

## HISTORICAL NOTES

### PREVENTION OF DIABETES – A HISTORICAL NOTE

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Diabetes is one of the oldest known diseases in the world recorded since ancient times. Early perception of this disease, which can be constructed from available ancient medical texts, is indeed amazing in view of our current knowledge. Information on the search and research undertaken over centuries to understand the underlying causes, risk factors and also treatment for diabetes, which is apparently innocent and painless but with far reaching complications, forms an interesting study in the history of medicine. Such studies in this line throw light on the genesis and progress in diabetes care and management over the years. Present understanding of diseases considers diabetes as a silent killer which is not curable but can be controlled through self awareness coupled with early medical intervention. The concept of diabetes prevention is a fairly new area of modern “diabetology”, although early medical systems had envisaged the importance of health care for protection from all diseases including diabetes. The present study tries to assess the development of a preventive concept for diabetes since the last century and seek its origin in ancient India.

#### Introduction

Diabetes, once regarded as a single disease entity, may now be designated as an “iceberg disease” with far reaching health consequences. Diverse aetiologies - environmental & genetic - lead to development of defect in production or action of Insulin, a hormone which controls glucose, fat and amino acid metabolism. It is a long term disease with variable clinical manifestations and complications affecting mostly the heart, kidney and nervous system. Previously considered a disease of the middle age, recent records show diabetes afflicts all age groups. Earlier thought to be a

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disease of the affluent, its rising incidence is now noted in both developed and developing countries including India.

The escalated prevalence is attributed to industrial and socio-economic growth. Population, hereditary factors, age structure and urbanization along with a life style shift are major determinants for the rising trend of diabetes observed since the twentieth century. According to a World Health Organization (WHO) report (1998) Indians were found to have an increased susceptibility to *Diabetes mellitus*<sup>1</sup>. Almost 20% of children and about 30-60 % of adult urban Indian are overweight, obese or have abdominal obesity, a condition which predisposes a person to diabetes. The total number of diabetics in this country has doubled from 19 million in 1995 to 40.5 million in 2006 and projected to reach a 70 million mark by 2025 to consolidate India's position as the "Diabetic Capital of the World"<sup>2</sup>.

#### **Historical Background and Landmark Discoveries**

Although diabetes is apparently projected as a disease of modern times, it is perhaps one of the oldest diseases known in the history of man. A description of this disease as "too great emptying of the urine" was found in an Egyptian manuscript (Ebers Papyrus) dating back to 1500 BC, discovered by the Egyptologist Georg Ebers in Thebes in 1872 (Ripoll, et al 2011). Ancient Indian physicians (*Suśruta* and *Caraka*) identified the disease and named it *Madhumeha* meaning "honey urine", which attracted ants (Portesky, 2009). It was described as "a mysterious disease causing thirst, enormous urine output, and wasting away of the body" (Das & Shah, 2011).

Ancient Indian non-medical and medical texts have referred to this disease as *Madhumeha*. The earliest description of *Madhumeha* is found in *Atharvaveda*, one of the four *Vedas* rich in medical content. *Atharvaveda* is an important multi-layered historical document that incorporated diverse ideas and experiences current among the non-Vedic streams of people of the mid-Ganga plains (Das, 2010-11). It is interesting to note that in the *Rgveda* (8.5.19.2-4) Ṛṣi Vaśiṣṭha was invoking *Indra* and *Varuṇa* as 'I am shaking like an inflated leather bag; if through infirmity done wrong, pardon me'. In stanza 4 he mentions that 'thirst troubles me thy worshipper in the midst of water, grant me happiness and wealth'. Amiya Kumar Roychowdhury (1988)

notes that this feature is highly suggestive of diabetes with oedema and hypertensive features (K.W. Syndrome) of Ṛṣi Vaśiṣṭha. Mention of diabetes as a disease where no pain is felt, is found in an early Buddhist text *Aṅguttara Nikāya*. *Cullaniddeśa*, another Buddhist text narrates other diseases as ‘low’ whereas diabetes is ‘high’ (*ukattha*) indicating severity of this disease; *ukattha* also implies high born, suggesting diabetes to be a disease of the affluent. (Talim, 2009).

The etiology, symptomatology, pathology, prognosis and management principles of diabetes are described in detail in *Caraka Samhitā*, one of the classical medical texts of India (Sharma, 1981). Eating of heavy unctuous (rich in fats & oils), sour and saline substances, new grains and sweet juices in excessive amounts along with oversleeping, little exercise, neglect in evacuation were identified as causes of *Madhumeha*<sup>3</sup>. *Kapha*, *pitta*, *māṃsa* and *medas* were considered to obstruct the path of *vāta* which carries *ojas* to *basti* (urinary passage) which resulted in development of *madhumeha*. It was further stated that if the symptoms were overlooked severe *pidakas* (boils) arise in muscular areas, vital parts and joints<sup>4</sup>. There are detailed descriptions of the boils which resemble diabetic boils of modern medical terminology. A case of *madhumeha* was diagnosed as one who passes astringent, sweet and pale urine due to impaired *vāta* and the disease was considered incurable<sup>5</sup>.

*Suśruta Samhitā* used the term *Kṣaudrameha* for diabetes, where urine was found to acquire a sweet taste and resemble honey (Sharma, 2010). *Kṣaudrameha* is described as one type of *prameha* which occur in persons indulging in day sleep, idleness, lack of exercise and take cold, unctuous, sweet food and drink and is characterized by copious urine having the taste and colour of honey<sup>6</sup>. *Prameha* related soft, painful boils (*pramehapiḍikā*), located in skin and muscle are also described<sup>7</sup> with recommended treatment including surgical intervention, failing which further untreatable complications are likely to arise<sup>8</sup>. A full chapter in *Cikitsathāna of Suśruta Samhitā* deals with medication and diet of *madhumeha*<sup>9</sup>. Bitter and pungent agents were recommended for therapeutic use<sup>10</sup>.

*Vāgbhaṭa* agreed with *Caraka* on *Madhumeha* but added that the sweetness was present not only in the urine but in the whole body (Srikantha Murthy, 1999, 2000). Another term used for *madhumeha* was *dhātupāka*

*janya vikṛti*, - a term used to mean derangement of body metabolism. “*Dhātupāka*” means metabolism and “*vikṛti*” is abnormality (Ncbi.nlm.nih.gov/books/NBK33790). Modern medicine have identified that diabetes is indeed a metabolic disorder. This knowledge is therefore a rediscovery of a fact that finds record in ancient Indian medical text. The ancient Indian physicians may also be credited with identifying two types of this disease since they noted that one type was associated with youth (type 1) and the other type (type 2) was found be related to overweight (Portesky, 2009). The basic theoretical positions formulated in ancient Indian medical corpus were not therefore entirely lost to the medical culture.

The Greek Apollonius of Memphis was probably the first to coin the term *diabetes* which meant “to pass through” around 250 BC and the Latin word *mellitus*, meaning honey, was later added as the urine passed was sweet. (Mac Cracken, 1997). That the sweet taste comes from an excess of a kind of sugar in the urine and blood of diabetics was confirmed by Mathew Dobson in 1776. It is interesting to note that the names for diabetes in Chinese, Japanese and Korean also mean diseases related to sugar in urine suggesting their knowledge and understanding of the disease from an early date. It may be noted that the association of a sweet tasting substance in urine of diabetics was first reported in Sanskrit literature in the works of *Suśruta*, *Caraka* and *Vāgbhaṭa*, describing the urine as having taste like honey, being silky to touch and attracting ants. These properties of urine formed the criteria for clinical diagnosis of *madhumeha*<sup>11</sup>. Ancient Indian medical literature also suggested implication of hereditary, life style and dietary factors in the causation of diabetes. *Suśruta* advised exercise as a remedy for this disease.

From the writings of the Unānī physician *Buqrat* (460 BC) it appears that signs and symptoms of excessive urinary flow along with wasting of the body, associated with diabetes, was recognized as a diseased condition; however no specific name was mentioned for this ailment (Sanders, 2002).

The name of the Greek physician *Aretaeus* of Cappadocia (81-138 AD / 2<sup>nd</sup> century AD) has been linked to diabetes for his medical texts, which comprises of a sophisticated synthesis of early knowledge with his own observation providing a detailed and accurate description of diabetes. *Aretaeus* flourished in the 2<sup>nd</sup> century AD as a great medical practitioner in

Rome and Alexandria. He was totally forgotten after his death, until two of his manuscripts “On the causes and indications of acute and chronic diseases” (4 volumes) and “On the treatment of acute and chronic diseases”(4 volumes), written in Ionic Greek dialect, were discovered in 1554 (Britannica online Encyclopaedia). *Aretaeus* is believed to be the first to use the name “diabetes” which is derived from the Greek word for “siphon”, indicative of intense thirst due to excessive emission of fluids from the body. The Latin word “mellitus” meaning honey was added to the name because the urine passed by diabetics was sweet. *Aretaeus* did attempt to treat diabetes but considered life with this disease to be painful and short. *Galen* (131-201 AD), the Roman physician also reported his observations on diabetes around the same time and considered it to be a rare affliction.

Arabic medicine excelled during the 9-11<sup>th</sup> centuries AD, when translation of Indian medical texts were made and knowledge on diabetes was shared and exchanged between the physicians of these countries (Ali et al 2006). This was a period when regular communication between cultures of the world prevailed. Rhazes (846-930 AD) translated Hindu writings and enriched the Arabic medical literature with information on diabetes. His recommendation for treatment of diabetes was the use of agents that “cool thirst and thickness of blood”. “Sitting in water until the skin turns green because it tightens the bladder muscle, cools the kidney and stops thirst” was advocated with prescription of licorice.

In medieval Persia, *Avicenna* (980-1037) provided a detailed account on diabetes in “The Cannon of Medicine”, where the disease was associated with abnormal appetite, loss of sexual function and sweet tasting urine. Primary and secondary diabetes were described and diabetic gangrene was identified. *Avicenna* prescribed mixtures of plant extracts (lupine, trigonella and zedoary) for treatment of this disease (Bin Murad, 1991, [newsmedical.net/health/History\\_of\\_Diabetes.aspx](http://newsmedical.net/health/History_of_Diabetes.aspx)).

Many landmark contributions in the history of diabetes were made during the 16-19<sup>th</sup> centuries which was described at length by Sadikot in his article ‘From ants to analogues- A history of diabetes’ for the web site of Diabetes Association of India. Cardona (1501-1576) on the basis of measurement of intake and output of fluids concluded that diabetic people lose more water from the body than their total intake but could not explain

the reason. About the same time Von Hohenh, a Swiss physician observed the formation of a white powder after evaporation of a diabetic's urine, which he incorrectly interpreted as a residue of salt resulting from excessive salt deposition in the kidney. A British physician practicing in the 17<sup>th</sup> century Thomas Willis (1621-1675) rediscovered the presence of sugar in the urine of diabetics, which had already been known since ancient times. The credit of discovering sweetness of diabetic urine should be in fact given to the ants, as early Indian observation on diabetes (*madhumeha*) was based on the congregation of ants around urine of diabetics<sup>11</sup>. According to Willis, diabetes was related to consumption of excessive food and wine. The first experimental evidence to demonstrate that diabetes is a systemic disorder with accumulation of sugar in the body, which can be detected by a test developed by him both in urine and body fluids, came from Matthew Dobson (1735-1784), a British physiologist in 1776 (Bolodeoker & Donaldson, 1996). Thomas Cawley published in 1788 the first report suggesting a connection between diabetes and pancreas. In 1798, John Rollo, a Scottish physician published a paper entitled "An account of two cases of Diabetes mellitus" where the author distinguished between diabetes mellitus from other cases of polyuria (excessive urine production) where urine lacked the sweet taste. He restricted the use of the term *Diabetes mellitus* to only those cases where sugar was detected in the urine; other polyuria were designated *Diabetes insipidus* (*insipidus* in Latin means tasteless). Rollo recommended a diet of high protein and low carbohydrate along with appetite suppressing compounds like antimony, digitalis and opium as treatment for diabetic patients. This treatment regime did produce relief from some disease symptoms and therefore was followed for about a hundred year.

The major breakthrough was made in the understanding of diabetes following the discoveries by 19<sup>th</sup> century researchers (Kiple2003). Claude Bernard (1813-1878) found that an excess of a sugary compound, resulting from breakdown of liver glycogen by "glycogenolysis", was secreted into the blood and urine; this according to him was the cause of diabetes. Another important landmark was the identification of two types of cells in the pancreas by a German medical student Paul Langerhans (1847-1888) which came in 1869. One of these cell types were found to secrete pancreatic juice, the function of the other type remained unknown until the characterization of these cells by Edouard Laguesse in 1893. The pancreatic juice secreting

cluster of cells were named after Paul Langerhans as “islets of Langerhans” and were found to produce a substance that had some association with diabetes. This suggestion came after a providential revelation by Von Mering, a German physician of Strasburg and his colleague Oskar Minkowski that experimental removal of pancreas can produce symptoms of diabetes. Actually Von Mering was exploring the role of pancreas in digestion and in this work his colleague had surgically removed the pancreas of a dog. Next day their technician noticed and reported that the operated dog was urinating profusely in the cage, in spite of being house-trained. Minkowski realized instantly what that meant, tested the urine and found presence of high glucose. They announced that they had produced diabetes in a dog by removal of the pancreas and concluded that pancreas contained an anti-diabetic substance. The Franco-Prussian war of 1870 resulted in another important contribution to diabetology. Rationing of food in Paris under siege by Germany during the war was found to be associated with decrease or disappearance of glycosuria (sugar in urine) in diabetic patients. This observation made by French physician Bouchardat, supported the practice of prescribing caloric restriction, periods of fasting and increased muscular activity as a rational therapy for diabetes. Future diabetic control methods were developed on this line. In this connection it may be noted that traditionally followed religious practices of all faiths have recommended fasting in some form or other. Whether the practice of fasting, apart from spiritual implications, was intended also to keep diabetes at bay is a pertinent academic query.

The 20<sup>th</sup> century saw an intensification of research and consequently advancement in medical science. (Medvei, 1993) Great strides were made in the understanding of the causal factors involved in the onset and pathogenesis of diabetes. Sir Edward Albert Sharpey-Schafer in 1910 suggested that there was a deficiency of a particular substance in people with diabetes. He proposed naming this chemical “insulin’ derived from the Latin word *insula* meaning island as it was a product of the islets of Langerhans in the pancreas. Frederick Madison Allen and Elliot P. Joslin emerged as the two leading diabetes specialists in the United States during 1910-20. The books “Studies concerning glycosuria and diabetes” and “Total dietary regulation in treatment of diabetes” published by Allen in c 1913 and 1919 was instrumental in revolutionizing researches and treatment of this human metabolic disorder. The first dedicated treatment centre for diabetes and high blood pressure



was established by Allen in New Jersey in 1920. The idea of insulin in relation to diabetes treatment was conceived by Banting<sup>12</sup> at this time following several scientific observations with respect to the role of pancreas and influence of pancreatic extracts on diabetes. The endocrine role of pancreas in metabolism and existence of insulin in the pancreas was clarified by the discovery of Banting and Best<sup>12</sup>. In the summer of 1921, presence of insulin in pancreas was confirmed by Banting on the basis of his successful treatment of a pancreas-removed dog with extracts of pancreatic islets of Langerhans. A paper entitled "The beneficial influence of certain pancreatic extracts on pancreatic diabetes" was presented by Banting at a session of the American Physiological Society at Yale University on December 30, 1921. Banting, Best, Collip and colleagues (1991) purified the hormone insulin from bovine pancreas at the University of Toronto<sup>12</sup>. The Nobel Prize for Physiology and Medicine went to Banting and MacLeod for this work in 1923. The extraction of insulin can be considered as one of the greatest medical events of the century as the availability of insulin ushered in a new era in diabetes management. Other major landmarks in the history of diabetes include classification of diabetes type 1 and 2 made by Himsworth<sup>13</sup>, determination of amino acid sequence of insulin by Frederick Sanger and the development of the highly sensitive radio-immunoassay for insulin by Yalow and Berson in 1960<sup>14</sup>. Yalow was awarded the Nobel Prize for this achievement in Physiology and Medicine in 1977. Goeddel DV in 1979 announced a method for inducing human intestinal bacteria *E. coli* to produce human insulin and in 1980, a US biotech company Genentech developed human insulin from genetically altered bacteria. The bacteria, inserted with human gene for synthesizing human insulin, produced large quantities of insulin, which were then purified to yield human insulin for pharmacological use on diabetic patients. Graham Bell et al published the sequence of amino acids that made up the human insulin gene in 1980.

Despite advances in comprehensive knowledge on diabetes, the disease and its complications remained a major cause of mortality and morbidity mostly in the developed countries. The 20<sup>th</sup> century saw substantial improvement in management outcomes for diabetes (Patlak, 2002). Oral drugs were introduced to help lower blood glucose levels during the 1950s. Use of insulin changed the scenario in diabetes treatment from the 1980s and technologically improved modalities became available for control of the



various complications. Although the major cause of diabetes appears to be a lack of insulin or insulin resistance, the etiology of diabetes, like any other life style disorders, has been established as multi-factorial (WHO, 1980, 1985). Hereditary factors do predispose one to diabetes, but the life style factors definitely exert a stronger influence. Important precipitating conditions for diabetes include over nutrition, low physical activity and obesity. Incidentally this fact was already known to physicians from the remote past. After middle age, both occurrence and mortality due to diabetes is known to increase with obesity. It is of interest to note that during both world wars, the incidence and mortality showed a downward trend which may be attributed to food rationing (Scott, 1973). Apart from excessive carbohydrate intake, lack of physical exercise, and elevated blood sugar, leading to diabetes, is also associated with stress of all kinds, which seems to be a leading cause for increased incidence of diabetes in the post world war period. This trend continued through the past century to the present, thereby necessitating consideration of diabetes management and control as essential throughout the globe. Focus had largely remained on treatment with its two arms viz. lifestyle modification and medication in the past two centuries. Around the 1960s, this focus started shifting towards the preventive aspects too, which was inevitable, as by then it was almost clear that diabetes and the associated severe and often fatal complications were “not curable”, but were fortunately found to be preventable by early care. Prevention of diabetes and its complications therefore emerged as a fairly recent concept in modern medicine.

#### **Development of Preventive Concepts and Strategies for Diabetes**

The current prevalence of diabetes worldwide is approximately 200 million, which is likely to increase to about 366 million by 2030, and India alone would have a load of about 57 million diabetic patients. Every fifth diabetic in the world being from India, our country was declared as the diabetic capital of the world. One of the reasons for the rapid increase in global incidence of diabetes is lack of awareness among people which is more acute in developing countries. To create and spread awareness on diabetes the International Diabetes Foundation declared November 14 as World Diabetes Day in 1991 and since then is observing this date with co-sponsorship of the World Health Organization.

Diabetes is a metabolic disorder characterized by impairment of carbohydrate, lipid and protein metabolism and chronic hyperglycemia. The origin and etiology is varied but is always associated with defect in insulin secretion, insulin sensitivity or both. Three major types of diabetes are recognized Viz. Type 1 (10-15 %), Type 2 (85-90%) and Gestational (detected during pregnancy). Type 1 diabetes develops following destruction of insulin secreting  $\beta$  cells of the pancreas by the body's immune cells resulting in no insulin production. Type 2 is more prevalent among overweight individuals and is a result of insulin resistance or inadequate insulin production or a combination of both. Although gestational diabetes develops during pregnancy, increases the health risk of both mother and child, and disappears after child birth, it may reappear as Type 2 diabetes later in life in both. Extensive researches have elucidated the complicated pathophysiology of diabetes which guided the treatment protocols for the disease (Holt et al 2010, Holt and Kumar, 2010). However, it has been realized that diabetes cannot be cured, but can at best be kept under control by medical treatment. Based on an understanding of the disease it appeared that the possibility of preventing diabetes would largely depend on the type of diabetes and compliance of subjects to follow recommendations on prevention. Type I diabetes as such is not preventable, but steps can be taken to stop or slow down related complications. Type II diabetes is preventable by reduction of life style related risk factors and with available medication (traditional and modern). However the genetic pattern of a race or ethnic group, which cannot be altered, remains a strong pre-disposing factor that is beyond control. The major risk factors for Type 2 diabetes, determined through epidemiological studies, are increasing age, obesity (especially abdominal), physical inactivity, family history, ethnic background, high blood pressure, high cholesterol and previous gestational diabetes. Since many of the risk factors are modifiable, the possibility of prevention of diabetes was considered mainly for this predominant type and the concept of prevention of diabetes was conceived.

Since the rising prevalence of diabetes was closely associated with industrialization, urbanization and socio-economic development, bringing about dramatic changes in work place environment, life and living practices were recommended for reduction of stress and improvement in physiological/metabolic conditions especially in the genetically susceptible group. This

was considered be an important area of preventive efforts. The insight led to the conceptualization of prevention of diabetes in the mid-twentieth century. The credit for this concept cannot perhaps be attributed to any single country, person or group, as because a similar thought process emerged around the same time at different parts of the developed world which gradually percolated to other places, giving rise to a concrete shape to the concept aiming at controlling diabetes. Two strategies were suggested for primary prevention (a) Population strategy for prevention of risk factors which have not yet appeared (viz. high blood sugar and obesity) by adoption of healthy food habits ensuring proper nutrition and physical exercise and (b) High risk individual strategy by providing genetic counseling along with other methods of prevention. Of these two approaches, the first was widely accepted while the second was not considered as a practical approach. Life style changes were recommended as the first line of preventive modalities for diabetes. Since oxidative stress is an important risk factor, prescription of antioxidants was considered as a preventive measure (Roca et al. 2005; Nishikawa et al 2000). The environmental factors that unmask the inherited susceptibility include sedentary life style and unhealthy diet, both of which are amenable to alteration. These factors were highlighted and subsequently received attention as targets of preventive efforts for diabetes.

The population of India has a high susceptibility for diabetes mellitus. This was shown by a survey study on migrant Indians residing in Fiji, Singapore, South Africa, UK and USA and systematically reviewed to indicate the potential for further rise in prevalence of diabetes in this population in the coming decades (Ahuja, 1979, Wild et al 2004, Tripathy et al 2007). The problem of susceptibility to diabetes in Indian population is further aggravated by their general negligence of health and lack of awareness particularly among women who have an additional risk of diabetes during pregnancy (gestational diabetes). Despite the belief that diabetes is generally associated with affluent life style, according to medical reports, the population of India, a country of predominantly poor people, were found to have high levels of blood sugar. This clinical condition was studied by David Barker, a clinical epidemiologist at the University of Southampton, UK nearly two decades ago. His extensive studies revealed that a baby with low birth weight (which is common in India for several reasons including poor maternal health),

if exposed to better nutrition later in life was more prone to develop diabetes<sup>15, 16</sup>. It was established that a woman's body composition and diet at the time of pregnancy can influence health of her offspring in later life<sup>16</sup>. The etiology and pathogenesis of gestational diabetes have been investigated at great length (Kuhl, 1998; Kjos and Buchanon, 1999). Nutritional management was recommended for prevention of diabetic pregnancy and its later complications (Dornhorst and Frost 2003). Sedentary life style and unhealthy food habit are additional predisposing factors, which can be checked by physical activity and recommended exercise (Dempsey, Butler and Sorensen 2004). The concept of glycemic control in preventing the development of microvascular complications (an outcome of diabetes) assumes significance in this respect. It is perceived that "metabolic memory" is a neurological phenomenon of mental or sensory information which can regulate / control physiological function. Therefore the possibility of "Switching off" the metabolic memory for diabetes has been suggested as a means of prevention. (Shah, 2012). Overweight and obesity being strongly associated with diabetic risk factors, weight control by healthy eating practices and physical activity/exercise forms an approach for prevention of diabetes (Gupta and Deedwania 2012).

India has long passed the stage of diabetic epidemic which is now a major public health problem. The concept of "Available, accessible and affordable care for diabetes" emerged where economic realities and concerns have to be taken into consideration for implementing preventive strategies for diabetes control. The National Diabetes Control Programme (NDCP) of India was started in 1987 by the Government of India during its 7<sup>th</sup> Five Year Plan on a pilot basis in some districts of Tamil Nadu, Jammu & Kashmir and Karnataka. Due to paucity of funds this programme could not be extended. Since 1995-96 and 1997-98 the allocation of funds improved for implementation of the objective of NDCP which are (a) preventing diabetes through identification of high risk subjects and early intervention in the form of health education (b) early diagnosis and timely treatment with reference to high risk group (c) prevention of acute and chronic metabolic, cardiovascular, renal and ocular complications of diabetes and (d) provision of equal opportunity for physical attainment and scholastic achievement for diabetic patients along with rehabilitation of partially or totally handicapped diabetics.

The foundation of a diabetic health care, which ideally should be a part of the national public health care concern, is not likely to succeed in the absence of awareness or apathy towards the potential problem on the part of public health planners and the government (Rao et al, 2002). Fortunately individual and group efforts have helped in creating awareness and providing diabetic care to some extent in our country, though the situation is far from ideal. In this connection mention may be made of Dr. V. Mohan, an internationally acclaimed diabetologist, and his late wife Dr Reema Mohan, a specialist in diabetes related eye disorders, of Chennai. They had started the Dr. Mohan's Diabetes Specialties' Centre (DHDSC) in 1991, which in a span of eighteen years blossomed into a centre of excellence in diabetes. The objectives of this centre are (a) to increase awareness and provide holistic care of diabetes and its complications and (b) prevention, management and control of the disease along with conducting advanced research on diabetes. The vision was to provide world class health care to diabetics in India at nominal charges or for free and training of dedicated doctors for improving strategies for prevention and treatment of diabetes and associated complications.

Towards the close of the 20<sup>th</sup> century "Self Care" was considered to be a crucial element in prevention of diabetes. This strategy recommended that the major responsibility for controlling and preventing the disease should rest on the patient/ individual under medical guidance. It would therefore be imperative to expect patients or high risk individuals to be knowledgeable so as to be able to appreciate the reasons for adherence to diet and medication, examination and monitoring of blood/urine glucose by self administration of insulin, abstinence from alcohol, maintenance of optimum weight, attending periodic medical checkups, recognition of symptoms associated with glycosuria and hypoglycemia (Park, 2009). DMDSC's major project PACE (Prevention, Awareness, Counseling & Education) undertaken in collaboration with the Madras Diabetic Research Foundation (MDRF) was among the earliest initiative in this line since 2004. Large scale screening was introduced for detection of diabetes as well as pre-diabetes, revealing and predicting alarming situations necessitating further stress on diabetes control efforts. Although the public health programmes in India continues to emphasize on eradication of communicable diseases, the present 21<sup>st</sup> century began with a wider interest in prevention of non-communicable diseases including

diabetes. Since diabetes is associated with disability due to its several complications like blindness, kidney failure, coronary thrombosis and gangrene of the lower extremities, special clinics are required to handle these conditions, which form a part of tertiary prevention activities, the concept of “Management of Complications of Diabetes” gained ground in this decade. The public health care sector and a number of dedicated organizations have started massive drives working on this latest concept. Prevention of diabetes has thus become a primacy in our public health strategy for this century with emphasis on “awareness” as the first line of attack for combating the “silent killer”.

#### **Future Prospects**

The past two decades have seen a renewal of interest in health promotion in parallel with a quest for understanding of diseases and formulating new and advanced treatment protocols. This added focus has been possible because of increased attention of the academic arena in revival of past/ancient medical wisdom. The realization that protection of health and preventive intervention before a disease sets in is of utmost importance which assumes greater significance in view of the rising trends in most of the non-communicable diseases in current times. Scanning through medical and historical literature it becomes clear that although many of the so called life style disorders, including diabetes, were known from time immemorial, they appear to be of rare occurrences earlier. It is most likely that the early health promotive and diseases preventive practices, which were integrated within day to day living in ancient society, saved our ancestors from many human ailments. Many of these were in vogue through ages and were followed traditionally in our country possibly accounting for the low incidence rates of such diseases even in the 19<sup>th</sup> and early 20<sup>th</sup> centuries. Popular articles in health related periodicals in Bengali published in this period ([savifa.uni.hd.de/thematic/portals/periodicals/overview.html](http://savifa.uni.hd.de/thematic/portals/periodicals/overview.html)), which were meant for informing and educating common people on prevalent health problems and preventive care, interestingly testify this point. These human maladies surfaced and spread rapidly in our country since the rejection of the “ancient and unscientific” traditional medical virtues in favor of “modernization” offered by the colonial rule. Fortunately, the trend of rejecting the past is out of date. Modern medical science is trying to validate ancient knowledge base and

accumulated wisdom revealed by historical researches, accept those with substance and incorporate them into the modern healing practices. Many positive outcomes are already evident from recent reports which encourage acceptance and integration of virtues of the past and present to ensure better health for all in the present century.

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