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# Case Studies on the Impact of Yogatherapy on Diabetes, Prediabetes & Metabolic Syndrome

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## Abstract

*Over the last 10 years various studies have attempted to quantify the effects of Yoga on diabetes, with most reporting measurable improvements in important health markers, both particular to diabetes and to general health. These studies have largely pursued the approach of testing a standardized Yoga practice, often focused exclusively on asana, on primarily type 2 diabetes patients. Even with these limitations, the promising results suggest that there is the potential for much greater effect if the particular needs, strengths, and situations of each individual patient are taken into account and the particular Yoga practice assigned is customized to these. Additionally, if a broader set of Yoga's tools is implemented, especially the subtler and, by virtue of this, more powerful ones, the potential for positive influence is further increased. This qualitative study provides an insight into the particular concerns with type 1 and type 2 diabetes, as well as pre-diabetes and metabolic syndrome (related conditions understood to be precursors to the expression of type 2), and how Yogatherapy can support patients in the process of healing. It aims to find commonalities and differences in circumstances and the appropriate approach to treatment between these conditions and among patients. It also provides details on specific case studies and highlights how the approaches can vary along more complicated lines than simply the type of diabetes. We targeted 13 patients, including 12 female and 1 male participant. The range of ages was 14 years old to 68 years old. Of the participants, we examined 4 Type 1, 6 Type 2, and 3 pre-diabetes and metabolic syndrome. Participants received personalized yoga practices and were observed by a yoga therapy student for respective periods. Our results showed that personalized yoga practices are an effective tool for addressing complications and suffering in patients with diabetes.*

## Introduction

Diabetes is a simple term that describes a complicated set of chronic conditions associated with elevated blood glucose levels and the diminution or absence of, or dysfunctional response to, insulin in the body. It is a pervasive disease whose effects are felt in every country in the world and whose incidence has been

increasing rapidly even as its exact triggers elude identification.

Current estimates of the incidence of diabetes worldwide stands at ~422 million cases (taking into account both diagnosed and undiagnosed), representing a quadrupling of worldwide cases in less than 40 years<sup>1</sup>. To put it in proper perspective, this means if all persons with diabetes were to live in one country, this country would firmly have the third largest population in the world (exceeded only by China and India)<sup>2</sup>.

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It would exceed the population of the United States (currently in third place) by more than 22%<sup>3</sup>.

Incidence in adults 20-79 years old by country varies greatly, from worrisome (1.0% incidence for Benin) to catastrophic (more than 30% incidence for the Marshall Islands). The United States, Argentina, Japan, and Norway (noted here since they are the birth countries of the authors of this paper) stand at 10.8%, 5.9%, 5.6%, and 5.3% incidence rates, respectively<sup>4</sup>.

As high as these may seem, especially for developed countries, the rates of diabetes are both much higher and rising more quickly in the developing world, where changes from traditional agricultural communities to modern lifestyles and diets seem to be fueling increased incidence. The lowest incidences of diabetes (currently running the gamut between 1% and 3%) are potentially misleading, since the majority of the countries in that list are developing countries (mostly in Africa) with few resources to appropriately diagnose, let alone track, the incidence of diabetes<sup>4</sup>.

These statistics are further complicated by the fact that what we call diabetes is not a homogenous disease but rather one that manifests in dramatically different ways. Though the definitive sign of the disease is elevated blood glucose levels, this condition can be achieved via the obliteration of cells responsible for the production of insulin, which itself is responsible for triggering the body's use of glucose, or the body's own lack of sensitivity to insulin, even as it is produced in abundance. Additionally, the onset of these conditions can be seemingly rapid or gradual. In some cases, as in gestational diabetes, they may be temporary but signal higher risk of later development of the chronic condition.

With only recent indication of strong genetically inherited predisposition and no clear mechanism for onset, there is a general acceptance that we know little about what leads to these conditions. Experts in the medical field

speak of associated markers, such as obesity, sedentary lifestyle, and poor diet, rather than causative agents for diabetes (in the case of type 2), and genetic predisposition and potential environmental triggers (in the case of type 1 mostly). There is data that could be interpreted as pointing to a genetic component for type 2, but which needs to be scrutinized so as to remove the influence of socio-economic variables<sup>5,6</sup>.

The progressive component of the disease means that its implications are often not immediately obvious at the time of diagnosis, though many cases are discovered specifically because serious manifestations of the disease have begun. Even if treated to mitigate its effects on the body's organs, diabetes contributes to a higher overall mortality rate. If left untreated and unmanaged (via diet, activity, and, where necessary, exogenous insulin treatment), however, mortality increases exponentially. Along the way, various complications that reduce quality of life and present daily physical, emotional, and psychological challenges are experienced to varying degrees.

With its pervasiveness and rapid increase, as well as the challenges in identifying a clear root cause, it is no surprise, then, that the World Health Organization (WHO) considers diabetes one of four priority non-communicable diseases (alongside cardiovascular and pulmonary diseases and cancer)<sup>1</sup>.

The emphasis on the recent proliferation of diabetes suggests it is fueled by elements in modern life and the changes in dietary habits and activity levels that come with it. This is especially true when you consider the increase in incidence of diabetes in developed countries, which have sustained a sedentary lifestyle and Western diet, is comparatively slow when compared to countries that have only recently adopted the modern lifestyle and diet<sup>4</sup>. But diabetes is by no means a modern disease. Identified via its characteristic symptoms as early as 1552 BCE in Egypt, diabetes was, if not common, at least considered noteworthy enough

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to be documented in ancient times. Various ancient texts in Ayurveda (*Caraka-Saṃhitā*, *Suśruta-Saṃhitā*, and *Bhṛigu-Saṃhitā*) have described the characteristic sweet smelling (or tasting) urine and the increased amount of urination that diabetics exhibit. These texts have been dated as far back as 100 BCE<sup>7,8</sup>. At the time, no differentiation between what we understand to be type 1 and type 2 diabetes was specified, but this is not to say that diabetes was not further categorized. In India, *Prameha* and *Madhumeha*, which can be generally translated as diabetes (and inclusive of prediabetes), was divided into at least 20 different categories<sup>9</sup>.

These ancient observations very quickly identified both mitigating factors in the development of the disease and ways to manage it after it had developed. Though no statistics are available on the prevalence of type 1 diabetes at that time, we can assume that the mortality rate of diabetes was largely contributed to by this population. It was the development of injectable animal insulin (and later synthetic insulin) that improved the lifespan of type 1 diabetics even as the number of type 2 diabetics increased. Both in ancient and modern times, one thing seems to be agreed upon: there is no known effective way to fully reverse diabetes. Once established, it is a matter of managing the disease and the person through diet, exercise, and, where appropriate or necessary, medication. Ultimately, staving off the complications associated with diabetes becomes the primary focus. It is only recently that type 1 diabetes has been fully reversed in lab mice by inciting, through grafting, the pancreas of the mice to regenerate the cells that create insulin<sup>10</sup>.

In recent decades, the search for effective ways to manage diabetes has come full circle, returning to ancient approaches in Ayurveda and Yoga, as well as other so-called alternative healing systems. Over the last 2 decades, many studies, mostly in India, have attempted to identify and even quantify the effects of Yoga practices and Ayurvedic interventions.

## Background: Understanding Diabetes

From both Western and Eastern perspectives, diabetes mellitus is not one disease with a singular cause but rather a complex syndrome whose development and characteristics can vary significantly. In a broad sense we can speak of diabetes in two types: type 1 diabetes (where the body in part or entirely loses the ability to produce insulin), and type 2 diabetes (where the body becomes resistant to the insulin it produces). A third category, gestational diabetes, which develops in some women during pregnancy and recedes after delivery, increases the likelihood that the mother will develop type 2 diabetes later in life.

Only two decades back, type 1 diabetes was considered a disease of the young, and type 2 was considered a disease whose onset occurred only in adulthood, and late adulthood at that. The nuances of these have avoided easy categorization, however. It is now believed that some adults who have been diagnosed with type 2 diabetes in fact have an adult onset version of type 1<sup>11</sup>. Additionally, more and more children worldwide are being diagnosed with type 2 diabetes, a statistic normally attributed the rise in obesity in children<sup>12</sup>.

Diabetes insipidus is, by the Western perspective, an unrelated and rare condition that causes imbalance of fluids in the body which leads to thirst and excessive urine production. In Ayurveda, this separate categorization is not as clear and has been alternatively aligned with *Madhumeha* and one of the sub-categories of *Prameha*.

### ***Type 1 Diabetes Mellitus***

Type 1 diabetes mellitus (T1DM) results from autoimmune destruction of the insulin-producing  $\beta$  cells in the islets of Langerhans. Formerly called insulin-dependent diabetes mellitus (IDDM) or juvenile diabetes, though

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both terms are concerned mischaracterizations now, T1DM is characterized by low or absent levels of endogenously produced insulin and by dependence on exogenous insulin to prevent development of ketoacidosis, an acute life-threatening complication of T1DM<sup>13</sup>.

### ***Pathogenesis***

This process, which occurs in genetically susceptible subjects, is probably triggered by one or more environmental agents, and usually progresses over many months or years during which the subject is asymptomatic and euglycemic. The natural progression of T1DM includes 4 distinct stages: (1) preclinical  $\beta$ cell autoimmunity with progressive defect of insulin secretion, (2) onset of clinical diabetes, (3) transient remission, and (4) established diabetes during which there may be acute and/or chronic complications and decreased life expectancy<sup>14</sup>.

The onset occurs predominantly in childhood, with a medium age range of 7 to 15 years old, but it may present at any age and has in recent time been increasingly seen in adults. The incidence of T1DM has steadily increased in nearly all parts of the world. Susceptibility to T1DM is genetic and the predisposition can be detected months to years prior to clinical onset of T1DM.

T1DM is associated with other autoimmune diseases such as thyroiditis, celiac disease, and Addison disease.

These individuals may have ketoacidosis, but they have extensive periods of remission with variable insulin deficiency, similar to patients with type 2 diabetes mellitus (T2DM)<sup>14</sup>.

### ***Clinical Presentations***

T1DM can present in several different ways.

- Classic new onset of chronic polydipsia, polyuria, and weight loss with hyperglycemia and ketonemia (or ketonuria)

- Diabetic ketoacidosis

**Classic new onset** Hyperglycemia without acidosis is the most common presentation of childhood T1DM in most populations. Patients typically present with four symptoms:

- Polyuria, or excessive urination – Polyuria occurs when the serum glucose concentration rises significantly above 180 mg/dL (10 mmol/L), exceeding the renal threshold for glucose, which leads to increased urinary glucose excretion. Glycosuria causes osmotic diuresis (ie, polyuria) and hypovolemia. Polyuria may present as nocturia, bedwetting, or daytime incontinence in a previously continent child. In children who are not toilet trained, parents may note an increased frequency of wet diapers and/or diapers that are unusually heavy (wet).
- Polydipsia, or excessive thirst – Polydipsia is due to increased serum osmolality from hyperglycemia and hypovolemia (often without the classic signs of dry mucous membranes or decreased skin turgor).
- Weight loss – Weight loss is a result of hypovolemia and increased catabolism. Insulin deficiency in diabetic children impairs glucose utilization in skeletal muscle and increases fat and muscle breakdown. Initially, appetite is increased (polyphagia), but over time, children are more thirsty than hungry, and ketosis leads to nausea and anorexia, contributing to weight loss.
- Diabetic ketoacidosis — Diabetic ketoacidosis (hyperglycemia and ketoacidosis) is the second most common form of presentation for T1DM in most populations. Symptoms are similar but usually more severe than those of patients without acidosis. In addition to polyuria, polydipsia, and weight loss, patients with ketoacidosis may present with a fruity-smelling breath and neurologic findings including drowsiness and lethargy. This can be misinterpreted as an acute vomiting

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illness because classic pediatric symptoms of dehydration (decreased urination) are masked by the polyuria that is associated with excess glucose in the urine (glycosuria)<sup>13 14</sup>.

### **Risk Factors**

Both genetic and environmental factors are believed to contribute to the risk of developing T1DM.

**Genetic susceptibility** The lifetime risk of developing T1DM is significantly increased in close relatives of a patient with T1DM:

- No family history – 0.4 %
- Offspring of an affected mother – 1 to 4 %
- Offspring of an affected father – 3 to 8 %
- Offspring with both parents affected – Reported as high as 30 %
- Non-twin sibling of affected patient – 3 to 6 % by age 20 years and 10 % by 60 years
- Dizygotic twin – 8 %
- Monozygotic twin – 30 % within 10 years of diagnosis of the first twin and 65 % concordance by age 60 years<sup>13 14</sup>

**Other risk factors** In genetically susceptible individuals, exposure to one or more environmental agents appears to trigger an immune response that ultimately causes destruction of the insulin-producing pancreatic  $\beta$ cells. Identification of these factors should lead to a better understanding of the pathogenesis of the disease and aid in developing strategies to prevent T1DM.

Reports have linked each of the following factors to an increased risk of T1DM; however, none of these associations have been verified and many have been contradicted by other studies:

- Viral infections, particularly respiratory or enterovirus infections
- Immunizations

- Diet
- Higher socioeconomic status
- Obesity
- Vitamin D deficiency
- Perinatal factors such as maternal age, history of preeclampsia, and neonatal jaundice
- Higher than normal birth weight (greater than 4kg) for gestational age
- Very low birth weight (lower than 2.5kg)
- Lower gestational age birth<sup>13 14</sup>

### **Diagnosis**

T1DM is one of several different types of diabetes mellitus. The initial step is to diagnose diabetes. The second step is to differentiate T1DM from other causes of diabetes based upon the clinical presentation of the patient and laboratory studies.

**Diagnostic criteria for diabetes** Diabetes mellitus is diagnosed based upon one of the following four signs of abnormal glucose metabolism:

- Fasting plasma glucose (FPG)  $\geq 126$  mg/dL (7 mmol/L) on more than one occasion. Fasting is defined as no caloric intake for at least eight hours.
- Random venous plasma glucose  $\geq 200$ mg/dL (11.1 mmol/L) in a patient with classic symptoms of hyperglycemia.
- Plasma glucose  $\geq 200$ mg/dL (11.1 mmol/L) measured two hours after a glucose load of 1.75 g/kg (maximum dose of 75 g) in an oral glucose tolerance test (OGTT). Most children and adolescents are symptomatic and have plasma glucose concentrations well above  $\geq 200$ mg/dL (11.1 mmol/L); thus, OGTT is seldom necessary to diagnose T1DM.
- Glycated hemoglobin (HbA1c)  $\geq 6.5$  % (using an assay that is certified by the

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National Glycohemoglobin Standardization Program). This criterion is more useful to diagnosis of T2DM in adults and should be confirmed by hyperglycemia<sup>13 14</sup>.

### ***Treatment***

Morbidity from diabetes involves both macrovascular (atherosclerosis) and microvascular (retinopathy, nephropathy, and neuropathy) disease. Interventions can limit end-organ damage, and therefore, patients with diabetes require initial and ongoing evaluation for diabetes-related complications. Monitoring includes a history and physical exam two to three times yearly to obtain information on nutrition, physical activity, reduction of cardiovascular risk factors, current management, and diabetes-related complications.

Glycemic control can minimize risks for retinopathy, nephropathy, and neuropathy in both type 1 and type 2 diabetes and has been shown to decrease the risk for cardiovascular disease (CVD) for type 1 diabetes.

HbA1c goals in patients with diabetes should be tailored to the individual, balancing the improvement in microvascular complications with the risk of hypoglycemia. A reasonable goal of therapy might be an HbA1c value of  $\leq 7.0\%$  for most patients (using an assay in which the upper limit of normal is 6.0%). Glycemic targets are generally set somewhat higher (eg,  $<8\%$ ) for older adult patients and those with comorbidities or a limited life expectancy and little likelihood of benefit from intensive therapy. More stringent control (HbA1c  $<6\%$ ) may be indicated for individual patients with type 1 diabetes and during pregnancy<sup>13 14</sup>.

Intensive insulin therapy is recommended for the majority of patients with type 1 diabetes, and therefore, patients with type 1 diabetes should be referred to an endocrinologist for management of diabetes.

### ***Type 2 Diabetes Mellitus***

Type 2 diabetes mellitus (T2DM) is the most common type of diabetes, accounting for around 90% or more of all diabetes cases worldwide. T2DM is most commonly diagnosed in older adults, but is increasingly seen in children, adolescents and younger adults due to rising levels of obesity, physical inactivity and poor diet<sup>16</sup>.

### ***Pathogenesis***

T2DM develops when the body becomes resistant to insulin or when the pancreas is unable to produce enough insulin. Insulin resistance often is the primary metabolic abnormality leading to the development of T2DM. T2DM can be viewed as the consequence of a series of pathophysiologic changes, each of which makes the patient vulnerable to subsequent disruption of normal glucose homeostasis. In most individuals, insulin resistance is the first of a sequence of abnormalities leading to the development of T2DM. Insulin resistance is compensated by increased insulin secretion (hyperinsulinemia), which allows glucose metabolism to remain normal. The  $\beta$  cells in genetically susceptible individuals become impaired, leading to delayed and insufficient insulin secretion. Due to decreasing  $\beta$  cell function, the individual with insulin resistance first develops postprandial hyperglycemia and subsequently develops fasting hyperglycemia. Chronic hyperglycemia contributes to a further suppression of pancreatic  $\beta$  cell insulin secretion and worsens insulin resistance. These three components (insulin resistance, insulin deficiency, and glucose toxicity) are the targets of conventional therapeutic interventions<sup>16</sup>.

T2DM is often accompanied by other conditions, including hypertension, high serum low-density lipoprotein (LDL) cholesterol concentrations, and low serum high-density lipoprotein (HDL) cholesterol concentrations

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that, like T2DM, increase cardiovascular risk. This constellation of clinical conditions is referred to as the metabolic syndrome. Hyperinsulinemia occurring in response to insulin resistance may play an important role in the genesis of these abnormalities. Increased free fatty acid levels, inflammatory cytokines from fat, and oxidative factors have all been implicated in the pathogenesis of metabolic syndrome, T2DM, and their cardiovascular complications.

The most striking environmental risk factors in most patients who develop T2DM are increased weight gain and decreased physical activity, each of which increases the risk of diabetes. The mechanism by which obesity induces insulin resistance is poorly understood. Inflammation may be the common mediator linking obesity to the pathogenesis of diabetes <sup>16</sup>.

### ***Clinical Presentations***

The symptoms of T2DM are similar to those of T1DM and include:

- Excessive thirst and dry mouth
- Frequent urination
- Lack of energy, tiredness
- Slow healing wounds
- Recurrent infections in the skin
- Blurred vision
- Tingling or numbness in hands and feet.

These symptoms can be mild or absent and so people with T2DM may live several years with the condition before being diagnosed <sup>16</sup>.

### ***Risk Factors***

T2DM most likely represents a complex interaction among many genes and environmental factors. Changes in diet and physical activity related to rapid development

and urbanisation have led to sharp increases in the numbers of people living with T2DM.

**Genetic Susceptibility** It has long been suspected that T2D is, in part, inherited. Family studies have revealed that first degree relatives of individuals with T2D are about three times more likely to develop the disease than individuals without a positive family history of the disease. It has also been shown that concordance rates for monozygotic twins, which have ranged from 60-90%, are significantly higher than those for dizygotic twins. Thus, T2DM seems to have a strong genetic component.

One approach that is used to identify disease susceptibility genes is based on the identification of candidate genes. Candidate genes are selected because they are thought to be involved in pancreatic  $\beta$ cell function, insulin action / glucose metabolism, or other metabolic conditions that increase T2DM risk (e.g., energy intake / expenditure, lipid metabolism). To date, more than 50 candidate genes for T2DM have been studied in various populations worldwide <sup>16</sup>.

**Other risk factors** There are other risk factors not associated with genetics:

- Family history of diabetes (non-genetic)
- Overweight and obesity (Body Mass Index or BMI  $\geq 25$  kg/m<sup>2</sup>)
- Fat distribution. If you store fat mainly in the abdomen, you have a greater risk of T2DM than if you store fat elsewhere, such as in your hips and thighs
- Unhealthy diet
- Physical inactivity and sedentary lifestyle
- Increasing age (Age  $\geq 45$  years)
- Cardiovascular disease
- High blood pressure
- Increased levels of triglycerides ( $>250$  mg/dL), low concentrations of high-density lipoprotein cholesterol (HDL-Cholesterol)

- Ethnicity (Non-white ancestry; Asian, African American, Hispanic, Native American, or Pacific Islander)
- Impaired glucose tolerance (IGT is a category of higher than normal blood glucose, but below the threshold for diagnosing diabetes.)
- History of gestational diabetes
- Poor nutrition during pregnancy
- Polycystic ovarian syndrome (characterized by irregular menstrual periods, excess hair growth and obesity)

## **Diagnosis**

T2DM is usually diagnosed using one or a combination of various blood tests:

- Glycated hemoglobin (HbA1c) test (HbA1c). This blood test indicates your average blood sugar level for the past two to three months. Normal levels are below 5.7 % (39 mmol/mol), and a result between 5.7 and 6.4 % is considered prediabetes. An HbA1c level of 6.5 % or higher (48 mmol/mol) on two separate tests is considered a metric for diagnosis for diabetes.
- Random blood sugar test. Blood sugar values are expressed in milligrams per deciliter (mg/dL) or millimoles per liter (mmol/L). Regardless of when you last ate, a blood sample showing that your blood sugar level is 200 mg/dL (11.1 mmol/L) or higher suggests diabetes, especially if you also have signs and symptoms of diabetes, such as frequent urination and extreme thirst.
- Fasting blood sugar test. A blood sample is taken after an overnight fast. A reading of less than 100 mg/dL (5.6 mmol/L) is normal. A level from 100 to 125 mg/dL (5.6 to 6.9 mmol/L) is considered prediabetes. If your fasting blood sugar is 126 mg/dL (7 mmol/L) or higher on two separate tests, you have diabetes.
- Oral glucose tolerance test. This test is less commonly used than the others, except during pregnancy. The patient needs to fast overnight and then drink a sugary liquid at the doctor's office. Blood sugar levels are tested periodically for the next two hours. A blood sugar level of less than 140 mg/dL (7.8 mmol/L) is normal. A reading between 140 and 199 mg/dL (7.8 mmol/L and 11.0 mmol/L) indicates prediabetes. A reading of 200 mg/dL (11.1 mmol/L) or higher after two hours suggests diabetes.

## **Treatment**

Microvascular complications are specific to diabetes mellitus and do not occur in nondiabetic subjects. The principal sites that are damaged are the eye (retinopathy), the kidney (nephropathy) and the nervous system (neuropathy) and the clinical consequences can be blindness, renal failure and foot problems with risk of amputation. Macrovascular complications are not unique to diabetes but occur much more commonly in diabetic subjects. The main large vessels that are involved are those supplying the heart, the brain and the legs. Thus, macrovascular disease gives rise to heart attack, stroke and gangrene.

Most patients with T2DM die prematurely of macrovascular disease. Macrovascular mortality is 50% after 10 years of overt T2DM. Prevention is felt to be the best method of approaching the problem, but in T2DM especially, the disease may be diagnosed late after years of occult glucose intolerance in middle-aged individuals who already have extensive macrovascular disease at diagnosis <sup>15</sup>.

The early diagnosis of T2DM is important. In T2DM subjects, good blood glucose control and tight blood pressure control can prevent complications or delay their progression. The early detection of retinopathy, nephropathy and neuropathy can lead to a reduction in the incidence of blindness, kidney failure and amputation due to diabetes. T2DM also seems to



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increase the risk of Alzheimer's disease, though it's not clear why. The worse the blood sugar control, the greater the risk appears to be.

From the perspective of Western medicine, the cornerstone of managing T2DM is a healthy lifestyle, which includes a healthy diet, regular physical activity (both defined in the next paragraph), not smoking, and maintaining a healthy body weight. Research indicates that a majority of cases, up to 80% according to some studies, of T2DM could be prevented through healthy diet and regular physical activity<sup>19</sup>.

A healthy diet includes reducing the amount of calories consumed if individual is overweight, replacing saturated fats (eg. cream, cheese, butter) with unsaturated fats (eg. avocado, nuts, olive and vegetable oils), eating dietary fibre (eg. fruit, vegetables, whole grains), and avoiding tobacco use, excessive alcohol and added sugar. Regular physical activity is essential to help keep blood glucose levels under control. It is most effective when it includes a combination of both aerobic (eg. jogging, swimming, cycling) exercise and resistance training, as well as reducing the amount of time spent being inactive<sup>18</sup>.

Over time, a healthy lifestyle may not be enough to keep blood glucose levels under control and people with T2DM may need to take oral medication (Metformin and Sulfonylurea). If treatment with a single medication is not sufficient, combination therapy options may be prescribed. When oral medication is not sufficient to control blood glucose levels, people with T2DM may require insulin injections<sup>18</sup>.

## ***Prediabetes***

Pre-Diabetes implies that the sugar level of the body is higher than normal, but not high enough to be diagnosed as T2DM. If there is no change in the contributing factors, largely believed to be associated with lifestyle and diet, then the expectation is that prediabetes will progress to T2DM. If dietary and lifestyle

changes are made, there is a good chance that the level of sugar can drop off without any medications. This progression can affect both children and adults.

## ***Pathogenesis***

No single dominant cause of prediabetes is known, but family history as well as the genetic history seems to have a strong role. Lack of activity and excess fat, especially in the belly, are high risk factors that contributes to developing diabetes.

What is known as a fact is people with prediabetes don't process sugar (glucose) properly. As a result, sugar is accumulated in the bloodstream instead of being absorbed by the cells that make muscles and other tissues. The amount of glucose in the body comes from what we eat every day. Insuline from the pancreas is responsible for moving the glucose from the bloodstream to the cells of the entire body.

As long as there is insulin in the bloodstream (and there is no de-sensitization), sugar can easily go to the cells to fulfill their job as well as decrease the level of sugar in the bloodstream. As this occurs, the pancreas reduce then cease the production of more insulin.

In prediabetes this process is not functioning well. Sugar is accumulated in the bloodstream instead of going to the cells. The main problem occurs when the cells become resistant to the insulin.

## ***Clinical presentations***

Often there are no visible signs or symptoms regarding this illness. Sometimes there is a detectible darkness in the skin color in certain parts of the body like neck, armpits, elbows, and knees. Symptoms signaling the transition from prediabetes to T2DM could be:

- Higher level of thirst
- Frequent urination during the day
- Fatigue
- Blurry vision

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## ***Risk Factors / Diagnosis***

Risk factors for prediabetes are the same as those for T2DM:

- *Weight.* Overweight is an important factor to prediabetes. The more the accumulation of adipose tissue, mostly in the abdominal area between muscles and skin, the more insulin resistance is likely.
- *Food patterns:* Red meat, processed food, and drinks with increased amounts of sugar are linked with risk of developing prediabetes. Eating fruits, vegetables, whole grains, and healthy fats like olive oil are a way to lessen the risk of developing this illness.
- *Inactivity:* Sedentary lifestyle, also associated with metabolic syndrome, is a risk factor for prediabetes.
- *Age:* Risk of prediabetes increases after age 45.
- *Family Background:* There is a higher risk of developing prediabetes if parents or siblings have T2DM.
- *Race/ethnicity:* Certain groups, such as African-Americans, Hispanics, Asian-Americans and Pacific Islanders are more likely to develop this illness.
- *Gestational diabetes:* If the mother develops gestational diabetes during pregnancy, both the mother and the child are more likely to develop prediabetes later on.
- *Birth weight* A higher birth weight (especially above 4kg) is associated with increased risk of developing prediabetes.
- *Polycystic ovarian syndrome:* This condition, characterized by long, irregular periods, excessive hair growth and obesity, increases women's tendency for prediabetes.
- *Sleep:* People with disturbed sleep (obstructive sleep apnea) have more chances to develop insulin resistance and thus prediabetes. The risk is also present for people who work late at night (late shift work).

Other physiological conditions associated with pre-diabetes are high blood pressure, low HDL cholesterol, high triglycerides, and obesity. These markers constitute collectively a related but separate condition believed to be a pre-cursor to prediabetes.

## ***Prevention / Treatment***

Healthy lifestyle choices can help you prevent prediabetes and its progression to T2DM — even if diabetes runs in the family.

- Eat healthy foods
- Get at least 150 minutes of moderate aerobic physical activity a week, or about 30 minutes on most days of the week
- Lose excess weight
- Control blood pressure and cholesterol
- Avoid or quit smoking

## ***Metabolic Syndrome***

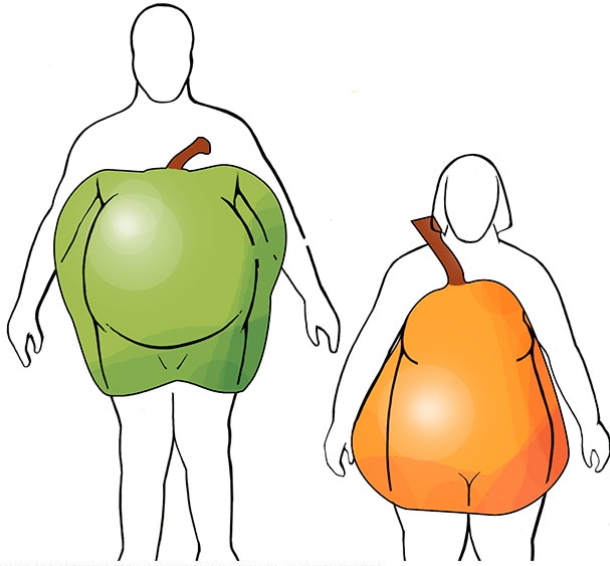
Metabolic syndrome is a cluster of conditions that occur together, increasing your risk of heart disease, stroke and T2DM.

## ***Critical Presentations, Metabolic Risk Factors, and Diagnosis***

The five conditions described below are metabolic risk factors. Any one of these risk factors may be present on their own, but they tend to occur together. An individual must have at least three metabolic risk factors to be diagnosed with metabolic syndrome.

- **A large waistline** This also is called abdominal obesity or "having an apple shape." Excess fat in the stomach area is a greater risk factor for heart disease than excess fat in other parts of the body, such as on the hips. For men a waist that measures 94

cm or more around, and for women 80 cm or more around.



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- **A high triglyceride level.** Triglycerides are a type of fat found in the blood.
- **A low HDL cholesterol level.** HDL, sometimes is called "good" cholesterol, helps remove cholesterol from the arteries. A low HDL cholesterol level (below 40 mg/dl for men and 50 mg/dl for women) raises your risk for heart disease.
- **High blood pressure** Blood pressure is the force of blood pushing against the walls of the arteries as the heart pumps blood. If this pressure rises and stays high over time (greater than 130 mmHg systolic or 85 mmHg diastolic), it can damage the heart and lead to plaque buildup.
- **High fasting blood sugar.** Mildly high blood sugar (greater than 100 mg/dl) may be an early sign of diabetes <sup>20</sup>.

The risk of heart disease, diabetes, and stroke increases with the number of metabolic risk factors present. The risk of having metabolic syndrome is closely linked to overweight and obesity (indeed a requirement for the definition) and a lack of physical activity <sup>20</sup>. Insulin resistance, when present for other reasons, also may increase the risk for metabolic syndrome.

People who have metabolic syndrome often have two other conditions: excessive blood clotting and constant, low-grade inflammation throughout the body. It is currently unclear whether these conditions cause metabolic syndrome or worsen it.

### ***Risk Factors***

The following factors increase the chances of developing metabolic syndrome:

- **Age.** Risk of metabolic syndrome increases with age.
- **Ethnicity.** In the U.S., Hispanics, especially women, appear to be at the greatest risk of developing metabolic syndrome.
- **Obesity.** Carrying too much weight, especially in the abdomen.
- **History of Diabetes.** A woman is more likely to develop metabolic syndrome if she had gestational diabetes during pregnancy. Also an individual is more likely to develop metabolic syndrome if there is a history of T2DM in the family.
- **Other diseases.** Risk of metabolic syndrome is higher for individuals who have had nonalcoholic fatty liver disease, polycystic ovary syndrome or sleep apnea.

### ***Prevention, Mitigation, & Treatment***

A lifelong commitment to a healthy lifestyle may prevent the conditions that cause metabolic syndrome, as well as T2DM <sup>21 22</sup>. A healthy lifestyle includes:

- At least 30 minutes of physical activity most days <sup>23</sup>
- Eating plenty of vegetables, fruits, lean protein and whole grains
- Limiting saturated fat and salt in diet
- Maintaining a healthy weight
- Not smoking

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The major goal of treating metabolic syndrome is to reduce the risk of ischemic heart disease. Treatment is directed first at lowering LDL cholesterol and high blood pressure and managing diabetes, if these conditions are present <sup>24</sup>.

The second goal of treatment is to prevent the onset of type 2 diabetes, if it has not already developed. Long-term complications of diabetes often include heart and kidney disease, vision loss, and foot or leg amputation. If diabetes is present, the goal of treatment is to reduce your risk for heart disease by controlling all of your risk factors.

Sometimes lifestyle changes are not enough to control your risk factors for metabolic syndrome. A patient may also need medication to lower cholesterol, blood pressure, to prevent blood clots, and to reduce blood sugar levels.

## Background: Ayurveda & Yoga

### *Diabetes in Ayurveda*

Though Yogatherapy has a variety of tools to address imbalances, it does not have an extant repository of disease classification (if it ever did). For this, Yoga/Yogatherapy turn to their sister science, Ayurveda, which shares with Yoga a particular understanding of the human system in both health and disease. Diabetes was not understood as just one condition in Ayurveda but rather observed as similar symptoms with a variety of causes <sup>9</sup>. The term *Prameha* is often used as a direct translation of what we understand today as diabetes mellitus, though some literature aligns *Prameha* with pre-diabetes and *Madhumeha* with diabetes mellitus <sup>9 25 26</sup>. It is up for debate whether these translations are complete or misleading.

What is not debated is that *Prameha* and *Madhumeha* are the closest classifications to diabetes in ancient Ayurvedic texts, and that the documented method for diagnosing showed an acute awareness of the nuanced ways the body

functions when in and out of balance. Despite there being no vehicle for examining bloodwork, ancient Ayurvedic doctors were able to classify 20 types of *Prameha* <sup>9</sup>.

*Prameha* is generally defined as excessive urination (taking into account both the frequency of urination and the quantity of urine) with turbidity (cloudy urine). Of the varieties of *Prameha*, two align closely with T1DM, some with T2DM, some with prediabetes, some with metabolic syndrome, and some with diabetes insipidus. Each of these had variable approaches that took the patient's constitution into account to bring the body back to proper function (if possible). Among the 20 are types that are more easily manageable through exercise and dietary changes alone, and some which require further intervention <sup>9</sup>.

In a very basic way, *Prameha* is a problem in metabolism and *agni* (digestive fire) in Ayurveda. Though understood in general to be a *kapha doṣa* dysfunction (the listed risk factors for *prameha* are all *Kapha* increasing), the classifications of *Prameha* can be organized by which of the three *doṣa-s* are affected (10 are *Kapha* related, 6 are *Pitta* related, and 4 are *Vāta* related). Even without going into further detail on the nuance of these categorizations (and the distinction between *Prameha* and *Madhumeha*), it's clear that Ayurveda (and by extension Yoga) do not see diabetes as homogeneous in cause or manifestation. It follows then, that the interventions would also vary depending on the particular manifestation and the constitution and condition of the individual.

The interventions could vary from what Western medicine would suggest. Aside from the variety of herbs and minerals Ayurveda uses in contrast to pharmaceuticals, the most obvious example is the consumption of fish, which was considered by Ayurveda a risk factor for developing diabetes mellitus, but which Western medicine sees as a part of a healthy diet for diabetics.

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The perspectives that Ayurveda and Western medicine take on diabetes also vary significantly. Where Western medicine sees diabetes as a problem of insulin (either it is lack of production or the body's resistance to it), in Ayurveda, diabetes is seen as a systemic imbalance in the *doṣa-s* and that individual's unique reaction to it. From the Western perspective, the problem in diabetes is inherently physical. Whether a problem of metabolism (T2DM) or an autoimmune disorder (T1DM), a mix of genetics, activity level, diet, lifestyle habits (such as smoking), and environmental factors (pollution, etc.) contribute to the body's functional breakdown, either attacking itself and destroying the cells that produce insulin or becoming increasingly desensitized to the presence of insulin in the blood.

From an Ayurvedic (and Yogic) standpoint, diabetes occurs from an imbalance in the *doṣa-s* which can be instigated via any of (and any combination of) various dimensions of the person. Chronic stress, emotional imbalance, and even spiritual trauma can contribute to a shift in the *doṣa-s* which, if sustained, can manifest at the physical level. The problem remains about metabolism and autoimmune disorder, but the initial spark for the cascade need not be the metabolism of food. Recent research attempting to link the etiology of *Prameha* with diabetes mellitus has identified a variety of potential risk factors not currently recognized by Western medicine. Among them, stress achieved the highest odds ratio (suggesting individuals who are highly anxious or stressed chronically have a nearly eightfold risk of developing diabetes). The study identified anger, long duration exposure to heat, and improper food intake (irregular meal schedules and consuming meals before prior meals are completely digested) as additional risk factors that might increase the risk of developing diabetes fourfold<sup>27</sup>.

This said there are plenty of areas where Ayurveda and Western medicine agree on the treatment protocol for diabetes: reducing

consumption of sweet substances, increasing physical activity, avoiding a sedentary lifestyle, reducing stress and anxiety, reducing the consumption of meat, and engaging in activities that nurture enthusiasm and positive mental attitudes.

Even in the West, Yoga has been increasingly accepted as an effective way to achieve some of the above. Unfortunately, in the West, Yoga, interpreted through the lens of a gross understanding of *āsana* and meditation, is seen primarily as a physical activity or a calming exercise, respectively, when it actually offers a great variety of potential approaches for helping to reduce suffering in diabetes patients. *Āsana* and meditation are certainly a part of this toolbox but represent only a small portion of the options and not necessarily the most effective or efficient ones for all or even most individuals and circumstances.

### ***Disease & Healing in Ayurveda & Yoga***

The approaches that Yoga and Ayurveda take to disease and healing is holistic in the broadest sense of the word. This is most obvious in the lack of specialization within these fields, which contrasts to the Western model that offers us cardiologists, podiatrists, neurosurgeons, and neurologists, etc. The Association of American Medical colleges lists more than 120 categories and subcategories of medical specialization. Though doctors can specialize in multiples of these and some fields are more generalist than others, it is impossible for any one doctor to specialize in most, let alone all. If while working with one doctor regarding a particular issue, a problem is discovered in some other part or system of the body, the doctor will refer the patient to someone who specializes in that area. Inherent and consequent in this perspective is the idea that most problems in the body can be approached only in this atomistic way. It is an approach that has led primarily to symptom management in medicine.

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The models used in Yoga and in Ayurveda are quite different from those in Western medicine and promote a different approach to healing. Though there are various models that come into play, a handful are used with great frequency and speak to the perspective that these two traditions take.

**Pañcamaya Model** The *Pañcamaya* model is, for the purposes of understanding how Ayurveda and Yoga contrast with Western medicine, the foundation for the rest of the models. Within this model is the idea that the human system is comprised not strictly or even primarily of physical components but rather of critical components at various levels, all of which can experience balance and imbalance, health and disease, and each of which can influence the others. A person is not simply a physical being, but also a psychological, emotional, energetic, and spiritual one. Traumas in any one of these dimensions of the person can manifest symptoms in any one of the others. The *pañcamaya* model roughly breaks down the dimensions of an individual into five (*pañca*) distinct but interrelated components (*maya*, indicating “something that is all pervading”<sup>28</sup>).

- *Annamaya* (level of food; physical)
- *Prāṇamaya* (level of energy)
- *Manomaya* (level of mind, intellect)
- *Vijñānamaya* (deeper level of mind, emotions, feelings, behaviors)
- *Ānandamaya* (level of bliss).

Each of these components is responsible for a critical aspect of the person (you can’t function without all of them), and they lie in a continuum of gross (with *Annamaya* as the grossest) to subtle (*Ānandamaya* is the subtlest). Disease and imbalance can originate in any of them and often will permeate one or more of the others. In the same way, healing and the restoration of balance can begin at any one of these and permeate to the rest.

Though many times it is ideal that problems be addressed early, before they grow and spread, it is not necessary that the healing process begin at the same level at which the disease being treated began. Many times a person will resist this kind of targeted approach, especially if the problem represents a deep and painful wound. Working with the other levels, then, becomes a useful way to circumvent resistance.

From a practical standpoint in healing, we can assume that relatively smaller influences or adjustments (positive or negative) in the subtler components will generally result in more dramatic impacts in the system as a whole as compared to influences or adjustments in the grosser components.

By this model, then, we can take away that adjustments at the physical level (and we should understand here that this includes the current way *āsana-s* are used in most Western applications of Yoga) are the least efficient approach. This isn’t to say they are never warranted or useful. Sometimes they are indeed necessary.

The greatest takeaway of this model for the purposes of this discussion, is that balance in the person is only truly present when there is balance and health across these five dimensions. A person who presents as physically healthy may still suffer emotional or spiritual imbalance. If that imbalance is allowed to persist, the imbalance will likely permeate at least some of the other layers, manifesting as either anxiety, breathing issues, fatigue, or pain, etc. It would be impossible to find the origin of the pain at the physical level, as the pain is simply a symptom, a ripple that originates from a different aspect of the person. Pain relief can be offered, yes, but this will only treat the symptom, concealing the issue temporarily. As long as the cause for the imbalance remains, the issue in the person will persist, manifesting in different and often more severe ways (and across different dimensions) over time. This primary takeaway informs the other models typically used in Ayurveda and Yoga.

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**Doṣa Model** The *doṣa* model is likely the most well known of the models used in healing due to the increasing popularity of Ayurveda in the West. This model acknowledges three distinct influences that permeate all aspects of life:

- *Vāta*,
- *Pitta*, and
- *Kapha*.

Within Ayurveda, *Vāta*, *Pitta*, and *Kapha* are ascribed attributes described in terms of 10 groups of opposites (hot/cold, heavy/light, mobile/static, etc.). These attributes, when present, signal the presence or excess (or diminution) of each of the *doṣa-s* in an individual. The attributes can be understood as indicative of the *doṣa* dominance being exhibited (rashes that are hot to the touch can signal excess *Pitta*), but can also be causative (cold and wet seasons can increase *Kapha* in individuals). *Vāta*, *Pitta*, and *Kapha* influence a person's inherent constitution (*prakṛti*), which is largely unchanging after birth (or early childhood) so that each person has a particular and rarely changeable natural balance of these three influences established from early life. These influences can be seen through the individual's physical characteristics (skin, eyes, hair, teeth, build, etc.) as well as their psychological and emotional characteristics (intelligence, memory, temper, etc.). A person can be dominant in one, two, or (very rarely) equally influenced by all three of *doṣa-s*. However, the degree to which that influence is present, the combinations of influences, and the types of manifestations vary so much across individuals that it could be said to be virtually unique. Two *Pitta* dominant people will not manifest *Pitta* qualities in exactly the same way.

The three *doṣa-s* are always in flux: the seasons, time of day, diet, activity, etc, all shift the influences on a person, leaning them one way or the other. Depending on the person's inherent constitution, they can more easily be thrown into dysfunction in certain cases. A naturally *Pitta*

dominant person will be more easily thrown into *Pitta* excess than a person who is *Kapha* dominant because the former already has a dominance of *Pitta*. Some of these influences quickly change, but some may persist, creating in the person an imbalanced combination of the *doṣa-s* (*vikṛti*). These influences can be seen in some aspects of their appearance, behaviors, and natural functions.

Because the *doṣa-s* are naturally in constant interplay, balance is always being negotiated in one way or another within the individual. When the influence of a particular *doṣa* is heightened and the individual is thrown off their natural balance, disease potentially occurs. This function of interplay in the *doṣa-s*, however, can also be used to facilitate the healing process. The way in which the *doṣa-s* would be used in healing is not simple and a good amount of training and experience is required to make the most of the approach, but, generally speaking, we can affect excesses of a *doṣa* by increasing qualities that are opposite to the problematic dominant *doṣa*. For instance, we can address excess *Kapha* in a patient by increasing qualities (through diet, lifestyle, exercise, activities, and of course, Yoga practices, among other things) that are opposite to *Kapha*. These opposing qualities will either belong to *Vāta* or *Pitta*, depending on the attribute.

The primary takeaway of the *doṣa* model for our purposes is that each person is unique in constitution and will react differently to different stimuli. This applies to both stimuli that may lead them into imbalance and disease, or stimuli that will lead them into balance and health. The same stimulus may cause disease in one person but not another. And when dealing with two individuals who seem to suffer the same disorder, the same technique may bring healing to one person but not another.

**Pulse Diagnosis and the Doṣa Model** An important tool within the *doṣa* model is pulse diagnosis, which, in addition to observation, inquiry, and additional palpation, can help reveal which *doṣa* or combination of *doṣa-s* is

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dominant, weak, or dysfunctional. It is a powerful tool used alongside the other tools in Ayurveda and Yoga and can help validate the effects of lifestyle changes, dietary adjustments, and practice.

The Ayurvedic pulse involves using three fingers, each of which generally detects dominance of one of the *doṣa-s*. The quality of the pulse, the specific location along each of the fingers where the pulse is detected, and the location on the body where the pulse is taken become critical in properly diagnosing conditions or, at a minimum identifying what parts of the individual's system are particularly affected at the moment.

The art of pulse diagnosis is intricate and there are few who have mastered the ability to truly diagnose via the pulse diseases which have not started to manifest other typically recognizable symptoms in the body. It is possible to detect diabetes (*Prameha* and *Madhumeha*) via the pulse and to further differentiate the variety of diabetes, though it requires the presence of other factors to identify the condition versus a variety of others that are possible via the similar pulse characteristics. Because in our study we worked with patients who had already been diagnosed as diabetic or prediabetic, we did not need to (nor attempt to) diagnose diabetes via pulse. This did not mean that the pulse was not useful.

Indeed even if one has not developed the necessary skills to achieve such accuracy in diagnosis, detecting what *doṣa* or combination of *doṣa-s* is dominant (and in what side of the body), and the strength and regularity of the pulse contributes significantly to understanding how and why a person is suffering and the source of the symptoms troubling them. It is also invaluable in monitoring the state of an individual throughout the course of treatment. Despite living with a particular disorder, the pulse of an individual will change to reflect acute conditions and complications, which can be integral to adjusting treatment.

Moreover the use of pulse circumvents three important situations in working with patients which can lead to confusion: (1) a patient is not entirely honest (either out of shame, denial, or distrust) about the symptoms that have begun to manifest, (2) a patient does not have the sensitivity or awareness to detect some of the symptoms in themselves, and (3) a patient has become accustomed to the symptoms such that they seem normal and nothing out of the ordinary. The latter is particularly true of symptoms such as constipation, which when established over a long period of time, can achieve a predictability that feels normal to the patient, even though it is not normal, nor healthy, for a person to have a bowel movement once every three days. In these cases pulse can reveal what the patient themselves cannot or will not.

The last two models typically used to communicate function and dysfunction in Yoga and Yogatherapy both originate from the *prāṇamaya* level of the *pañcamaya* model but their implications reach to all the other layers.

***Cakra Model*** The *cakra* model gives us an entry point for understanding how dysfunction may manifest in various major energetic integration points in the individual by focusing attention in one of seven spots along the spine, each with primary functions at the physical, psychological, emotional, and spiritual levels and associated with organs, organ systems, tissue, and functions in the body.

Though there is much attention given to the *cakra-s* in meditation and spiritual pursuit in some modern Yoga traditions, their significance in identifying dysfunction and in rectifying imbalances is not as well understood. The *cakra-s* are integral components in the energetic body and can be most closely likened to areas along the spine that have particular significance for the nervous system.

Because these energetic centers develop along with the spine, the time of primary development for each of the *cakra-s* varies, with the lowest *cakra*, at the root of the spine,



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developing the earliest and the highest *cakra*, located at the crown of the head, developing the latest (and continuing to develop for the rest of the individual's life).

Far from being independent of one another, these energetic centers are intimately related to each other, with adjacent *cakra-s* often being affected when a particular *cakra* experiences dysfunction.

There are various healing models that reference *cakra-s* in the body. In Ayurveda and Yoga, there are seven *cakra-s* of interest when we deal with healing:

- *Mūladhāra cakra* (located at the base of the spine, on the pelvic floor),
- *Svādīsthāna cakra* (located along the spine at the level of the sex organs),
- *Maṇipūraka cakra* (located along the spine at the level of the navel),
- *Anāhata cakra* (located along the spine at the level of the heart),
- *Viśuddhi cakra* (located along the spine at the throat),
- *Ājñā cakra* (located at the level of the third eye within the skull), and
- *Sahasrāra cakra* (located at the crown of the head).

Each of the *cakra-s* are associated with parts of the body and functions and the presence of issues in related areas can signal potential dysfunction in a given *cakra*.

Beyond a mere diagnostic tool, however, the real power of the *cakra* model in Yoga is in the ability to affect these energetic centers, and their related functions, tissues, and body parts through targeted practices.

Because in diabetes there is a basic dysfunction in *jāṭharāgni*, located closest to the *Maṇipūraka cakra*, the latter is of particular interest.

***Pañcavāyu Model*** The *Pañcavāyu* model breaks down the function of *prāṇa* in the body into five major categories and various subcategories, which let us deduce through observation where imbalances may exist and potentially how to correct them. The functions of breathing, eating, digesting, circulation, and excretion all play critical roles in health and wellness. If any of these are impaired, even temporarily, they will create discomfort and ultimately disease. Identifying where problems lie can help determine a starting point for healing.

This model can be seen as an extension of the *doṣa* model, with the five *vāyus* being the five subtypes of *Vāta*:

- *Prāṇa vāyu* (responsible for inhalation)
- *Udāna vāyu* (responsible for exhalation and speech)
- *Samāna vāyu* (responsible for digestion)
- *Apāna vāyu* (responsible for elimination)
- *Vyāna vāyu* (responsible for circulation)

It is worth mentioning on its own here, versus the subtypes of *Pitta* and *Kapha*, since the *pañcavāyu*, by virtue of addressing important functions of *prāṇa* in the body, is at the heart of healing in Yoga.

The *vāyu-s* have further functions than the ones mentioned above and also have associated sites and organs in the body. In the context of diabetes, two of the *vāyu-s* are of particular interest: *Samāna vāyu*, as it is associated with digestion and *jāṭharāgni*, and *Apāna vāyu*, which is associated with elimination. The latter is of special interest since diabetes is characterized by excessive urination, but also because when the digestive process is altered, as is the case in diabetes, bowel movements also become affected.

All of these models are tools for a therapist to use to aid observation, identification, and the development of a plan for healing. They are meant to be used collectively and not in isolation. One is not more or less useful than the

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others. And all require interpretation based on an established relationship between patient and Yogatherapist.

### ***General Concerns and Approaches in Yoga for Diabetes***

Though Yoga and Yogatherapy should, for optimal effect and safety, always be applied in a manner tailored to the individual, there are some common concerns we encounter when dealing with specific disorders and these can always serve as a starting point for conversation with a patient. Of course, not every patient will encounter the same issues in the same way, nor will they necessarily see these issues as primary concerns if they are present (though they may very well be).

**Supporting Metabolism** Diabetes, especially T2DM, is fundamentally a disorder in metabolism or *agni* at the cellular level. This is the starting point for many of the subsequent issues an individual with diabetes will encounter. Many diabetics sustain impaired function in their metabolism for a long time before other symptoms and complications begin to appear. Insulin resistance is not an overnight process and exists in varying degrees in different people, which is one of the reasons why some T2DM patients require exogenous insulin and others do not. Even standardized Yoga practices have been proven to lower fasting blood sugar and post-prandial blood sugar in practitioners with T2DM versus control groups <sup>29</sup>.

Additionally, Yoga techniques focused on supporting, balancing, and stabilizing metabolism can help address digestive difficulties in patients.

Another important element of metabolism is elimination which, if disturbed, can cause a variety of problems in the individual. In our study we noted some level of constipation in a majority of patients. In some cases the severity was extreme, with patients going 4 to 5 days without a bowel movement in some instances.

For addressing metabolism, a variety of standing, seated, and reclined twists are helpful. *Utthita-Trikoṇāsana (Parivṛtti Bheda)*, *Parśvakonāsana (Partivṛtti Bheda)*, *Jāthara Parivṛtti*, *Marīcyāsana*, and *Matsyendrāsana*, even in their more accessible variations can be very useful, especially when paired with *prāṇāyāma-s* involving extended exhale and hold over exhale. Inversions, when possible and appropriate can also be very useful. *Sarvāṅgāsana* and *Viparītakarāṇī* can be particularly useful in helping address problems with waste buildup in the body.

Even simple *āsana-s* such as *Apānāsana*, *Cakravākāsana*, and other simple forward bends can be especially useful for supporting elimination and the *apāna* region in general, a very good starting point for someone with problems in elimination. Additionally, a variety of *mudrā-s*, especially using *Jalañdhāra Bandha* and *Uḍḍīyana Bandha* are useful because of their influence in stimulating *agni*, which is suppressed in the case of diabetes.

Lastly, *mantra-s* that stimulate the metabolic fire and create heat are particularly useful, especially when paired with placing the hands on the belly to focus the attention there (*nyāsa*) and/or visualizing light or fire within the belly (*bhāvana*). *Mantra-s* involving *surya* or *agni*, and especially *bīja mantra-s* can often achieve the same if not more dramatic results when paired with simple *āsana-s* than the more complex (and inaccessible) *āsana-s*.

Not all of these techniques need to be used, nor are they all appropriate or accessible, especially in the case of inversions and *mudrā-s*, for every individual. Deep twists will be problematic for individuals who are obese or who have severe back pain. Inversions are inadvisable for individuals with glaucoma related to diabetes. And some individuals, especially those who are very new to Yoga or who have a history of trauma, may find the *mudrā-s* and/or *mantra-s* a bit too powerful.

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**Assisting Circulation** Circulation problems are typically a later development in diabetes. As the blood builds up glucose, it becomes more viscous and there is an increased effort required in moving it throughout the entire body. As a result, many patients suffer problems in their extremities, especially the legs and feet, with peripheral artery disease (PAD) and/or peripheral neuropathy a common development and, in many cases, amputation required due to gangrene or infection.

Supporting the circulation of blood through the body becomes particularly important in diabetes patients, then, for preventing these complications or in mitigating their effects if they have started to appear.

Using *vinyāsa krāma* throughout practice, which makes the individual work through movements coordinated with breathing to get into and out of *āsana-s* is especially useful in supporting circulation. Movement, after all, is how blood moves through the veins from the extremities back to the heart. *Sūrya Namaskara* and other varieties of sun salutations are the most well known uses of *vinyāsa krāma*, but the technique can be implemented with any *āsana*.

When implementing *vinyāsa krāma*, having the individual move only on hold after exhale (rather than the more common movement on inhale and exhale) can invite lightness at all levels of the body.

For individuals suffering pain, related or unrelated to diabetes complications, movement on exhale only can also be very useful, as it keeps the individual relaxed. Pain generally comes when muscles are contracted.

Though movement is especially useful in circulation, we should remember that movement is not achieved through the limbs alone. Ultimately, in Yoga, the movement of *prāṇa* is what is critical (and what is achieved through the movement of the body). Thus, *prāṇāyāma* with a focus, through *nyāsa*, *bhāvana*, or *dhyānam* on different parts of the body, or paired with movement, would be especially appropriate. The

use of *bhāvana* and *dhyānam* can be applied to the energetic body as well, with the person focusing on the different *cakra-s*, each of which is associated with not just the spine but different areas of the body.

**Enabling Relaxation** The detrimental effects of stress have been studied for quite some time and are known to be responsible for many health problems, especially issues in circulation. The negative effects of chronic stress and anxiety cannot just be intuited to extend to diabetes, but there has been research that identifies these, in addition to persistent anger as potential risk factors<sup>27</sup>. Additionally, once diabetes is established, stress and anxiety can act as barriers to practice by affecting enthusiasm, and to overall function of the body by creating a persistent state of inflammation.

Yoga has been associated in the West with relaxation and peace of mind for many decades and so perhaps this specific function (and the way to achieve it) seems to be common sense. But the role of specific techniques should not be taken for granted. Not all Yoga practices will produce calm in a person. In fact many Yoga practices are designed to vitalize and energize rather than to ground and relax. This is to say that not all Yoga practices are appropriate to achieve relaxation in a person.

*Langhana* techniques with focus on exhale and with stays in all or particular *āsana-s* will generally help relax an individual, especially when paired with extended exhale, subsequent extension of exhale, and holds after exhale.

*Āsana-s* paired with *nyāsa* techniques such as palming the eyes and placing the hands on the heart or navel can also help calm the individual.

*Mantra-s* that promote peace and relaxation, such as *Om Śantiḥ*, the *Daśa-Śāntayaḥ*, or *mantra-s* to the moon (moon focused *mantra-s* and meditation should be approached carefully in the case of emotional or hormonal instability), can be paired with *āsana* or done on their own. Similarly any meditation object that helps the individual relax would be appropriate.

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**Addressing Obesity** Though not all individuals with diabetes are overweight, the association of metabolic syndrome with increased risk for developing prediabetes and eventually T2DM means that many diabetic patients will have a high enough BMI that they fall into the category of obese. Even if the BMI is not high enough to categorize the person as obese, many T2DM patients have a BMI that is higher than desirable and considered overweight.

Many of the techniques used to address obesity would be similar to those used to address the issues discussed already, namely improving metabolism and circulation. In addition, techniques to reduce *Kapha* and improve energy level are especially useful.

Practices for reducing *Kapha* include *vinyāsa krāma* and *aṅghalāghava* sequences (movement on hold after exhale), as well as *Parivṛtti āsana-s*. The use of *Jalaṅdhāra Bandha* and *Uḍḍīyana Bandha* is also effective. *Krama* in exhale and/or inhale, and retention after inhale and/or exhale, especially with *bṛhmaṇa mantra-s* can be very useful as well, though it should not conflict with practices aiming to help the individual relax.

## Literature Review on Yoga as an Intervention for Diabetes

### *Results of Prior Studies*

A review of 23 studies conducted between 1992 and 2014 on the effects of Yoga practice on patients with T2DM found significant reductions in fasting blood glucose, postprandial blood glucose, and/or HbA1c, critical markers in both diagnosing and tracking diabetes, in all but one of the studies that tracked these markers<sup>30</sup>. Additionally, many studies found improvements in important health markers associated with the risk of developing diabetes as well as cardiovascular disorders. Many patients experienced significant reductions in LDL cholesterol and increases in HDL cholesterol

(colloquially known as the bad and good cholesterol, respectively), important markers used today to determine the risk of a heart attack, as well as reduction in BMI.

These were not insignificant studies done on a small number of participants. Though a handful had smaller numbers, the smallest groups had at least 20 participants, with many involving 40 or more. Fifteen of the studies had more than 50 participants. Seven of the studies had more than 100 participants. Three studies had more than 200 participants.

Nor were the studies relegated only to one region of the world. Though, as expected, the great majority of the studies were conducted in India, there were representations from other countries, including Iran, England, and Cuba, where one of the largest studies was conducted.

These studies help validate the benefits of Yoga techniques beyond the plentiful anecdotal evidence that had been available for decades prior. They are helping bridge a divide between traditional and modern medicine that has existed since modern medicine brought a different, more segmented and specialized, understanding and approach to the treatment of disease and its symptoms. By using the tools and techniques of modern science (including blind controls, large sample sets, and standardized approaches that facilitate easier direct comparison), these studies in Yogatherapy have advanced interest in the medical field in the perspective and approaches of Yogatherapy, most of which are alien to Western doctors.

In adopting the modern medical approach, however, these studies have in most cases (though not all) stepped away from the core of Yoga's approach and power, which is anything but standardized, raising concerns that they will misrepresent the discipline of Yoga, its applications, and its potentials in the context of health and healing.

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## ***Concerns with Using These Studies to Define What is Possible with Yoga***

The first and major concern with some of these studies is that most (though certainly not all) approach Yoga as if it were monolithic and the results are interpreted as if they are representative of Yoga in general. This is problematic first and foremost because it is an oversimplification of Yoga, its tools, and, by extension, its potentials.

Adding to issue is that the primary, indeed in some cases the only, tool of Yoga used in the studies is *āsana*. Though some more recent studies have had the foresight to use additional controls that involve a prescription of aerobic exercise, most have simply compared groups of patients involved in *āsana* practice to groups that have no exercise at all, confounding the effects of any physical activity with the effects of Yoga *āsana* practice.

Some studies have focused on *prāṇāyāma* and/or meditation techniques, rather than *āsana*, though these have primarily focused on the calming effects and have interpreted the results to be due to stress reduction and changes in mental attitudes. This is not to say that both these effects do not contribute to the changes that practitioners experience. Both are understood to happen when an appropriate Yoga practice is prescribed. But the problem is in interpreting the effects of Yoga as being limited to these or these being the primary effects.

Largely absent in these studies is the use of Yoga's more powerful and subtle tools such as *mudrā-s* and *bandha-s*, both of which are known to have very strong effects on metabolism, homeostasis, and the immune system. Similarly, *mantra* and *bhāvana* have not been used to any meaningful extent in many of these studies.

The most important blindspot in the majority of studies has been the use of Yoga practices as a standardized tool rather than a customized one. In most studies, whether out of ignorance, convenience, or a desire to isolate and compare

effects, all participants were exposed to the same Yoga practices (again, primarily *āsana*) over a period of weeks to months. Adjustments were made for physical ability but practices were not uniquely prescribed. Inherent in this approach is an assumption that all patients with diabetes face the same or similar challenges (though most care providers would agree this is not the case), and that what led to the development of diabetes in each individual is similar enough. In most studies of Yoga and diabetes, the focus has been on T2DM, further solidifying the confidence in the latter assumption.

Lastly, by design, these studies have focused exclusively on the application on Yoga's tools and the effects on the participants but ignored entirely the importance of the Yogatherapist. This is understandable, given that the scientific method of conducting tests demands this focus and exclusion, specifically because of the bias and influence that those conducting the tests can exert on the execution of the test and the subsequent gathering and analysis of the results. In Yoga and Yogatherapy, however, the Yogatherapist is a critical component of the healing process. It is understood that the relationship between therapist and client, much as is the case with psychotherapy, is critical to the healing process. If there is trust in the relationship and a genuine connection, the healing process will go further than the tools could take it in isolation.

And so, from the perspective of Yoga philosophy, the modern process of testing the efficacy of Yoga and Yogatherapy techniques, though necessary to establish the bridge between traditional techniques and modern medicine, is a misapplication of the tools of Yoga and one that reduces their effectiveness. Ironically, in trying to identify and isolate the potential benefits of Yoga for patients with diabetes, the applications by and large chosen function to diminish the likelihood that a strong signal will be found. That these studies have nonetheless seen repeatable significant differences in improvements between the tested patients and

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the controls speaks to the enormous possibilities for healing found within Yoga's tools.

## Methods

As part of the study we included both T1DM and T2DM patients, as well as prediabetes and metabolic syndrome patients, regardless of age, gender, amount of time since diagnosis, or complications. The exception in exclusion was pregnant women with gestational diabetes. We examined 12 female and 1 male participant. The range of ages was 14 years old to 68 years old. Of the participants, we examined 4 with T1DM, 6 with T2DM, and 3 with prediabetes and/or metabolic syndrome. The period of intervention varied by patient according to their need and willingness. Maximum was 5 months.

Participants were not excluded based on association with the therapists. Existing patients, friends, family and patients referred by friends were all included in the study.

Each participant worked with a yoga therapy student to determine chief complaint, assess current baseline, and received a personalized home practice. Patients were followed, where possible, over a period of 2-3 months to determine how effectively practices addressed the chief complaint as well as other factors.

The participating therapists met regularly to discuss cases, observations, and ideas about how to proceed. The cases were also discussed with mentors for further guidance.

Of the 13 patients who began this study, six dropped after one or two sessions for various reasons, including lack of enthusiasm, motivation, availability, or time running out in the study. Some of these are included in the patient case studies, as the experience still provides important learnings for any Yogatherapist working with diabetes patients.

## Results

### T1DM Results

#### Agnetha

Agnetha is a 32-year-old female who was diagnosed with T1DM in 2010. The diagnosis coincided with the death of her father in a bicycle accident. She used to live alone but now is sharing her house with her new girlfriend. She likes to dance and to be in her garden, it relaxes her a lot. She is working in an art museum and studying art as well. She becomes very nervous before exams. She does not want too much to be around people but likes to be in small groups of friends.

Agnetha's chief complaint was anxiety and constipation. She is very unstable in her emotions with her mood coming up & down very frequently. She could not find time to be alone or space to practice.

Agnetha received 5 sessions in three months. She received two practices. Her pulse shows more *Vāta* than *Pitta* although she seems to be very *Pitta*. She has a good amount of knowledge of Yoga practice. She has been doing *Aṣṭāṅga-Vinyāsa* Yoga for five years and enjoys it very much.

Agnetha was prescribed two different practices: at the beginning she received *Virabhadrāsana*, *Parśva Uttānāsana*, *Ardha Uttānāsana*, *Utkatāsana*, *Maricyāsana* and *Mahā Mudrā* (as an *āsana*) as main *āsanas*.

Later, Agnetha was prescribed *Baddha Konāsana* with *bhāvana*, visualizing that she can have nutrients from the *Mūladhāra* and store them within herself. For anxiety she was prescribed *Candra Bedhana* before going bed, as well as *Śantiḥ mantra* for chanting after the practice while visualizing light in her heart.

Although she was feeling better during the three months of practice and had developed much energy and become less constipated and more stable emotionally, her blood sugar test didn't improve, which was a great frustration.

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She seems to eat some sugar sometimes and then she can correct the values with medicine.

Agnetha has returned recently. She was feeling better, but not practicing so often. She started to study astrology and requested a practice for groundedness. She was prescribed a practice that includes dynamic and static movements.

### ***Kavita***

Kavita is 48 years old female with T1DM. She has had hypothyroid disorder since she was 30 years old. When she was 40, she got married and her life changed drastically. She started to feel a lot of stress. After that, she felt severe fatigue for two to three days and lost 7 kg, noticed she was urinating far more frequently than usual, and then was diagnosed with T1DM. She started using insulin after diagnosed. She lives with her husband and works for a day-service.

When she came to a therapy class, her main concern was the color of her palms. She also expected to improve HbA1c.

She looked slightly irritated with her situation. Eyes were big and radiant. Her palms were significantly yellow and her skin was thick and dry. Pulse showed strong *Pitta* on both sides.

The main aim of the practice was to balance her excess *Pitta*. The practice she received was mostly exhale focused forward bend *āsana-s* with *Śantiḥ mantra* included *Sūrya Namaskara*. The practice was closed with *Śitali prāṇāyāma*.

After the first meeting, she was motivated to improve her eating habits. She developed a good amount of discipline in this area. Though HbA1c was not decreased instantly, it has been stable and she is still maintaining a good diet.

On the second class, visualization of light was added to bring her awareness to the light inside her.

Her voice was getting calmer, even during the class, and the yellowish color of her palms decreased and the skin became much softer.

On the third class, her pulse showed a much more balanced *Pitta*.

### ***Andrea***

Andrea is a 46-year-old female with T1DM. She was diagnosed with the disease when she was 11 years old. She has two younger brothers who also have T1DM. Her father lost his speech after a stroke 10 years ago, but neither of her parents are diabetic.

She works as a Communication Adviser, which can be a demanding and stressful job at times. She was divorced 6 years ago, and shares custody of her two kids (she lives with them every second week). She lives a healthy lifestyle when it comes to diet, and she practices Yoga and runs regularly. Her bowel movements are regular. She is confident and emotionally stable.

Her chief complaints are disturbed sleep with poor quality, feeling stressed, and HbA1c that is too high and hard to control. She sees clear increases in blood sugar at stressful times. Also, she has vivid dreams and nightmares during the night, seemingly due to hormonal changes. She has recently got a chip installed in her arm that measures blood glucose continually, so she can better control her blood glucose levels.

She has normal weight, and her pulse shows *Vāta* and *Pitta* dominance.

She has a strong belief in Yoga, and also has previous experience practicing Yoga on a regular basis.

She was given a practice to balance *Pitta* and *Vāta* dominance, which could be the main causes for the feeling of stress and poor sleep quality. She was advised to apply oil before the practice in the evening. The first practice she was given started with *Candra Bhedana prāṇāyāma*, (inhale through left nostril and exhale through right nostril). This was later changed to *Śitali*

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*prāṇāyāma* because she suffered from one stuffed up nostril. She was given primarily forward bending *āsana-s* with an exhale focus to calm down. A sequence with *Vajrāsana*, *Cakravakāsana*, *Januśirṣāsana*, *Apanāsana*, and *Śantiḥ mantra* with visualisations in the belly, heart and eyes.

Kavita reported a feeling of harmony after each practice. Her sleep patterns improved and she felt more calm. Her HbA1c didn't change during the three month test period, but she still has confidence in continuing Yoga practice since her blood glucose clearly changes due to stress.

### **Momoko**

Momoko is a 38-year-old female. She was diagnosed with T1DM at age 27, relatively old for type 1. After her diagnosis, Momoko quickly jumped into Yoga practice as a way to maintain a healthy lifestyle, which she knew would be critical to success in managing the diabetes. She was also equipped with knowledge from her job as a nurse. Momoko's yoga style of choice was Power Yoga, with some Hot Yoga included, very dynamic and physically intense styles which nonetheless kept her slim and which seemed to offer good results in managing her blood sugar.

She fled the home when she was younger to get away from family, particularly her mother, a recovering alcoholic, with whom she has what she describes as a toxic relationship. When Momoko was on her honeymoon, she developed endometriosis in her navel and bled constantly until she had the lesion removed. Her mother and father never married and separated, then started new relationships with other people. The man her mother paired with is the one who raised her for the most part and she has a distant relationship with him but feels great affection for him. She is not as close to her biological father.

She is close to both her half siblings (children of her stepfather and her mother) and her brother was living with her when she started

the study. She had tried very hard to get him out of parent's house.

Momoko used to suffer vivid dreams but these stopped around the time she was diagnosed with diabetes.

Her primary complaint was her constipation. She would go several days (typically 3, but as many as five) without a bowel movement and then had a very small bowel movement (pellets, dark). She had to regularly take a laxative to make herself eliminate. Additionally, Momoko wanted to address some of her negative feelings regarding her mother, which she understood troubled her greatly, despite living away from home. Her pulse was strongly *Vāta* on both sides, even though her presentation suggested *Pitta* dominant constitution.

The first practice Momoko received included *Jāthara Parivṛtti* with legs straight and hold after exhale. This was a very strong pose but with Momoko's 10-year history of Yoga and expectation of a strong practice, it seemed appropriate. Within the first two days of practice, Momoko's constipation had disappeared and she was having bowel movements daily (sometimes twice a day) and of reasonable size. The first one she had surprised her as she described it as excessive. But she was happy with the quick results.

Within a few days, however, she was very distraught because she was having vivid, dark dreams. In one dream she was swimming in black water and human-sized bat-like creatures were trying to pull her underwater. She also had a dream of being subjected to sexual aggression men in her family. A name that she did not recognize came up in the dream.

Momoko's practiced was changed to include forward bends with *krama* on exhale to calm and ground and a prayer asking the Divine to help her manage whatever was coming up and to protect her. Momoko was raised religious but had moved away from the church. She considers herself spiritual and prays regularly. She was very happy with the practice. This helped the



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dreams settle. She had not needed a laxative since starting practice.

Momoko and her husband asked her brother to move out of the house because her husband wanted to start focusing on just the two of them and potentially start thinking of having a family. This created some tension with her brother but ultimately was resolved amicably. Momoko then started to travel home to help her younger sister who was having trouble and ultimately invited her to live with her and her husband.

During the trips home she had very strange encounters with family that pointed to the sexual aggression in the dreams (her biological father trying to enter her room at night). Momoko began to speak as if it was clear that something had occurred in her childhood or that of someone in the family and that she had suppressed this. She accepted that she has an intuition about not trusting her mother or her biological father that is founded on something real rather than just resentment about separation or alcoholism. Her anxiety started to increase and some constipation returned.

She developed a sexually dysfunctional attitude, wanting to cheat, have multiple partners, and acting out. Something in Momoko's eyes was different at this point, like she was barely holding something back that wanted out. She recovered memories of an aunt who was a prostitute and was murdered. Practice was adjusted to grounding only (forward bends, extended exhale, stays in each pose, and a lotus as a meditation object) to help her calm down and connect to a part of herself that is not affected by the traumas in her life.

The next consultation, Momoko was calm, grounded, happy and had news that she was pregnant. At this point, her practice was adjusted to support her pregnancy (*Jalandhāra Bandha*, *Januśīrṣāsana*, *Mahā Mudrā*).

As with the other cases, Momoko is someone who has suffered trauma in her youth and focused on helping others, at the expense of her own needs. Despite having left an unhealthy

home, she stayed focused on helping her siblings get out and to some degree helping her mother, which can be seen as a diversion from the changes she encountered in her life when getting married and the expectation of having a family.

The diabetes diagnosis in her case was coincident with the suppression of dark memories, feelings, and energies, which became so hidden that she had no idea of their existence when discussing her past. The constipation was suggestive of both not processing and not letting go (which can't happen without processing) emotions and memories, and this manifesting at the physical level as well (literally at the level of food).

When Yoga practices addressed the metabolism, the memories and energies became active again, making her unstable. This is a classic example of how the *Pañcamāya* functions, with events in one layer manifesting in the others. What is always interpreted as a metabolic or autoimmune condition (which T2DM and T1DM, respectively, are) need not originate from the *Annamaya*.

A last learning in this case is how physical presentation and even experience with Yoga are not necessarily indicators of how fit a person is for strong practices. Momoko received similar practices to the other participants but in her case the practices made her unstable because of the origin of her condition. To say that someone is unstable need not suggest they are in the midst of fluctuation at the moment; it can also mean that the situation they are in can be easily changed... it has no stability. In Momoko's case, this inherent instability was in her putting all her energy into suppressing her family past. Stabilization was then more important than directly pursuing the chief complaint, which may likely be an adaptation to suffering, assault, or injury in her past.

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## T2DM Results

### Albin

Albin is a 60-year-old man. He is divorced and has two daughters. He was diagnosed with T2DM in 2017. As he had a history of high blood pressure, in 2018 he suffered a stroke. His emotional state became very sensitive due to his stroke and his high blood pressure episodes.

He works in electro-mechanics; he loves his work and is very dedicated to it. He likes bicycling and walking.

He does not have very good social skills and he prefers not to talk too much but rather to listen and to stick to his routine.

He is in a relationship with a woman who lives far from his home; as he has to travel on weekends to visit her, this situation brings tension with one of his daughters.

As he cannot talk too much he was not given chants but rather a focus on long exhale. Working with the shoulders separately via asymmetric *āsana-s* was part of his practice as he has significant differences between his shoulders and pain and lack of mobility in one of them. Albin was also given *Virabhadrasana* with *Parśva Uttanāsana* with the support of a wall for strengthening and equilibrium as well as working with asymmetries.

In the floor he does mild twists, *Dvi Pāda Pītham* and *Apānāsana*. This helped reduce his back pain significantly. He works mostly asymmetric.

He was also given *Supta Baddha Konāsana* with one leg at a time, *Śavāsana* with elevated legs for rest, and then seated meditation, connecting with the space in his heart.

He came seven times in three months and was given three practices. Now he is practicing every day with the help of his ex-wife.

He came for the last time in November 2019 and he had improved a lot. He had developed much more awareness in the movements. His

back pain has diminished and his arm and shoulders are much more mobile. His breathing was very long in both inhale and exhale.

The news was not all pleasant. Since the previous class he was diagnosed with prostate cancer. He is going to receive some treatment in the few months (x-rays mostly) so he was given a new practice to be prepared for that and was advised to consult a nutritionist to help him with appropriate diet during treatment. He was also recommended to have one main doctor because he is dealing with different specialists but not one to collect all his information.

### Sarika

The Patient is a 14-year-old student, who was pointed fatty liver and hyper glycaemia, then diagnosed with T2DM at the age of 12. She has a past medical history of myelitis when she was 2 years old. She also has a family history of stroke on her father's side.

Her main issues were constipation and insomnia. When she came to the first class, she was totally new to Yoga.

Her appearance was chubby, slouching and her hair was almost white. She didn't speak at all so her mother, who was present at the consultation, answered most of the questions. Her pulse showed strong *Pitta* and *Vāta*.

She received exhale focused and mostly forward bending *āsana-s* including twists with *Śantiḥ mantra* for helping her relax, connect to herself, and express herself. We used visualization as well. Twists were prescribed to improve constipation and metabolism in general. When she was practicing, she was instructed to pay attention to moving softly and comfortably.

After the first class, her expression changed and became softer, and for the first time in our exchange she enjoyed speaking with clear voice. She kept practicing and came to the second class. On the second class, she said she felt sleepy after practicing but still had difficulty falling asleep.

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Similar *āsana-s* were prescribed with *Om Somāya Namaḥ* in order to cool.

Unfortunately, she experienced some lack of motivation and stopped practicing.

## ***Sakura***

Sakura is a 65-year-old female, who received her T2DM diagnosis after she went to see a doctor about a bruised small toe that was bruised and not healing. She did not remember bumping it. As it turned out, the toe was a result of her diabetes and not impact.

She divorced decades ago and has been living with her mother since, intermittently living with her sister's family as well. She has never sustained a romantic relationship since her divorce, though she has dated. She has also not sustained a job for very long after her divorce (she was a dental assistant previously) and has spent most of her time unemployed tending to her mother, even though her mother has not needed regular care, being healthy for her age. Sakura has a passion for art and has a couple of times made money helping to plan and decorate events at a ballroom for rent but has not held onto these jobs for more than a couple of years.

When she approached Yogatherapy about joining the study, we first focused on the toe. She had immobilized it completely based on her doctor's recommendation but whenever she would go to clean it, she felt it looked worse and had been warned she might lose it. The practice began with deep breathing and warm oil application on the toe, as well as gentle movements in the lower body with breathing twice a day. This was contrary to her doctor's recommendation and she was asked what she wanted to do. Because her doctor had indicated there was a high likelihood she would lose her toe, she opted to try something different and proceeded with this practice. Over a few weeks, normal color and sensation came back to the toe. She was a lot more confident with touching and

cleaning it and was very happy with the results and motivated to proceed with further practice.

The practice was then changed to include standing poses near a bed, as she was afraid of falling due to neuropathy in the lower body. She had fallen a few times and, due to her weight, been unable to get back up. She used movement on hold after exhale, then did some reclined postures on the bed, all on hold after exhale.

She slowly became stronger and more confident and is now able to do standing forward bends without support and with no fear of losing her balance.

Dynamic *Jāṭhara Parivṛtti* with legs bent and no stay was added. Her weight remained stable as has her blood sugar, which had previously been climbing. Aside from the recovery of her toe, the biggest impacts have been on her eating habits, which are not as sporadic as they were before (with snacking) and her energy level is more reliable. She stated a few times that she didn't realize how out of shape she was until she started practicing and saw what it felt like to have energy.

Though initially there was some hesitation to physical exercise, the primary motivator for Sakura was seeing the benefit Yoga had on her toe, which she fully expected to lose. That gave her faith in her ability to turn around some of the negative habits and patterns she had in her life which could help her manage her diabetes. She practices almost daily now and regularly asks for more demanding or lengthier practices as she becomes accustomed to the ones she has. Much of her practice is about overcoming fear and a limited sense of what she is capable of.

Consistently, the thing that gets in the way of practice regularity is her anxiety about her duty to other people. She allows the demands other place on her, and those she places on herself about her debt to others, to take priority over her own needs.

A lot of emotion comes up during practice and after it, and some of these emotions are

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difficult and not pleasant to face, which also makes her want to avoid practice at times. She sees this pattern and understands that facing these feelings is part of the process, in fact having them suppressed is what likely created the habits that led to her diabetes in the first place.

### ***Tsubaki***

Tsubaki is 45-year-old female, who is obese and had a quick slide into a T2DM diagnosis from metabolic syndrome and prediabetes. She is a professional who always has a kind disposition at work but is also consistently dealing with stress. She is always rushing for others, involved in planning and executing extracurricular activities at work and with her son and family, but does not reserve time for herself, either for exercise, relaxation, or even for planning her day so as to reduce stress.

Her main concern was insomnia. Secondly, she was worried about her weight. With Tsubaki, we focused on improving her sleep.

*Apānāsana* and then subsequent extension of exhale both helped her sleep more soundly and without interruption. She still had some trouble with the duration of sleep, which remained shorter than it should be for her. This was due to her staying up too late doing work for others (either home or profession related) but still having to maintain an early morning schedule because of her son's school and her work.

Simple movements were added before dinner with hold after exhale, including standing twists and *Jāṭhara parivṛtti* with knees bent and stay.

Tsubaki had a lot of trouble making time for even this short practice and kept not practicing for a while. She felt guilty about not doing it as if it was letting her Yogatherapist down. An attempt at explaining that this is about making time for herself was not entirely accepted. She was not able to see that she is important enough to merit making time. She fell out of the study,

intending to get back when she could but hasn't yet.

### ***Aina***

Aina is 44 years old, married with one son. She was diagnosed with T2DM 20 years ago when she fell into a diabetic coma while pregnant. She lost the baby, who was ready to be born.

After that event, she was very depressed for a year until she found a priest that told her to conceive again, that it was time for have another child. As she is a devout Roman Catholic she did as the priest suggested and now has a son. Although her son has no diabetes, he is always focused on controlling himself and inclinations towards poor diet. He has breathing problems.

Aina likes to dance but is not very fond of Yoga as relaxation; she prefers to be at home, gardening and drinking *yerba mate* (a local caffeinated drink) instead of practicing yoga.

Her chief complaint is that she is very frightened about changes. In fact, any little change affects her very much because she is slow in her movements and needs time to assimilate experiences. She is very anxious although she is very *Pitta* in character. She cries a lot and is very scared in life.

She came twice. She was given one practice, but she did not practice much. That is probably because she thought the project would provide her a solution for her need for insulin. Since that was not the project's goal, it did not fulfill her request and she seemed disappointed.

The practice she given included *Utkatāsana* and *Parsva Uttanāsana* as well as *Jāṭhara Parivṛiti* because she is very constipated. She also needs support in her metabolism. She realized that her bowel movements had improved when she did the practice. She also has *Supta Baddha Konāsana* for *langhana* approach. As she is very Catholic she was suggested to focus on light in her heart for the end of the practice.

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## **Beata**

Beata is a 62-year-old widow with three grandchildren. The death of one of her daughters and then of her husband in 2004 coincided with her T2DM diagnosis.

Her occupation is mainly housekeeping, though now and again she helps her son and daughter in the family business running a restaurant.

She is Roman Catholic.

She exercises Pilates twice a week.

Her mother had cardiac problems and her father had diabetes. The latter had serious complications requiring the amputation of both legs.

Her daughter is a Yoga teacher, so she has some exposure to Yoga, though she is suspicious of it.

Her sleeping is very erratic. She cooks for herself as she lives alone.

She says she has regular bowel movements and does nothing in particular to relax herself.

In her pulse she showed some *Vāta* and *Pitta*.

She is very sensitive and used to cry a lot. She now considers her grandchildren the main reason to keep living.

She came from a very humble family from a local town named Tigre but then, as business grew, her family has become very wealthy and they are very well known locally as they have opened another a second restaurant.

She is very *Pitta* and has a lot of energy. Her sister has diabetes as well, but she doesn't take care of herself, so they are always complaining about that. She is not very fond of Yoga, she only came because of her daughter and she did not practice at all, even though she was given a practice. The practice had some *PurVātana āsana-s* to open her chest as well as *Jāhatara Parivṛtti* for metabolism. Also, some *bhāvana* connecting herself with her heart was given at the end of the practice.

## **Prediabetes & Metabolic Syndrome Results**

### **Shuruti**

Shuruti is a 56-year-old female with metabolic syndrome. She was diagnosed as prediabetic 8 years ago. She is a hair stylist and living with her boyfriend.

Her main concern was constipation. She had bowel movements every three to four days. When she came, her height was 166cm, weight was 58kg, and she had a BMI of 21, which is not considered high, but she wanted to reduce her weight. She was feeling a disconnection from herself and wanted to improve this.

The practice was composed of mostly *langhana āsana-s* with *Śantiḥ mantra*. Some twists including *Jāṭhara Parivṛtti* were also prescribed.

After just two days of practice, she began to have bowel movements every morning.

### **Jyoti**

Jyoti is a 68-year-old female who was diagnosed with prediabetes and metabolic syndrome. She is a retired English teacher and now runs a guesthouse. She had a family history of diabetes in two brothers. Since her BMI is 28, she wanted to reduce body weight and to make exercise a habit.

She was totally new to Yoga. The practice was comprised of simple *āsana-s* including twists to help improve her metabolism.

### **Sumire**

Sumire is 67 years old. She is diagnosed with metabolic syndrome due to her weight and BMI, cholesterol. She is obese and inactive and, though has sustained good pulse, blood pressure (signs of proper cardiovascular function) she has

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done so through the help of medication, without which, she would have dangerously high numbers. Recently she had a few health scares related to her asthma, which manifested similarly to heart problems. She suffered asthma in her youth and it has returned in the last few years as her weight gain has exacerbated.

Her primary interest is to get her weight under control. Her motivation is very low and she was interested in participating because her sister was involved in the study. They have been competitive all their lives.

Competition, though not a great starting point in general for yoga, proved to increase her motivation temporarily. She received a similar practice with movement on hold after exhale, some standing poses and some reclined poses on the bed, including *Jāṭhara Parivṛtti*.

Sumire saw some results very quickly, with her strength and stamina increasing and a general feeling of “wellness” as she put it. Unfortunately she found it hard to sustain her practice daily and eventually fell out of it, citing various reasons at different times (from not having enough time with work, not having enough energy, having too many family commitments, etc.), which she would switch between if one was challenged or solutions were offered. She has since had some additional health scares and she has indicated wanting to return to practice but as of yet hasn’t done so.

## Discussion & Learnings

The previous profiles highlight an important element of Yogatherapy’s approach: individuals who share the same clinical condition will experience it differently, encounter different challenges, and suffer in different ways. This is true even in the case where the same symptoms are seen across the patients. A person who has experienced constipation for much of their life may not find it as troubling as someone who is only now encountering a severe instance of it. In

the same way, each individual’s mental attitudes may make the experience of certain symptoms more or less traumatic.

Honoring the uniqueness of individuals, however, does not mean that common elements and general learnings cannot be drawn from the collective experiences. This paper focused on a cluster of conditions under the umbrella of diabetes that, even within the Western perspective, can be categorized by the basic mechanism of the disorder (as between T1DM and T2DM) or in how advanced the condition is (as in metabolic syndrome and prediabetes). Within the Yogic and Ayurvedic models, this umbrella of *Prameha and Madhumeha* is further divided into a variety of categories, each of which suggested a particular intervention likely to be more successful in that instance.

In our study, we encountered some surprising observations regarding the individualized experience of diabetes (most obviously seen in the variety of chief complaints,) noticed some unexpected commonalities across cases (as in the precursor of trauma and suffering daily constipation), and observed alignments between information gathered from Yogic and Ayurvedic tools and perspectives and the particular diagnosis and complication in individual. In this section we detail eight major takeaways from our study:

- Chief complaints between diabetic and prediabetic patients can vary significantly
- In many cases, the diagnosis of diabetes coincides with a major traumatic event in the individual’s life
- Severe constipation is a common issue in many patients, though in most cases it was not listed as a chief complaint
- Practices that affect metabolism, though clearly called for in the case of diabetes, can have volatile effects if not approached carefully
- Grounding practices are very important to sustain some of the changes

- When dealing with complications, the Western medical recommendations and those that come from the Yoga and Ayurveda may conflict
- Resistance to the healing process and issues with self care vary between patients, with a notable signal between T2DM and T1DM patients
- Beyond detecting predisposition or onset of diabetes, the Ayurvedic pulse offers significant insight into the particular challenges the individuals facing

### ***Chief Complaints Highly Individualized***

As has been mentioned before, diabetes is not a single disease but rather a collection of conditions that have the common element of impaired function or absence of insulin, resulting in elevated blood glucose. We should expect, then, to see a diversity of experiences among diabetes patients. This is not only in terms of age, ethnicity, profession, and gender (to name a few), but also in terms of how the patients experience the diabetic condition, how it manifests, and what elements in that manifestation create the most suffering for them.

In our study, we had a variety of chief complaints and subsequent expectations and needs. Patients identified as chief complaints the need to improve the quality of sleep, reduce anxiety, control important markers such as HbA1c or BMI, address neuropathy or jaundice, relieve constipation, and lose weight.

Though some patients certainly manifested various of the above issues, often only one was cited, indicating that the others were not deemed as important, at least not at the moment. One patient who was concerned about the possibility of losing her toe due to complications was not concerned about her severe constipation, which she had been living with for some time. Another patient cited the need for consistently sound sleep as her primary concern and never noted the

need to lose weight despite having an extremely high and worrisome BMI.

It is possible, and in many cases expected, that as chief complaints are addressed, it leaves room for the patient to pay attention to other concerns which, in the presence of the first, don't seem as critical. Certainly constipation does not seem as important as the possibility of losing a part of the body. And the inability to sleep soundly can create immense amounts of problems in daily life when compared to body image, and it can be experienced as much more immediate than insidious complications associated with BMI.

This is an important element to keep in mind when working with diabetic patients. It can be tempting to see the primary concerns in diabetes as common across patients and as therapists we can become overly concerned with reducing or controlling certain markers such as blood glucose, HbA1c, BMI, blood pressure, cholesterol, etc. However, in doing so, we would miss the things that are creating suffering in a patient's life. It must be remembered that in Yogatherapy, we treat the person, not the disease, and so a group of people who share the same diagnosis may in fact experience very different conditions and necessitate different approaches for optimal healing.

### ***Trauma and Diabetes Diagnosis***

Though inescapably a physical condition, more research is pointing to experience and environmental factors as instigators of diabetes. From the Yogic perspective, this is not novel, and further extends to emotional, psychological, and even spiritual trauma.

Studies cited earlier mentioned associations between pervasive negative emotions such as stress or anger, and incidence of diabetes. These associations were found to have a higher correlation (odds ratio) than even dietary habits<sup>27</sup>. Put plainly, this suggests that strong, lasting negative emotions may increase the likelihood of

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developing diabetes more than eating inappropriate food at the wrong times. From the viewpoint of Yoga and Ayurveda, this is not unreasonable, as emotions reside in a deeper, more subtle, and thus more impacting layer of a person than food does.

In our study, many of the cases cited coincidence between the diabetes diagnosis or worsening of the condition and some powerful traumatic event (the loss of a loved one, escaping an abusive home, major changes in life situation, etc.).

Whatever a person's character, responding to a major, unforeseen event in life is challenging and can test a person beyond their limits. As a result emotional breakdown or suppression will often follow. This is experienced not just psychologically but physically. Many people develop gray hair prematurely or suddenly after a major event shakes them. Their systems change and begin to function in different ways. Some may change habits, developing new coping mechanisms (often negative ones such as smoking, drinking, poor eating, etc.) and losing the enthusiasm for previously enjoyable activities. In some cases, even foods that were previously pleasurable to consume seem to not offer the same satisfaction.

The person is, in various deep ways, changed. They can feel increasingly alien in their own life because they are experiencing their life situation from a fundamentally different point of view, with a different attitude.

This does not deny that diabetes is at its core a metabolic issue, but it points to metabolism at different levels as the potential instigator. Within the *Pañcamāya* system, metabolism occurs at various levels, not just within the digestive tract. A person metabolizes energy, transforming it from one form to another for use. They metabolize feelings, emotions, memories, and ideas. An assault on our ability to properly, fully, and efficiently metabolize at any of these levels results in the stunting of the process, a shift in our ability to process our place in our

environment, to integrate the useful elements of what we consume at different levels, and to eliminate what is not useful.

With T1DM, which begins as an autoimmune disorder, the process may have the further complication of suppression or repression, with the individual trying to ignore, and by virtue of this never processing, the traumatic event. The system then begins to battle itself at different levels.

If disconnection associated with a traumatic event is a strong risk factor in diabetes, this points to the importance of connection to oneself and others in mitigation and healing. This includes acceptance of one's current situation, something which may be especially difficult if it is a T1DM or a very advanced T2DM diagnosis that is facing serious complications, but also acceptance of the events, emotions, and consequences of the instigating traumatic event. If underlying conflicting emotions are not allowed to express and resolve, within the Yogic model, they will manifest as increasingly more serious issues, related or unrelated to diabetes.

### ***Constipation a Common Issue***

Since both Western medicine and Yoga/Ayurveda see diabetes as a problem of metabolism, it is no surprise that other issues in metabolism should be present. One common element in most of the patients was that of constipation. Even in cases where patients did not indicate constipation as a chief, primary, or even notable concern, when practices were started and bowel movements became more regular, patients mentioned the ability to pass stool regularly and of significant quantity as a major, positive change.

In some cases, the patient had been constipated for so long, that the condition had become normal for them. As a result, constipation was not raised in the initial discussions about their condition. This makes sense. In most cultures, discussing bowel



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movements and/or stool quality and quantity is a taboo or at minimum a crass subject, and is avoided. There is even resistance at times to discussing it in medical contexts.

This makes it nearly impossible for a patient to understand whether what they have been experiencing for some time is typical or abnormal.

Nonetheless, it is a critical issue to raise and identify. In some of the cases in this study, constipation was so severe that the patient would have a bowel movement only every three days, sometimes approaching five days. Some patients became regular users of laxatives to aid in bowel movements and even then were only able to pass a small amount of stool every day or two.

A notable observation in the positive effects of Yoga techniques is how quickly constipation could be addressed with simple *āsana* and *prāṇāyāma*. All patients that suffered constipation experienced almost immediate relief due to practice.

Practices and lifestyle changes that helped reduce excessive *Vāta* and/or which increased digestive fire helped achieve this. In particular the use of *Jāṭhara Parivṛtti*, even in modified form, was useful.

### ***Practices that Affect Metabolism Should be Approached Carefully***

The previous two learnings discussed aspects of how diabetes can be viewed from the Yoga and Ayurveda perspective as a problem of metabolism at multiple levels. Specifically we touched on the association of traumatic events with the initial diagnosis or worsening of symptoms, and how the common element of constipation appears throughout a majority of cases.

A third learning that is particularly meaningful makes use of these two concepts and offers a warning. In the same way that problems in the ability to process and digest thoughts and

emotions can translate to issues in processing and digesting food, practices in Yoga designed to help the digestive process at the physical level can influence the metabolism of thoughts and emotions.

In three of the participants, using *Jāṭhara Parivṛtti* effectively resolved constipation, but immediately brought back memories and caused disturbing dreams to emerge. The emergence of these was manageable in two of the cases but in the third proved traumatic in its own right and required scaling back the practice.

Though aiding in the processing of emotions is important as part of the healing process, it can only occur when the person is starting from a stable place. The suppression and repression of emotions often occurs because the individual is not prepared to handle the implications of the traumatic event. This has to be honored. The mind and body are wise beyond our cognitive abilities, and their adaptations, though potentially problematic in the long term, are often what is necessary at the moment of a major event to keep the person from breaking down or experiencing additional injury.

### ***Grounding Practices Important***

In cases of obvious imbalance where the source is seemingly identified, it can be tempting to offer a student a remedy that targets the issue effectively and efficiently. But this approach can create a backlash in the student if it is not tempered with sustaining and grounding practices that allow the student to feel supported and held during the healing process.

It is important to recognize that imbalance rarely occurs without adaptation in the human system. Indeed the imbalance is often the adaptation itself. Undue chronic stress which cannot be avoided often leads to eating for comfort rather than out of hunger, leading the individual to gain weight, achieving a physical grounding that is not available mentally. If the stress is sustained for a long enough period of

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time, the dietary habits can have various negative effects, among them the variety of physiological conditions that lead to metabolic syndrome and ultimately T2DM.

So the disorder is present because of some catalyst or source, which, if still present when practices target changing patterns that are unhealthy (but which are present as a coping mechanism), will be felt acutely when the adaptation is removed. This will lead the individual to reject the practice or subconsciously find reasons for not doing it.

This resistance to practice appeared in various of the participants in our study. All participants who stopped attending sessions suffered T2DM and, though they all offered a variety of reasons for not doing the practice (not enough time, tiredness, pain, etc.), the result was the same: avoiding making the necessary changes.

Even the participants that continued to practice found the regularity of practice difficult and practices had to be adjusted to help sustain what they had gained without continuing to move forward with changes.

The need for sustaining practices is not unique to T2DM only. In one of the T1DM cases, though initial practices addressed effectively the primary complaint of constipation, an almost immediate reaction included nightmares, panic, and erratic behavior. To help the patient, calming and grounding techniques such as *Paschimottanāsana* and *Janusirsāsana* with extended exhale were offered, in addition to palming the eyes and grasping a stress ball during Yogic breathing. These practices calmed the patient of the sudden anxiety but resulted in unwanted symptoms returning. Combining techniques like *Jāṭhara Parivṛtti* that targeted metabolic balance with grounding techniques enabled the patient to be relieved of the chief complaint but without sudden change.

## ***Yoga & Western Approach May Conflict***

Because Yogatherapists, especially when working with diabetes patients, will not be the only care providers for patients, it is particularly important to be aware of when interventions will conflict with what a patient has been advised by care providers from other disciplines, especially when the care provider is on the side of Western medicine, which will almost always trump the suggestions of other healing modalities.

In many cases, Yoga's approach entailing working with other levels of the person means that practices will not intersect, let alone conflict, with what is recommended by Western doctors. This is not always the case, however. The most notable example of this was with the patient who came concerned about losing her toe. She had been advised to keep the toe covered, immobile, and to not touch it. Though rest is recognized as critical for healing in Yoga, it is also understood that *prāṇa* is needed as well. In this case, the avoidance of touching, moving, or even looking at her toe, was in conflict with healing.

Because the suggestion of moving the toe and applying oil as she used visualization of light moving into the toe was in direct conflict to what she had been advised, the choice was left up to the patient to decide how to proceed. Because her toe had been getting worse and her doctor had indicated it would more than likely need to be removed, she opted to try something different, as it would not make it worse. In the end, her toe recovered its color and she was able to start feeling it again.

Two other cases had less dramatic examples, where an affinity towards fast paced and high heat activities were seen as positive from the perspective of Western medicine, but from a Yoga/Ayurveda perspective were seen as increasing the already elevated and problematic *Vāta* in the patient. Because the Yogic and Ayurvedic models are not well known in the West, it is particularly important to take care that suggestions about letting go of practices that are

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viewed as beneficial doesn't create skepticism about Yogatherapy as an intervention or distrust within the therapist and patient relationship.

An approach that potentially mitigates this would be to explain the perspective of Yoga/Ayurveda and let the patient decide if they are willing to try.

### ***Resistance to Healing & Lack of Self Care Varies***

A common element in our T2DM patients was a lack of time dedicated to self care. In many cases, the patients resist practices, even if they were relatively short, insisting that they had many duties either at work or at home. A common theme in the language pointed to not wanting to let others down. There was in some cases even the suggestion of guilt at taking time that is just for oneself and not in the service of others.

This was an immense challenge in maintaining motivation, even when the patient was faced with the potential benefits of taking even 20 to 30 minutes a day to commit to practice and self care. Various ways of reasoning through the importance of self care were attempted, including how self care gives one the energy and vitality to be able to help others further, how not caring for oneself may result in disease and complications that make it impossible to help others, and how not engaging in self care sets a poor example for children and other family members. When the discussion turned to why the patient had not been able to engage in regular, let alone daily, practice, it developed visibly very sad undertones. In some cases, the patient seemed to feel guilt at letting the therapist down.

This same dynamic did not seem to be present with the T1DM patients, who were largely more motivated to try something new.

This discrepancy in attitude is not entirely unexpected. T1DM patients typically are faced with the reality of insulin dependence and

develop a rigid routine and disciplined attitude. Their lives very literally depend on this.

In the case of T2DM patients, the decline that often begins with metabolic syndrome and progresses through pre-diabetes into full blown T2DM is steady and takes place over many years, over which health markers signaling a problem are ignored.

This distinction was well documented in Ayurvedic texts, where the categorizations of *Prameha* included distinctions between very thin (more aligned with T1DM) and obese (more aligned with T2DM) patients.

### ***Pulse Offers Meaningful Insight***

Pulse diagnosis has been taught and used along side various forms of traditional medicine (including Ayurveda and Traditional Chinese Medicine) for thousands of years. The three finger Ayurvedic radial pulse was used by our team primarily to detect excesses in the *doṣa-s*, though among Ayurvedic doctors who specialize in the practice, it can be used, via different levels of the pulse, to detect the presence of various disorders and imbalances in the body.

Though the patients in our study shared a common diagnosis, the pulse was significantly different between them, pointing to variance in the appropriate intervention. Some patients displayed increased *Vāta* and some increased *Pitta*. This was evident from other factors as well, such as yellowing of the skin (*Pitta*), dark circles around the eyes (*Vāta*), and general lethargy (*Kapha*). In some cases, patients exhibited combinations of these. It has been mentioned that, fundamentally, *Prameha/Madhumeha* are a *Kapha* disorder that can be categorized by the dominant action according to each of the three *doṣa-s*. So prediabetes/diabetes, which we take to be aligned, if not synonymous, with the Ayurvedic terms, would also display a variety of influences from each of the *doṣa-s*, with sometimes *Pitta* elements being dominant in the person, and

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sometimes *Vāta* elements, in addition to the inescapable *Kapha*.

This was certainly seen across the patients in our study. The usefulness of the information gained from pulse diagnosis cannot be overstated, as often it reveals significant imbalances that are not obvious either because they are subtle or because the patient has purposefully or by mistake omitted information that would be useful.

Most important, pulse diagnosis serves as a reminder that we are first and foremost treating an individual with unique circumstances rather than delivering care as a formula applied in the case of a particular disease. Pulse can offer us insight into how practice is affecting the individual and if the intervention is heading in the right direction for the person.

## Conclusion

Over the last few decades, great advances have been made in the treatment of diabetes. These have in some cases (particularly in T1DM) significantly reduced mortality. Additionally, many studies have revisited ancient diagnostic tools and treatments to support healing alongside Western medical advances. This is an important recognition of the value that ancient techniques offer, as traditions such as Ayurveda and Yogatherapy long predate Western medical assessments and treatments of diabetes and prediabetes. Not only do they offer an alternate treatment but an overall different perspective on what diabetes is, how it manifests, how to avoid it, and how to treat it. This could offer the Western medical community insights that could be further investigated and which might help uncover further treatments.

The goal of both Western medicine and Ayurveda and Yogatherapy are all the same, after all: to offer healing and relief from suffering to the individual.

There is, of course, work left to be done, in particular in how some of the traditional healing techniques are applied. As Yogatherapy becomes a more recognized and accepted tool in the West, we must be careful that its approach is not forced into the Western context of medicine. Standardization of treatment, though long a staple of the Western approach, is not consistent with Yoga and Ayurveda, which approach each individual (and the manifestation of disease within them) as unique. There are certainly some generalities that could be drawn in theory, but when it comes to application, the specific constitution, imbalances, needs, and desires of the individual must be taken into account in order for Yogatherapy and Ayurveda to offer healing.

There are many published studies regarding the effect of Yoga on blood glucose and a growing number of studies in process which are revisiting these results to better understand how they are achieved<sup>31</sup>. This work is critical in helping Yogatherapy gain acceptance not just within the Western medical community, but within the community of Western diabetes patients.

Similarly, there are many studies looking into the role of various factors (including genetics, diet, viral triggers, etc.) in triggering the development of diabetes in individuals. The role of traumatic events and the response of the individual, understood to have effects on various levels of a person's health (psychosomatic disorders, stress, anxiety, depression, etc.) should also be considered as a potential trigger for developing diabetes. The concept of metabolism at various levels, not just the level of food, is a staple of the *pañcamaya* model and so critical to both Ayurveda and Yoga. The Western community would do well to investigate these ideas.

Additionally, further investigation into different approaches, not just through pharmaceutical treatment, towards T1DM and T2DM patients should be conducted. These individuals, though suffering many similar

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symptoms, likely arrived at those conditions in very different ways, and the specific circumstances of their conditions requires consideration. The same type of exercise regimen, diet, or Yoga practice, will not likely work for both types of patients as effectively.

All of these would benefit from larger quantitative studies that go on for a longer period of time and gather data at intervals. Currently few studies use controls that involve exercise to differentiate between Yoga and other forms of physical activity. This should be remedied in the future.

Yoga and Yogatherapy should not be considered benign approaches that can be applied in any way without any negative side effects. In the same way that practices are appropriate for a certain individual, practices can also be inappropriate. Where some patients can sustain a more expedient focused approach, others will need more support. So as studies continue to investigate effective ways to apply Yogatherapy for diabetes, care should be taken that patient wellbeing and the accuracy of results is not sacrificed for the sake of standardization.

Lastly, the role of Yogatherapist in the process must be taken into account when performing studies. Unlike the Western model of investigation, where the persons administering treatment should be neutral, passive, or sometimes invisible participants in the process. The Yogatherapist is one of the integral components to healing. Trust and confidence must exist between Yogatherapist and patient in order for healing to occur.

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