



## RESEARCH ARTICLE

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## Prevalence, prevention and management of Diabetes mellitus (Madhumeha) in Gulf countries

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### ABSTRACT

Diabetes mellitus is characterized by high blood sugar levels. Different types of diabetes are discussed in the present article. This disease has high prevalence in GCC countries and a major contributor to this disease is obesity and life style. Various life style modifications and diet control can help in reducing this disease. A number of exercises and herbal remedies have been found useful and are discussed in detail in the chapter. Various therapies are also helpful in controlling diabetes. The article also discusses role of several postures, breathing techniques and meditations which are helpful in controlling stress and give relaxation.

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## INTRODUCTION

Diabetes mellitus is a clinical syndrome characterized by Hyperglycemia due to absolute or relative deficiency of Insulin. If it is left untreated, it can cause acute complications including diabetic ketoacidosis and non ketotic hyperosmolar coma. Serious long - term complications include heart disease, stroke, kidney failure, foot ulcers and damage to the eyes.

It has become one of the largest burdens on health care systems worldwide. (1) It is expected that numbers of diabetic patients in Asia and Australia will rise from 82.7 to 190.5 million between 2000 and 2030. (2) In children the trend is almost the same. A previous study in Oman showed a doubling of cases of overweight grade 10 students between 2004 and 2008. ( 3-5). Arabian Gulf countries are facing a huge challenge with a high increase in diabetic cases. ( 6). World Health organization conducted a national survey in the United Arab Emirates (UAE) with the UAE Ministry of Health between 1998 and 2000 and reported that 19.6% of the population had diabetes, while among UAE citizens (as opposed to expatriates) it was 24%. The UAE currently has the second highest rate of diabetes in the world. (7)

A study was conducted in Muscat in six health centres. Only 2.4 % of diabetic patients achieved international recognised goals for all 6 diabetes factors (HbA1C <7%; BP <-130/80 mmhg; total cholesterol <5.2 mmol/l; low-density lipoproteins cholesterol (LDL) <3.3 mmol/l; high-density lipoproteins cholesterol (HDL) >1.1-<1.68 mmo/l, and triglyceride (TGD) <1.8 mmol/l. (8)

The prevalence of diabetes in the sultanate of Oman as revealed by the 2000 National Health Survey was 11.6% as compared to 8.3% in 1991, representing an increase of 40% over a single decade. ( 9)

The world health Organization estimates a 190% increase in the number of people living with diabetes in Oman over the next 20 years from 75000 in 2000 to 217000 in 2025. ( 10)

Six Arab countries in the Middle East and North Africa are among the 10 countries in the world with the highest diabetes and Pre Diabetes prevalence. According to International Diabetes Federation, 2009 these countries are Saudi Arabia, Oman, Bahrain, Kuwait, UAE and Egypt.( 11)

In the Gulf countries, efforts are being made through established national committees and campaigns to raise awareness about diabetes and the standards of its care.

While the world wide prevalence of Diabetes in 2030 will be 25% higher than in 2003, the prevalence in MENA region is set to increase by 81% during this period. This means Diabetes cases in Middle East region is expected to increase by 2 folds. (11, 12)

As per International Diabetes federation, Global health expenditure to prevent and treat diabetes was 376 billion USD in 2010 and it is expected to increase by 490 billion USD in 2030. These figures indicate that health expenditure for diabetes will grow by 30-34% between 2010-2030 which is more than assumed global population growth (28.6%) among persons aged 20-79 yrs over the same period. ( 13)

It has also been estimated that most of the countries will be spending 5-13% of the total health care budget on Diabetes. (IDF diabetes atlas fourth edition)

In Diabetes the fasting blood glucose is 126 mg/deciliter or greater or A1c above 6.5 percent. In Pre Diabetes fasting blood glucose is 100-125 mg/dl and 2hrs glucose between 140-199 mg/dl or A1c 5.7-6.4 percent. If blood glucose after 8-12 hrs of fasting is higher than normal but not high enough for the diagnosis of DM then it is a stage of Pre Diabetes. Same is the case with impaired glucose tolerance test also.

Between 35-65% of those with IGT develop Type-2 DM within 6 years compared to less than 5% who have normal blood glucose levels. Although age and genetics are risk factors for Type-2DM but obesity is the major contributor for pre-diabetes and full blown DM. People with Pre-Diabetes who lose 5% of their body weight can reduce the conversion to full blown by 58%.

## TYPES OF DIABETES

The disease happens when pancreas are not able to produce enough insulin or cells of the body donot respond to the insulin produced. The diabetes are classified into three types.

1.Type I DM also known as Insulin dependent diabetes mellitus. It results when body is not able to produce enough insulin. Its cause in not known. It is also referred to as juvenile diabetes.

2.Type 2 DM also known as non insulin-dependent diabetes mellitus is a condition in which cells donot respond to insulin. It is also known as adult-onset diabetes. The main cause is excess body weight and sedantry life style.

3.Gestational diabetes: It occurs when pregnant women without a previous history of diabetes develop high blood glucose level.

Type-II diabetes constitutes 95% of Diabetic population. Globally, as of 2013, an estimated 382 million people have diabetes worldwide, with type 2 diabetes making up about 90% of the cases. (13) Type 1 diabetes must be managed with help of insulin injections. Type 2 diabetes can be treated with medications with or without insulin. For obese patients, weight loss surgery is an effective measure. Gestational diabetes resolves in most of the cases after the baby is born.

**MAIN CAUSES OF DIABETES ARE CLASSIFIED AS BELOW:**

- 1- Genetic susceptibility.
- 2- Obesity
- 3- Physical inactivity
- 4- Stress
- 5- Wrong diet
- 6- First degree relative with diabetes
- 7- High risk race/ ethnicity (e.g. African American, Latino, Native american, Asian)
- 8- Women who have delivered a baby weighing >9 lb or were diagnosed with GDM
- 9- Hypertension (>140/90mmHG or on therapy of hypertension).
- 10- HDL cholesterol level <35mg/dl(0.90mmol/l) or a Triglyceride level>250mg/dl (2.82mmol/l)
- 11- Women with polycystic ovarian syndrome.
- 12- A1C>5.7%, IGT or IFG on previous testing.
- 13- History of CVD

Testing should be done in all adults who are overweight (BMI> 25kg/m<sup>2</sup>) and have additional risk factors. In the absence of above criteria, testing for Diabetes should start at the age of 45yrs. If the results are normal, testing should be repeated after every three years interval. Those with pre-diabetes should be tested yearly.

**EFFECT ON BODY**

In diabetes all three doshas, Vata (Air + Space), Pitta (Fire+ Water) and Kapha (Water+ Earth) get imbalanced which eventually affect other body tissues like muscular and fatty tissues, body fluids, blood, lymph, spermatic fluid and Ojas etc. Acute effects on body include polyphagia i.e. increased appetite, polydipsia i.e. increased thirst, polyurea i.e. increased urination, blurred vision, weight loss, fatigue, UTI etc. Chronic effects include blood vessel disease, atherosclerosis, neuropathy, nephropathy, retinopathy and loss of libido etc.

**PREVENTION AND MANAGEMENT OF DIABETES INCLUDE**

- 1.To reduce the sugar in blood and urine
- 2.Maintain ideal body weight
- 3.Physical exercise
- 4.Treat the symptoms
- 5.Provide adequate nutrition.
- 6.Donot use tobacco
- 7.Prevent vascular and other complications.
- 8.Proper foot care

**DAILY CALORIE REQUIREMENT OF DIABETES PATIENTS ARE AS FOLLOWS**

**Metric BMR Formula**

Women: BMR = 655 + ( 9.6 x weight in kilos ) + ( 1.8 x height in cm ) - ( 4.7 x age in years )  
 Men: BMR = 66 + ( 13.7 x weight in kilos ) + ( 5 x height in cm ) - ( 6.8 x age in years )

**Imperial (US) BMR Formula**

Women: BMR = 655 + ( 4.35 x weight in pounds ) + ( 4.7 x height in inches ) - ( 4.7 x age in years )  
 Men: BMR = 66 + ( 6.23 x weight in pounds ) + ( 12.7 x height in inches ) - ( 6.8 x age in years )

**Harris Benedict Formula**

To determine one's total daily calorie needs, BMR should be multiplied by the appropriate activity factor as follows:

- 1.If you are having sedentary life style (little or no exercise): Calorie-Calculation = BMR x 1.2
2. If you are lightly active (light exercise/sports 1-3 days/week): Calorie-Calculation = BMR x 1.375
- 3.If you are moderately active (moderate exercise/sports 3-5 days/week): Calorie-Calculation = BMR x 1.55
- 4.If you are very active (hard exercise/sports 6-7 days a week): Calorie-Calculation = BMR x 1.725
- 5.If you are extra active (very hard exercise/sports & physical job or 2x training): Calorie-Calculation = BMR x 1.9

Distribution of Calories as per the nutrients-  
 Cabohydrate + Monounsaturated fatty acids : 60-70% of total calories

Polyunsaturated fatty acids 10%  
 Proteins 15-20%

Diabetic patient should eat six times a day in divided doses. Three full meals and three times snacks should be taken.

Diabetic diet for approx 1800 K calories is listed in Table 1

TABLE1: DIABETIC DIET FOR APPROXIMATELY 1800 CALORIES

Food item	Quantity	Calories	Sources
Cereals	200gm	700	Yava(Barley), jowar, Bajra, maize, soyabean, wheat, rice etc
Lentils	50gm	175	Mung, Udad, Masoor, Rajma etc
Leafy Vegetables	300gm	90	Spinach, Methi, Lai, Rai, Cabbage, Cauliflower,
Salad Vegetables	300gm	75	Cucumber, tomatoes, radish, onion garlic, carrot

Non-starchy Vegetables	300gm	120	Bottle gourd, Ash gourd, Pumpkin, Bitter gourd, Brinjal
Fats	20gm	180	Mustard oil or cows ghee
Milk	300gm	210	Milk, butter milk and tea etc
Fruits	300gm	240	All fruits except banana, Mango, Grapes, and cheeku
Water	sufficient	Nil	Boiled and Filtered

### **DIETARY MODIFICATIONS**

Approximately 50% of the new cases of diabetes can be controlled by diet alone. (14)

The plate should be as follows (15)

◆ ½ of the plate should be filled with non starchy vegetables like broccoli, carrots, cucumbers, salad tomatoes or cauliflower.

◆ ¼ of the plate should be filled with whole grains or starchy food such as rice, chapatti or barley or wheat, potatoes, corn or pea.

◆ ¼ of the plate should be proteins like fish, tofu, lentils, poultry.

Along with this a glass of low fat milk or soya milk or butter milk or a piece of fruit can be taken.

Fruits should be limited to two servings per day. High sugar fruits such as dates, pineapple, papaya, banana, mango should be limited. Fruits like apples, berries, grapes, peach, plum and apricot should be taken.

Vegetables should be taken in larger quantities but starchy vegetables like potato, sweet potato should be taken in restricted quantity.

Highly refined grains like white flour, white bread, crackers, chips, noodles, cakes and cookies should be restricted. Instead of that, whole grains and grains with low glycemic index like Barley flour, red or brown rice should be taken. Vegetable protein sources have little or no sugar, hence they are highly recommended along with egg white, tofu, non fat cottage cheese which can be taken in moderation.

Nuts like almonds, walnuts have low glycemic index so can be taken in moderation. Minimum 8-10 glasses of water per day should be taken.

Meals should not be skipped. Three small meals with three snacks like digestive biscuits in between are best to maintain moderate blood glucose levels throughout the day.

Carbonated drinks should be avoided as they are high in calories and also increase Insulin resistance. The meat of domestic animals (cows, buffaloes, goat) and water animals (tortoise, crabs) is heavy to digest so they should be taken in less quantity in Diabetes while meat of lean animals like chicken, birds and fishes can be eaten. Barley should constitute the principle ingredient of food for a diabetic patient. (16)

### **FOLLOWING ITEMS NEED TO AVOIDED**

- Milk products with more fat like curd, kheer, cheese, butter, any milk based sweets. Low fat milk and milk products can be taken in small amount.
- Meat dishes with high fat contents like beef, pork, etc
- Grains derived from freshly harvested crops.
- Oily, fried and junk food like pizza, burger.
- Sugar, jaggery and sugar products.
- Fats, sweets and Alcoholic drinks.
- All foods with high glycemic index having high fats and carbohydrates.



Patients who are obese or have high blood sugar level should avoid afternoon sleep. They can take rest in the afternoon for few minutes but should avoid sleeping.

### **VARIOUS LIFE STYLE MODIFICATIONS WHICH ARE RECOMMENDED ARE GIVEN AS FOLLOWS:**

- Walking, jogging etc.
- Yoga and asanas
- Pranayama
- Meditation
- Herbs for diabetes
- Home remedies

#### **1. Walking**

In Ayurveda, great importance has been given to walking. It has been said that:

***“Poor patients who can not purchase medicines if walk for few kilometers regularly, then there Diabetes can be managed. (17)***

Instead of sitting jobs, diabetic patients should do more physical work and heavy exercise. Moderate intensity physical activity like brisk walking, cycling on a flat terrain and aerobics are also recommended. Vigorous physical activity including jogging, fast cycling, playing football, swimming are good for diabetic patients.

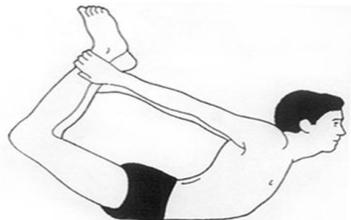
#### **2. Yoga and asanas**

They are defined as “postures in which after attaining the position one can relax all muscles and can maintain the position for long”. Twists in the body supply blood and oxygen to various organs increasing functioning and efficiency of these organs. These yoga exercises when practiced with breathing exercises and meditation

enhance digestion and help pancreas and liver function in a better way regulating blood sugar levels. (18)

Some useful postures in Diabetes include:

**1.Dhanurasana (Bow pose)**



Dhanurasana

**2.Ardhamatsyendrasana (Half spinal twist)**

**3. Matsyendrasana**



**4.Gomukhasana (Cow Face Pose)**



Fingers are locked behind the back.

**5.Vajrasana**



Besides the benefits of increasing lean body mass and bringing down body fat, there is up regulation of insulin receptors and improved insulin sensitivity and decreased insulin resistance. 12 sequence yoga postures are also very good exercise for diabetic patients as they improve blood supply in various parts of body and thus helps in Insulin administration. The following figure depicts the

sequence. (19)



**3. Pranayamas**

They improve oxygen concentration of blood, have calming effect on nervous system, reduce stress. Some of the Pranayams which are helpful in diabetes include:

**a.Nadi Shodhan pranayam (Alternate nostril breathing)**



**b.Bhastrika pranayam (Bellows Breath)**



**c.Bhramri pranayam (Humming sound)**



**4. Meditation**

*“Regular Meditation for few minutes daily reduces stress and help in the proper maintenance of insulin and Blood sugar level”*. Stress is also one of the important causes of Diabetes. According to medical research harmonious balance between sympathetic and parasympathetic systems can positively effect hormones in body. It has

also been found that during meditation if a person focusses on pancreas or visualizes proper functioning of Pancreas, it helps in improving the functions of pancreas. Chaioapanont studies showed the postprandial hypoglycemic effect of sitting breathing meditation exercise on type 2 diabetes and a slight reduction to systolic and diastolic blood pressure. (20)



## 5. Herbs for diabetes

Various herbs which are found useful are as follows:

### **a. Neem (Azadirachta indica)**

Bitter herbs help in reducing diabetes. Neem reduces Insulin requirement of the body. Khosla et. al. studied hypoglycaemic effect of Azadirachta Indica (neem) leaf extract and seed oil in normal and alloxan diabetic rabbits. The effect was comparable to glibenclamide. The data showed that treatment may be helpful in preventing or delaying the onset of disease. (21)



### **b. Triphala**

It has hypoglycemic and antioxidant property. It reduces blood sugar level as it has insulin stimulating action and helps in normalization of carbohydrate and glycogen metabolizing enzymes. Sowmya et. al studied the effect of Triphala powder, called The Three Myrobalans on NIDDM subjects for 45 days. Statistical evaluation showed significant reduction in blood glucose levels. (22)



### **c. Guduchi (Tinospora cardifolia)**

Krishna et. al. reported that various parts of the plant Guduchi are being prescribed in Ayurveda and other systems of medicine as a monoherbal or polyherbal preparation. Various extracts of the plant are included in various polyherbal preparations used for the treatment of diabetes, hepatitis, etc. (23). It reduces blood sugar and stimulates pancreas to secrete Insulin.



### **d. Kairata (Swertia chirata)**

Khondoker et.al. studied hypoglycemic effect of ethanolic extract of leaves of Kairata. There was significant reduction of blood glucose level after 3 hours of test sample administration. Glibenclamide at a dose of 5 mg/kg body weight was used as a standard in this study. (24) It is one of the most bitter herbs of the world. Because of its bitter taste it reduces the blood sugar.

### **e. Turmeric (Curcuma longa)**

It is very effective in Type-2 Diabetes. It is speculated that Curcumin, the anti-inflammatory and anti-oxidant ingredient in turmeric lessens insulin resistance and reduces Type-2 Diabetes. Somlax et. al. found that nine month curcumin intervention in a prediabetic population significantly lowered the number of prediabetic individuals who eventually got T 2DM. The curcumin treatment improved overall function of b-cells, with very minor adverse effects. (25)



### Some of home remedies are discussed as follows



1. Soak Fenugreek seeds (90-100) seeds in 250ml of water and leave overnight.

In morning, crush these seeds and sieve from a fine cloth. Now this mixture can be used for drinking.

2. Half cup juice of Karela ( Bitter gourd ) is very effective in treating diabetes.

3. Leaves, seeds and fruit of Jamun (Black Berry) tree are very effective.



4. Regular intake of two tender leaves each of Bilwa and Neem in the morning reduces blood sugar.

5. Supplementation of cereals with Gram is highly beneficial like Chapatti with barley and gram flour can be made.

6. Turmeric and Aloe vera gel (1-3gms) can be used for improving the Pancreas and liver functions.

### THERAPIES FOR DIABETES

#### 1. Ghitapana

Snehapanam therapy helps in removal of toxins and wastes from the body. Medicated ghee, herbal paste, herbal juice, milk, etc. are given to people on empty stomach. It lubricates lymph and other channels and forces out toxins into digestive tract. This therapy is carried out once in a day on an empty stomach. The type of ghee to be used is decided by an expert Ayurvedic practitioner.

#### 2. Vamana (Medicated Vomiting)

It is very effective for diabetes. Vomiting by herbal medicines is carried out under strict supervision of Ayurvedic practitioners. It eliminates toxins present in upper parts of the body. Medicated milk, tea or herbal

drink is given to the patient, which he/she has to drink till his/her stomach is full. Then a small amount of medicinal decoction made of black Pepper, beetle root, Tamarind and Liquorice is given with honey. This triggers vomiting. Vomiting in Vamana therapy is not unpleasant. A person feels relaxed and light after it.

### 3. Ayurvedic treatments in Diabetes can be listed as follows:

#### **•Virechana-**

In Virechana therapy, small amounts of medicated herbs are given with the diet that eradicate excessive toxins through stool. During this therapy a person is advised to maintain a strict diet as directed by experts that gives nutrients necessary to maintain the energy in the body and at the same time is easy to digest.

•Purgative medicine made of Herbal powder like Avipathy choornam, herbs like turpith, embellia fruits, ginger, lotus, cardamom, cinnamon etc. are given to a person on empty stomach early in the morning.

#### **•Marma**

It has been found that human body has 108 marma points. Gentle touch or light massage on these points balances the flow of Prana and gives total relaxation. Treatment is very effective in reducing blood pressure, anxiety, neurosis, sleeplessness and stress. Marma massage is very light stimulation of these points on the human body.

A few cases which were treated using above remedies and therapies in the Sri Sri

Ayurveda clinic, Oman are as follows:

Case1-

A Male aged 38 years (Wt-83, B-sugarf-137mg/dl, PP-243mg/dl) first visited the clinic on 9th March 14. After being on Ayurveda treatment for a month, second visit on 9th April 14 showed results as Wt-81.7KG, B-sugarf-88mg/dl, PP-162mg/dl

Case2-

A Male aged 33yrs (Wt-109, B-sugarf-154mg/dl) first visited the clinic on 4th September 13.

After being on Ayurveda treatment for a month, second visit on 23rd Oct 13 showed results as Wt-104.8, B-sugarf-115mg/dl, PP-165mg/dl

### **SUMMARY AND RECOMMENDATIONS**

Medical residents in GCC countries should be encouraged to join diabetes fellowship programmes for training. The physicians should be well versed with latest diabetes treatment guidelines. They should follow the international recommendations. Continuous medical education programmes should be held throughout the country for nurses and dietitians on a regular basis. All regional hospitals should have a complete diabetes team consisting of qualified diabetologists/family physicians,

diabetes educators, dieticians, psychiatrists and social workers.

Patients should follow the medical and dietary advice strictly. They should check their glucose daily and keep a log book. A sedentary life style must be avoided; patients should exercise daily for a minimum of 30 minutes. Because of hot weather of Oman, indoor gymns provide a good alternative. Diabetes education should be carried out not only by the medical team, but also by the mass media.

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