective of Diabetes or any illness, used as common vegan diet. The seeds, Fresh plant is used in making flat breads, soups, khichidi etc. The fresh juice is also edible. It is found to have hypoglycemic, hypocholesterolemic property on pharmaocologic screening.

Lashuna* (Garlic*: Allium sativum* Linn*)

L*ashuna* the unexceptional vegetable or the spice used in Indian cuisine. As the *Ayurveda* text explains its properties, this bears five tastes (sweet, salt, bitter, pungent and astringent) with predominance of pungent, heavy and penetrating and hot in potency. It is the pacifier of *Vata*, and favors the properties of *Pitta* and *Raktha.*[33] Garlic is widely used around the world for its pungent flavor as a seasoning or condiment. Fresh or crushed garlic yields the sulfur-containing compounds allicin, ajoene, diallyl polysulfides, vinyldithiins, *S*-allylcysteine, and enzymes, saponins, flavonoids, and Maillard reaction products, which are not sulfur-containing compounds. On Pharmacological Screening its Hypocholesterolemic, hypolipidemic, antioxidant, antiaging, cardioprotective, hypoglycemic, hypotensive, fibrinolyti actions were proved.[34] The typical serving size of 1–3 cloves (3–9 grams), garlic provides no significant nutritional value, with the content of all essential nutrients below 10% of the Daily Value (DV) (table). When expressed per 100 grams, garlic contains several nutrients in rich amounts (20% or more of the DV), including vitamins B6 and C, and the dietary minerals manganese and phosphorus. Per 100 gram serving, garlic is also a moderate source (10–19% DV)

of certain B vitamins, including thiamin and pantothenic acid, as well as the dietary minerals calcium, iron, and zinc (table). The composition of raw garlic is 59% water, 33% carbohydrates, 6% protein, 2% dietary fiber, and less than 1% fat. Several studies suggest that consuming moderate amounts of garlic (at least one clove or equivalent daily) when you have type 2 diabetes, can help regulate your blood sugar levels and improve insulin sensitivity. Results from nine studies looking at garlic and diabetes showed a significant reduction in fasting blood glucose (sugar) within 1-2 weeks in the group taking 0.05-1.5g of garlic supplement daily. Additionally, A1C was significantly reduced by week 12. Garlic consumption was also shown to reduce LDL (bad) cholesterol and increase HDL (good) cholesterol.[35] Most of its beneficial effects, such as antioxidant, antimicrobial, and antitumor, involve sulfur-derived amino acids. In a study the acute effects of aqueous effects of extract of garlic on plasma glucose and cholesterol levels in normal rats were re-evaluated. It was confirmed that garlic contained an active fraction exerting both glucose- and cholesterol lowering activity.[36]

***Upakunchika*(*Nigella sativa* Linn.)**

Upakunchika(black cumin) is bitter and pungent in taste, hot in potency and penetrating in nature. It is indicated in diabetes and considered as cardiotonic. Its hypoglycemic, hypotensive, cardiovascular, antidiabetic, and cardiac depressant actions were proved on pharmacologic screeing.[34,36] A study was conducted to evaluate the possible protective effects of the volalite oil of *Nigella sativa* seeds on insulin immun0reactivity and ultra structural changes of pancreatic beta cells in STZ-induced diabetic rats. A therapeutic protective effect in diabetes by decreasing morphologic changes, preserving pancreatic beta cell integrity and protecting against oxidative stress was observed.[37] Oils are 32% to 40% of the total composition of *N. sativa* seeds. *N. sativa* oil contains linoleic acid, oleic acid, palmitic acid, and *trans*-anethole, and other minor constituents, such as nigellicine, nigellidine, nigellimine, and nigellimine N-oxide.

Aromatics include thymoquinone, dihydrothymoquinone, *p*-cymene, carvacrol, α-thujene, thymol, α-pinene, β-pinene and *trans*-anethole. Protein and various alkaloids are present in the seeds.

***Ardraka (Zingiber officinale* Roscoe.)**

Ardraka is pungent in taste with hot potency. This has property of pacifying vitiated *Tridosha*. It is indicated in diabetes and heart disease and used as rejuvenator and aphrpdisiac.[38] Its hypolipidemic, anti -atherscleratic, cardiovascular, antioxidant, anti stress, and hypoglycemic actions were proved on pharmacologic screening.[39] In a study over 40 anti oxidative compounds from *Zingiber Officinale* Roscoe. Were found effective against development of diabetic cataract in rats and can be suggested for prevention or delay of diabetic complications.[40]

Fruits

Contemporary medical science advices not to consume fruits, fruit juices because of high sucrose contents. Generally, eating fruit as part of a healthful diet should not increase the risk of diabetes. A diet that is high in sugar, refined carbohydrates, and saturated fats is likely to be more of a risk. However, consuming more than the recommended daily allowance of fruit may add too much sugar to the diet. Most fruits have low GI scores, but melons and pineapple are in the high range. Processing food increases its GI ranking, so fruit juice has a higher score than a whole piece of fruit. Ripe fruit also has a higher GI score than unripe fruit. In Ayurveda eating fruits such as Amla(Indian gooseberry), Jambu (Jamun, Wax apple), Kapittha (wood apple) does not cause any ill effect on Glycemic index.

***Jambu* (*Syzygium cumini* (L) Skeels.)**

This is one among the most common medicinal plants used to treat diabetes. The tender leaves, ripened fruit, the bark all are intended to have hypoglycemic activity. Raw fruit is 83% water, 16% carbohydrates, 1% protein, and contains negligible fat. In a 100 gram reference amount, the raw fruit provides 60 calories, a moderate content of vitamin C. It has a mixed taste of sweet, astringent, sour, cool and light. This has property of pacifying vitiated pitta and kapha diseases. The exact mechanism of action of Jamun in lowering the blood sugar and cholesterol level is not known. The Jamun may have employed several putative mechanisms to bring out its effects (Figure 2). The diabetes is triggered by induction of free radicals. Jamun may have reduced free radicals and improved the functioning of β-cells of pancreas reducing the sugar level. Jamun also stimulates the activation of different enzymes like catalase glutathione peroxidase, glutathiones-transferase and increased synthesis of glutathione and depletes lipid peroxidation that may have also helped to reduce the sugar cholesterol levels in the blood. Jamun may have reduced the activity of α-amylase, which is upregulated in the diabetes. The α-amylase activity has been found to be reduced by Jamun. At molecular level presence of Jamun may have upregulated the PPARγ and PPARα leading to the suppressed activation of transcription factors including NF-κB, nitric oxide synthase (iNOS), tumour necrosis factor-alpha (TNF-α) and cyclooxygenases causing reduced inflammation and protection against diabetes and hyperlipidaemia. Apart from this Jamun may have also upregulated the transcription of Nrf2 leading to increase in the antioxidants that may have resulted in the proper functioning of β-cells of pancreas.[41,42,43] The jambu in different forms such as seed powder, decoction of tender leaf, fermented preparations in ayurveda such as Asava and Arista are highly indicated in Diabetic and pre diabetic conditions.

***Kapitta* (*Feronia elephantum* correa.)**

Kapitta, commonly kmown as Wood apple which is having very hard capsule which encapsulates very nutritious pulp which is sweet and astringent sometimes slightly sour in taste. This fruit resembles fruit of Beil. The fruit pulp of the plant has been reported in traditional medicine as a curative for various ailments such as diarrheoa, pruritis, impotence, dysentery, heart disease, vomiting, and anorexia, and has also been used for the treatment of asthma and tumours, and as a liver tonic. A decoction (Kadha) administered orally before breakfast has been advocated by local traditional medical practitioners as a tonic purpose. The fruit pulp of Feronia elephantum (Corr.) contains flavonoids, phytosterols, tannins, carbohydrates, triterpenoids and amino acids as its chemical constituents. The gum of the plant are widely used as a curative for diabetes mellitus in Indian system of medicine and also used as a folklore remedy to control the blood glucose level. Hence this study was undertaken to investigate the effect of methanolic extract of Feronia elephantum Corr. fruits pulp in normal and alloxanised diabetic rats.[44]

CONCLUSION

Diabetes the coined term for *Prameha o*r the *Madhumeha* is one of the leading health problem in the world. There are 425 million people around the world who have been suffering from diabetes in 2017. People hurdling to combat this or to maintain blood sugar level with multiple modules. People are Craving for the diabetic diet, and exercise schedules so that they can outreach the problem. Traditional Indian Diets, Yoga, Exercises in regular basis are prescribed to prevent and treat diabetics are functional and used as both food and medicine. Ayurveda emphasizes their selection on the basis of *doshas* involved, and properties of food stuffs which can be used as medicine. These are selected on fundamental principles, such as *Rasa guna*, *Virya*, *Vipaka*, *Prabhava*(Collectively these are called as physical and pharmaco dynamic properties). In recent researches they are proved to contain rich amount of dietary fiber, anti oxidants, and other active principles which reduces free radicals. It is time to highlight this ancient Indian Wisdom At global level and make the scholars aware about the depth of knowledge and foresight of ancient Indian Scholars.

By considering all the facts this can be wisely concluded as

1. Many food we eat becomes the Nutraceuticals which should be used wisely according to requirement and majority or those are proved useful many researches.
2. Due to varsity and changed food and life style culture some time tested neutraceuticles are not in usage. Overcoming to change in civilization adaptations and aggrgricgations many food cultures are used wisely in tribal and non urban areas. There is necessity to high light and propogate the benefit of these diets in the public domain.
3. Based on fundamental and contemporary scientific researches more diets and exercises are to be evaluated for the benefit of common man. There is also a need to popularize the true research outcomes to common man to take preventive steps from becoming young diabetics.

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