AYU

Access this article online
Website: www.ayujournal.org
DOI: 10.4103/0974-8520.169014
Quick Response Code:

Survey Study

Rising risk of type 2 diabetes among inhabitants of Jamnagar, Gujarat: A cross-sectional survey

Rohit Sharma, Pradeep Kumar Prajapati[1]

Department of Rasashastra and Bhaishajya Kalpana, Abhilashi Ayurvedic College and Research Institute, Abhilashi University, Mandi, Himachal Pradesh, [1]Department of Rasashastra and Bhaishajya Kalpana, Institute for Post Graduate Teaching and Research in Ayurveda, Gujarat Ayurved University, Jamnagar, Gujarat, India

Abstract

Introduction: Undoubtedly, diabetes is an incremental threat for the world health and substantial evidence now suggest that diabetes is strongly associated with patients' unhealthy lifestyle, behavioral patterns, and socioeconomic changes. Treatment modalities, in particular to this disease differs from patient to patient. In Ayurveda, this individuality is decided on the basis of *Prakriti, Vaya, Bala, Desha* etc., and hence it is essential to know these factors for successful management of diseases. **Aim:** To assess the role of demographic profile, changes in life style habits, dietary patterns, occupational and social background in increasing prevalence of type 2 diabete mellitus (DM) at Jamnagar region. **Materials and Methods:** A cross-sectional survey study was conducted on randomly selected 350 diabetic patients of Jamnagar region. A survey proforma was prepared and detailed history of each patient fulfilling the diagnostic criteria was taken along with demographic profile. **Observations and Conclusion:** The obtained data reveals that, certain faulty dietary and life style regimes of this region are responsible in manifestation of DM. Its magnitude and low awareness warrants appropriate public health interventions for its effective control.

Key words: Diabetes mellitus, diet, lifestyle, *Madhumeha*

Introduction

The number of people with diabetes is increasing due to population growth, aging, urbanization, and increasing prevalence of obesity and physical inactivity. Quantifying the prevalence of diabetes and the number of people affected by diabetes, now and in the future, is important to allow rational planning and allocation of resources. Latest reports of World Health Organization (WHO) predicts that, diabetes population will increase by 122% in 2025; in developing countries, the number of patients has increased from 84 million to 228 million people which shows a 170% increase.[1]

All polyuric diseases in Ayurveda are described under "*Prameha*," and *Madhumeha* is one amongst them, equated to type 2 diabetes mellitus (DM). *Apathya Ahara* (dietetic incompatibilities) and *Apathya Vihara* (lifestyle incompatibilities) both are the major risk factors for *Madhumeha*.[2]

Address for correspondence: Dr. Rohit Sharma,
Asst. Prof., Dept. of Rasashastra and Bhaishajya Kalpana,
Abhilashi Ayurvedic College and Research Institute,
Abhilashi University, Mandi - 175 028, HP, India.
E-mail: dhanvantari86@gmail.com

The rising trend of type 2 DM in developing country likes India presumably is due to (i) Changes in health status of demographic structure; (ii) Changes in life style and food habit; (iii) Change in environment (including air, water, habit, occupation etc.,) and soar in variety of stresses following industrialization and urbanization. Indian population is complex in nature involving different sociocultural, geographical, environment, rural-urban, vegetarian-non-vegetarian food habit. The prevalence and incidence with risk group etc., is not yet known. Type 2 diabetes is a largely preventable disease and intensive lifestyle interventions are not only highly effective but cost-effective too.

High incidences of diabetes has been observed at outpatient department level in IPGT and RA, Jamnagar; based on which

How to cite this article: Sharma R, Prajapati PK. Rising risk of type 2 diabetes among inhabitants of Jamnagar, Gujarat: A cross-sectional survey. Ayu 2015;36:10-7.

necessity of a well-planned regional study was sensed; which could provide certain leads towards prevalence, role of life-style and dietary factors in the manifestation of disease. Obtained results and observations may also provide leads for policy makers to take firm decisions in maintaining the health of the region.

Aims and objectives

To assess the role of demographic profile, changes in life style habits, dietary patterns, occupational and social background in pathogenesis of type 2 diabetes at Jamnagar region.

Materials and Methods

Participants and study design

A cross-sectional survey study was conducted on 350 diabetic patients, attending the outpatient department from May 1, 2013 to February 28, 2014. The participants were selected using simple random sampling. The participants were eligible if they had been residing in the study area for at least last 6 months, and were able to comprehend the questions, and answer accordingly. All participants were interviewed in the local language by a single person. A survey proforma was prepared, including the present and past medical history of first degree relatives and controls, medications, diet pattern and life-style etc., of patients in light of etiological factors explained for *Madhumeha* in Ayurvedic texts. Written informed consent was taken from patients as per the Helsinki declaration after offering sufficient explanations about the study and its aims. Before commencing the study approval had been taken from Institutional Ethics Committee (PGT/7-A/ethics/2012-2013/3552; Date: 25.02.2013).

Inclusion criteria

- Type 2 diabetics that had no confirmed mental illness to participate were selected without any bar of age, sex, cast and religion.
- Patients with symptoms of *Madhumeha*[3] as well as type 2 DM[4]
- Standard criteria of National Diabetes Data group and WHO for DM was adopted.[5] Symptoms of diabetes with random blood glucose levels ≥200 mg/dl or fasting blood glucose ≥126 mg/dl or 2 h blood glucose ≥200 mg/dl, during an oral glucose tolerance test.

Exclusion criteria

Type 1 diabetics and known cases of tuberculosis, AIDS, chronic obstructive pulmonary disease, malignancies and cases of diabetic complications were excluded.

Observations

Observations related to principle variables viz., age, gender, religion, marital status, occupation, socioeconomic status, *Desha* (habitat), chronicity, family history, addiction, *Sharirika Shrama* (physical activity), body mass index (BMI), emotional makeup, mental stress, *Nidra* (sleeping habits), *Ahara* (type of diet), frequency of food, *Viruddh Ahara* (dietetic incompatibilities), *Satmya* (wholesomeness), *Satva* (mental ability), *Agni* (appetite), *Deha* (body built), *Bala* (physical strength), *Rasapriyata* (liking of taste), *Deha Prakriti* and *Manasa Prakriti* (physical and mental constitution), are depicted in the Tables 1 and 2.

Table 1: Baseline characteristics of patients

Characters	Categories	Number of patients	Percentages
Age (years)	31-40	56	16.16
	41-50	63	22.14
	51-60	193	55.22
	61-70	57	16.48
Gender	Male	198	56.57
	Female	152	43.43
Education	Uneducated	60	17.14
	Primary education	77	22.00
	Secondary	112	32.00
	Higher secondary	46	13.14
	Graduation	49	14.14
	Postgraduation	03	0.85
Religion	Hindu	269	77.12
	Islamic	64	18.38
	Jain	87	02.50
	Christian	03	01.00
	Sikh	03	01.00
Marital status	Married	306	87.19
	Unmarried	30	08.81
	Widowed	10	03.00
	Separated	04	01.00
Occupation	Business	152	54.22
	Government employer	96	27.43
	Farmer and laborer	40	11.35
	Others	22	07.00
Socioeconomic status	Very poor	17	05.00
	Lower middle	95	27.25
	Middle	140	40.25
	Upper middle	78	22.50
	Rich	17	05.00
Habitat	Urban	253	72.39
	Rural	97	27.61

Discussion

Present survey highlights the relationship between faulty dietary and lifestyle patterns and the risk of developing type 2 DM in Jamnagar region of Gujarat.

Age and gender

As the manifestation of disease takes prolonged period, most of the subjects belonged to the age group between 51 and 60 years [Table 1]. These results correspond with the fact of greater risk of type 2 diabetes amongst middle to old age groups. At this particular age dietetic incompatibilities like *Vishamashana* (irregular timings of food), *Viruddhashana* (eating incompatible food articles); ignorance about *Dinacharya* (daily regimen), *Avyayama* (lack of exercise) etc., becomes the leading cause for metabolic disorders. This is the declining phase of life with *Vata Dosha* predominance. The physico-mental strengths

Table 2: Clinical, dietary and lifestyle observations of patients

Findings	Categories	Number of patients	Percentages
Chronicity (years)	≤1	54	15.55
	1-5	148	42.35
	5-10	88	25.10
	≥10	60	17.00
Family history	Paternal	123	35.15
	Maternal	131	37.55
	Nil	96	27.30
Addiction	Tobacco	144	41.22
	Tobacco + pan	18	05.28
	Alcohol	17	05.00
	Tobacco + pan + smoking	35	10.10
	Nil	136	38.40
Physical activity	*Pravara*	40	11.44
	Madhyama	89	25.36
	Avara	221	63.20
BMI* (kg/m^2)	<18.5 (underweight)	24	07.00
	18.5-24.9 (normal)	105	30.15
	25.0-29.9 (over weight)	151	43.25
	30.0-39.9 (obese)	65	18.60
	>40 (severe obese)	05	01.00
Awareness about diabetic complications	Yes	71	20.19
	No	279	79.81
Emotional makeup	Normal	136	39.12
	Tensile	38	11.18
	Depressed	24	07.00
	Anxious	149	42.70
Mental stress	Social	235	67.38
	Professional	81	23.12
	Domestic	33	09.50
Sleeping habits	Day	238	68.22
	Night	111	31.78
Type of diet	Niramish (vegetarian)	266	76.18
	Samish (vegetarian + Non vegetarian)	84	23.82
Frequency of food (per day)	Two times	50	14.34
	Three times	137	39.16
	Four times	162	46.50
Dietetic incompatibilities	Positive	275	78.67
	Negative	75	21.33
Affliction for sweets	Yes	166	47.55
	No	184	52.45
Diet and sleep timings	Regular	158	45.34
	Irregular	192	54.66
Satmya	*Pravara*	10	03.00
	Madhyama	185	53.12
	Avara	155	43.88
Satva	*Pravara*	214	61.20
	Madhyama	117	33.80
	Avara	19	05.00
Agni	*Vishamagni*	134	38.55
	Tikshnagni	71	20.44
	Mandagni	63	18.01
	Samagni	82	23.00

Contd...

Table 2: Contd...

Findings	Categories	Number of patients	Percentages
Deha	*Sthula*	193	55.32
	Madhyama	131	37.68
	Krisha	26	07.00
Bala	*Pravara*	84	24.11
	Madhyama	242	69.89
	Avara	24	06.00
Rasapriyata	*Madhura*	287	82.13
	Amla	227	65.00
	Lavana	189	54.00
	Katu	101	29.00
	Tikta	112	32.00
	Kashaya	63	18.00
Deha Prakriti	*Kaphapradhana*	105	30.12
	Pittapradhana	57	16.38
	Vatapradhana	188	53.50
Manas Prakriti	*Tamasapradhana*	92	26.33
	Rajaspradhana	242	69.22
	Sattvapradhana	16	04.45

*BMI: Body mass index

and defense mechanism of body tends to decrease with growing age and the body is no longer able to cope up with unhealthy life style choices; which, in turn, results in manifestation of diseases like diabetes. Worldwide estimation project that in 2030 the greatest number of individuals with diabetes will be 45–64 years of age.[5]

Male:Female ratio was almost comparable, which shows that both the genders are equally susceptible.

Education

Percentage of literate people under study was reasonable (83%), but most of the individuals at the time of diagnosis were not aware of the disease. Though, today literacy rate is much higher than the previous decade, ironically, there is no respite from diabetes incidence. This literate sector of society is associated with increased burden of working hours at work places, irregular dietary habits, anxiety levels among the people and increase in the sedentary life-style.

Occupation

Higher incidence observed in businessman and government employee, that is, 54.22% and 27.43% respectively followed by farmers, laborers, retired government employee, housewife and retired from field work. Expansion of urban and industrial lifestyle spread the risk factor very fast. Machines have made us sluggish and reduced activity levels may become potential risk factor.[5]

Socioeconomic status

Higher incidence of DM was found in middle (40.25%) and lower middle (27.25%) class, which is consistent with the predictions of WHO that currently more than 70% of people with diabetes live in low and middle income countries.[6] This data shows that DM is no more a disease of affluent society.

Habitat

Urban population was found to be more prone to DM [Table 1]. Population based survey in six largest Indian cities also extrapolated similar observations nationwide, applying a 4:1 urban: Rural ratio for prevalence of diabetes.[7] Greatest burden of diabetes among urban population could be due to their fast track life style and variety of competitive social and professional stresses. It presents an alarming risk of rise in prevalence of diabetes in future, unless preventive strategies are introduced.

Chronicity

Maximum patients had duration of illness 1–5 years, followed 5–10 years. In initial phase patients prefer allopathic medication but due to chronic nature of the disease, limitations of allopathic medication to control glycemic level and associated side-effects, they hope towards Ayurveda either as better alternative or as supportive treatment. Only 15.00% had chronicity ≤1 year which indicated the appeal of these people towards Ayurveda for better management right from initial phase.

Family history

Positive family history in majority of patients reflects the hereditary background of the disease. "*Prameho Anushanginam*" refers to chronic persistence and perpetuation of disease. It recurs again and again and continues in generations due to *Beeja Dushti*. This may be compared with *Beeja Doshaja Madhumeha* (*Kulaja Vikara*).[3] A positive family history confers a two to threefold increased risk to develop DM in first degree relatives.[8] Although hereditary factors could play an important role in prevalence of disease; but how genetic factors interact with environmental and dietary factors to increase its incidence is not clear.

Addiction

One or different type of addiction (alcohol, smoking and tobacco) was observed in majority of patients. 41.22% patients

were addicted to tobacco chewing. Nicotine and other products in tobacco smoke make it more difficult for insulin to work properly. In additional, chewing processed tobacco is high in sugar. Tobacco slows the circulation in the smaller blood vessels. People with diabetes are already more likely to suffer from poor circulation in their feet and legs. Tobacco use can also aggravate foot ulcers, foot infections and blood vessel disease in the legs.[9] Alcohol restriction in this area may be one of the reasons for lesser incidence (5%) of addiction to alcohol. *Madyapana* has the significant role as etiology of *Madhumeha*.[10] *Vyavayi*, *Vikasi* etc., 10 *Guna* (properties) of *Madya* (alcohol) are opposite to *Ojas*, causes *Tridosha Dushti* (vitiation) and *Kshubdhata* (altered state) in *Ojas*[11] which in turn can hamper *Vyadhi Kshamatava* (immunity); it may be one of the predisposing factors of *Madhumeha*. Smoking and alcoholism are considered as risk factors for DM.[12]

Motivation by the physician

Majority of the diabetics revealed that their physician did not given enough time and motivation for the life style modification, which are must for the management of diabetes. Without proper awareness regarding the dietary and life style modifications for diabetes, it is difficult to maintain good glycemic control. Studies have proved that active participation of the patients in the form of life style changes can result in less expense for the management of diabetes and ensure good glycemic control.[13]

Medication taken at the time of diagnosis

Total 69% of the patients were taking allopathic medication for diabetes. However, majority of the patients have the opinion that Ayurvedic medicine have less side effects and they feel better while taking it; however, they opined that it showed reduction in blood glucose levels late than allopathic medicine. These findings reveal that there was less awareness among the people that good glycemic control can be achieved by Ayurvedic medication supported by life style and diet style changes.

Reduced physical activity and inappropriate body mass index

Particulars in Jamnagar region most of people do not engage in any work between 1 PM and 4 PM It infers they prefer to live more relaxed life. Majority of patients never did any sort of regular exercises. With change in life style, walking habits are changed and supported by automobiles, two wheelers. Television and computer changed the behavioral approach, change of posture, force decrease of physical activity. Sedentary lifestyle as one of the potential causative factor for aggravation of *Kapha*, *Meda* and *Mutra*; which in turn is responsible for genesis of *Madhumeha*.[14]

Majority of patients were found to be overweight (43.25%) followed by normal (30.15%) and obese groups (18.60%). Type 2 diabetics are usually obese (80%) but elderly individuals may be lean. Insulinemia and insulin resistant factor are insidious features of obesity, having direct correlation with BMI.[15] Similarly, in Ayurveda, *Madhumeha* is included under *Medodhatu Dushti Vikara*, which is justified by obtained data. Present study also supports the fact that ~90% of people with type 2 diabetes are overweight or obese. Central obesity is a strong risk factor for insulin resistance[16] which is found in 66% of the registered patients as *Medo Vriddhi Lakshana – Udara Parshva Vriddhi*. An adipose tissue derived hormone named resistin is held responsible for insulin resistance, which suggest an important link between the adipocyte and diabetes.[17,18]

Although BMI and physical activity are independent predictors of incident diabetes and mortality, the magnitude of the association with BMI is much greater than with physical activity.[19] In a recent study, being overweight increased the risk of developing type 2 diabetes within 7 years by 3 times, being obese by 12 times. However, being obese but active still increased the risk by 11.5 times.[20] In other words, fitness alone is not sufficient to prevent diabetes.

Ayurveda opines two types of diabetic persons: *Sthula* (obese) and *Krisha* (lean and thin), both having different etiology and lifestyle intervention. *Sthula Pramehi* are advised to do exercises such as wrestling, horse riding, vigorous walking etc., but *Krisha Pramehi* are advised to protect their strength and not to do exercises.[3]

Awareness about diabetic complications

Only 20% of patients were aware of the diabetic complications. Ignorance or lack of knowledge about the possible complication of the diabetes may lead to poor glycemic control and can lead to early incidence of multiple complications of DM.[21]

Anxiety and mental stress

Majority of the patients committed that they get anxious on small matters. Stress related anxiety has been shown as a major contribution factor for type-2 diabetes.[22,23] Middle to old age is the period in life in which persons get exposed to variety of stress. Further stress causes imbalance in hormonal and nervous regulation of the body and makes the person susceptible to disorders including DM. Social and professional stress was common in the subjects. High risk of complications of diabetes is associated with influence of psycho stressors and depressive disorders.[24] Charaka has emphasized anxiety, anger, worry, grief etc., as risk factors for development of *Prameha* in susceptible individuals. This is supported by a study in which diabetes was induced by stress in Albino rats and their blood examination showed increase rate of catalase activity suggesting the acceleration rate of cell injury and free radical generation, which in turn is a precursor to diabetes.[25]

Improper sleeping habits

Maximum patients (68.22%) had sleeping habit of 8–9 h including day sleep, which highlights the habit of *Divasvapna* (day sleeping) in Jamnagar region. *Divasvapna* is one of the risk factor for *Prameha* or DM.[26,27] Majority of patients were found to be indulged in *Ratrijagrana* (vigil) and having disturbed sleep. Though much evidences are not available on role of *Ratrijagarana* in diabetes development, a report showed that sleep deprivation severely affect the body ability to metabolize glucose, which can lead to early stage type 2 DM. It was observed that a greater incidence among both short-term (<6 h) and long term (>8 h) sleepers,[28] as well as sleep loss, have been related to glucose tolerance and to increased risk of type 2 diabetes.[29,30]

Unhealthy dietary habits

People in Jamnagar region prefer to consume over oily, deep fried and sweet predominant food items. In Gujarat, a high

dependence of milk products and oily foods coupled with genetic factors are responsible for diabetes.[31] Cottonseed oil is found mostly used in cooking, however, it is reported to have considerably high polyunsaturated fatty acids levels which decrease the favorable high-density lipoprotein cholesterol levels in the blood and may adversely affect the lipid profile of individual.[32] Consumption of "*Nava Anna*" (fresh harvested grains) is common among the population which is stated as one the causative factor for diabetes in Ayurveda.[2]

The people are fond of flour preparations, *Farsan* (salty and spicy snacks), Fermented food items (*Dhokla*, *Khaman*, *Idli*, *Dosa* etc.), *Bhajiya-Puri* (salty-oily feast), sweetened drinks, refrigerated, preserved and reheated food items. Due to increasing restaurant culture, people are in habit of taking their meals outside frequently. Dependency on packaged food like chips etc., has increased manifold owing to the busy schedules of society today, wherein they hardly have time to eat at home. Grabbing a Mc-Donald's burger seems much easier than spending an hour cooking every morning. Fewer intakes of dietary fibers and more intake of foods having high glycemic loads (viz., starchy items like potatoes) was observed in the subjects, which is associated with increased risk of diabetes.[33]

Most of the patients are reported consuming milk along with *Khichadi* (a type of food item predominant with rice, *Moong Dal*, flavoured with salt and spices); *Gathiya* (a type of salty snack) with tea; cold drinks in lunch and dinner, *Shrikhanda* (sweetened curd preparation) etc., which are few of the dietary incompatibilities explained in the Ayurvedic classics under the heading of *Guna Viruddham*.[34] These dietetic incompatibilities might be responsible in vitiation of *Kapha* and *Pitta Dosha* and *Dushti* of *Mamsa* and *Meda Dhatu* which may in turn cause *Madhumeha*.

Adhyashana (over eating) is found to be common in present survey [Table 2], which is proved as a risk factor for DM.[35] A peculiar habit of consuming food in small amounts frequently (*Nashta*) is also prevalent in the region. Such dietary habits have been emphasized in classics as factors of disease provocation with special reference to *Madhumeha*.[2] Hence, diet, both in quantity and quality and pattern of intake can affect the health. All these dietary irregularities further contribute to disturb the carbohydrate and lipid metabolism and consequently result in *Madhumeha* in susceptible individuals. Ayurveda recommends *Sthula Madhumehi* person diet should be of *Apatarpanaguna* and heavy for digestion, while *Krisha Madhumehi* persons diet should be *Santarpanaguna* and light in digestion.[3]

Significant numbers of patients (47.55%) were found to have affliction to sweets in the form of jaggery products, milk products, and other sugar enriched food. High sugar or carbohydrate rich article immediately burden the β-cells and lead to insulin resistance etc.[36]

Irregular timings of meals and sleep are common habits in the community (54.66%), which signify their disturbed biological clock. It is often the result of daily life related stress, and often associated with the fast eating; both are the major risk factor for type-2 diabetes.[37]

Vegan and non-vegan dietary patterns and diabetes

The relation of diabetes care and religious bound dietary patterns is an important issue in community health. Although, majority (76.18%) of patients were vegetarian (vegan, lacto-ovo or semi-formats), considerable number of patients (23.82%) were non vegetarian. Hinduism and Jainism pose both regular and seasonal practices on vegetarianism. Of interest, many reports prove advantages of vegan diet for reduction in diabetes incidence and improving insulin resistance.[38,39]

Influence of *Satva*

Maximum patients had *Madhyama Satva*, that is, 61.20% followed by 33.80% and 5.00% had *Avara* and *Pravara Satva* respectively, supporting the Ayurvedic statement that the people with *Madhyama* and *Avara Satva* are more vulnerable to diseases.[40] *Madhyama Satva* persons may not follow the dietetics and exercise regularly while the *Avara Satva* persons may not adopt the preventive measures; as a result they are more prone to the disease.

The *Agni* factor

Maximum patients were suffering from *Vishamagni* (imbalanced appetite) or *Agnidushti* which signifies the imbalanced state of *Agni*. The digestion and metabolism depends on *Agni*. In *Madhumeha*, functioning of *Dhatvagni* diminishes (poor metabolism), leading to altered lipid metabolism, thus may create tendency towards high glycemic level due to *Dhatvagni Mandya*.[41]

Role of *Deha* and *Bala*

Maximum patients were *Sthula* (obese) followed by *Madhyama Deha* and *Krisha*. Maximum patients were obese because of disturbed metabolism. Habitual physical inactivity and obesity are the main risk factors for DM.[2] *Madhyama Bala* is found in most of the patients which also signifies the disturbed metabolism. Due to inefficiency of the cell to metabolize glucose, reserve fat of body is metabolized to gain energy. To utilize fat, the body uses more energy as compared to glucose; thus body goes in negative calorie effect, which results in fatigue.

Rasapriyata (likings towards taste)

More than half of the patients liked *Madhura*, *Amla* and *Lavana Rasayukta Ahara*, which is mentioned in etiology of *Madhumeha*.[3]

Predominance of *Deha* and *Manasa Prakriti*

Maximum patients belonged to *Vatapradhana* (53.50%) followed by *Kaphapradhana* (30.12%) and *Pittapradhana* (16.38%) *Prakriti*. Knowledge of *Prakriti* could help in deciding the dietetic regimen and exercises that may help in the management of the disease.

Majority of patients had *Rajas* (69.22%) and *Tamas Prakriti* (26.33%). *Rajasika* and *Tamasika Prakriti* people are more prone to the *Madhumeha* manifestation because of erratic diet regimen and activities. This observation is supported by a study, which proved relatively higher incidence of Diabetes in subjects of *Kaphaja* and *Vata Kaphaja Deha Prakriti* and *Rajasika Manasika Prakriti*.[42]

Limitations of present survey

Limitation of present epidemiological study is small sample size. Other shortcomings are: (i) Retrospective examination of a clinical phenomenon, (ii) point estimation of risk factors, which cannot prove a causal association, (iii) and the inferences observed are always non confirmatory in nature; thus these studies have lowest evidence level in evidence hierarchy.[43] This is a known inherent weakness of a cross-sectional study. In addition, present work is only an observational study and a suitable diet and life style intervention program could have provided rigid outcomes to health sector.

Perspectives and future directions

Rapid increase in DM incidence is attributable to the social change. The number of individuals who will develop diabetes over the next few decades will affect the workability and performance in all sectors including intellectuality. The factual position of diabetes on the ground reality through large scale survey involving different ethnic group should be undertaken. Sustained, well-executed community awareness and mass media campaigns increase awareness and can be effective to improve knowledge and attitudes about increasing physical activity, improving nutrition, attitudes and eating behavior in a range of target groups, in different settings. Well-designed community-based intervention programs can improve lifestyle choices and dietary habits.

"Self-care strategy" initiatives for diabetics: A way forward

Neither the curative model nor the compliance/adherence model is rigorously effective in diabetes care; thus an alternative paradigm is needed. Self-care coping strategies could prove effective among diabetics. Patients' awareness regarding diabetes related suitable diet and lifestyle adjustments is essential and this idea points to self-empowerment approach, which recognizes that the patients are in control of, and responsible for, the daily self-management of their diabetes.

Initiatives are running in IPGT and RA, GAU, Jamnagar to draft suitable, acceptable and applicable diet and lifestyle guidelines of Ayurveda for rationalization and standardization of health promotion among the global community. The Institute organized a 3 days national workshop (21–23 March 2014) to churn the knowledge from the cream of gathered Ayurveda people for the successful implementation of this project. The work is under pipeline stage under the umbrella of WHO collaboration, which could certainly provide fruitful health impacts among society in future. The institute is planning to first execute the awareness among the inhabitants of Jamnagar and the Institute itself. An event like this surely corroborates with David Brower's succinct words, "Think globally and act locally."

A concerted, global initiative is required to address the diabetes epidemic in each sects of society so that the concerned authorities could take some possible actions to improve health conditions in that particular area.

Conclusion

To sum up, the present study provides an updated quantification of the growing public health burden of diabetes in Jamnagar region. Faulty dietary and lifestyle habits may be held responsible for increasing diabetes prevalence. As diabetes is primarily a lifestyle disorder, thus, only by improving the daily routine and adopting suitable dietary habits, one can maintain the metabolism to normal and curb the pathology of diabetes to a good extent. Extremely important areas of research could be identifying the risk factors involved in diabetes in people of different geographical regions. Type 2 diabetes is an endemic health problem; therefore, socioeconomic, behavioral and nutritional issues relating to it should be highlighted and addressed. It is suggested that life-style approach in accordance with the geographical habitat, diet, physical activity and the rest should be defined as adaptation.

Financial support and sponsorship

IPGT and RA, Gujarat Ayurved University, Jamnagar.

Conflicts of interest

There are no conflicts of interest.

References

1. International Diabetes Federation. Diabetes Atlas. 3rd ed. Brussels, Belgium: International Diabetes Federation; 2006. p. 50-78.
2. Acharya YT. Charaka Samhita, Sutra Sthana. Ch. 17, Ver. 78. Reprint ed. Varanasi: Chaukhambha Orientalia; 2004. p. 103.
3. Acharya YT. Charaka Samhita, Chikitsa Sthana. Ch. 6, Ver. 4-57. Reprint ed. Varanasi: Chaukhambha Orientalia; 2004. p. 445-9.
4. Available from: http://www.medical-dictionary.thefreedictionary.com/diabetes. [Last accessed on 2012 Feb 01, at 14:19].
5. Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, *et al*. Diabetes Mellitus, Figure 338-2,3. Harrison's Principles of Internal Medicine. Ch. 338, 17th ed., New York: McGraw-Hill Professional; 2008. p. 2275-2279.
6. Available from: http://www.worlddiabetesfoundation.org/composite-35.htm. [Last accessed on 2011 Dec 08, at 23:28].
7. Ramachandran A, Snehalatha C, Kapur A, Vijay V, Mohan V, Das AK, *et al*. High prevalence of diabetes and impaired glucose tolerance in India: National Urban Diabetes Survey. Diabetologia 2001;44:1094-101.
8. Goldstein BJ, Muller-Wieland D. Pathogenesis of type-2 diabetes. Type-2 Diabetes Principles and Practice. 2nd ed., Ch. 2. New York: Informa Healthcare Publication; 2008. p. 21.
9. Available from: http://www.naranorthwest.org/diabetes%20and%20tobacco.pdf. [Last accessed on 2014 Feb 19, at 21:15].
10. Acharya YT. Charaka Samhita, Nidana Sthana. Ch. 4, Ver. 5. Reprint ed. Varanasi: Chaukhambha Orientalia; 2004. p. 212.
11. Acharya YT. Charaka Samhita, Chikitsa Sthana. Ch. 24, Ver. 29-30. Reprint ed. Varanasi: Chaukhambha Orientalia; 2004. p. 583-7.
12. Goldstein BJ, Muller-Wieland D. Pathogenesis of type-2 diabetes. Type-2 Diabetes Principles and Practice. 2nd ed., Ch. 1. New York: Informa Healthcare Publication; 2008. p. 6.
13. Available from: http://www.ncbi.nlm.nih.gov/pubmed/17266094. [Last accessed on 2014 Feb 19, at 21:20].
14. Paradakara HS. Astanga Hridaya, Nidana Sthana. Ch. 10, Ver. 3. Reprint ed. Varanasi: Chaukhambha Sanskrita Sansthana; 2010. p. 502.
15. Liese AD, Mayer-Davis EJ, Tyroler HA, Davis CE, Keil U, Duncan BB, *et al*. Development of the multiple metabolic syndrome in the ARIC cohort: Joint contribution of insulin, BMI, and WHR. Atherosclerosis risk in communities. Ann Epidemiol 1997;7:407-16.
16. Steppan CM, Bailey ST, Bhat S, Brown EJ, Banerjee RR, Wright CM, *et al*. The hormone resistin links obesity to diabetes. Nature 2001;409:307-12.
17. Shuldiner AR, Yang R, Gong DW. Resistin, obesity and insulin resistance – The emerging role of the adipocyte as an endocrine organ. N Engl J Med 2001;345:1345-6.
18. Kirwan JP, Kohrt WM, Wojta DM, Bourey RE, Holloszy JO. Endurance

exercise training reduces glucose-stimulated insulin levels in 60- to 70-year-old men and women. J Gerontol 1993;48:M84-90.
19. Hu FB, Willett WC, Li T, Stampfer MJ, Colditz GA, Manson JE. Adiposity as compared with physical activity in predicting mortality among women. N Engl J Med 2004;351:2694-703.
20. Weinstein AR, Sesso HD, Lee IM, Cook NR, Manson JE, Buring JE, *et al.* Relationship of physical activity vs body mass index with type 2 diabetes in women. JAMA 2004;292:1188-94.
21. Available from: http://www.jyoungpharm.in. [Last accessed on 2014 Feb 19, at 21:29].
22. Available from: http://www.healthcaremagic.com/./doctor-anxiety-pre-diabetes-United States. [Last accessed on 2014 Feb 19, at 20:20].
23. Kato M, Noda M, Inoue M, Kadowaki T, Tsugane S; JPHC Study Group. Psychological factors, coffee and risk of diabetes mellitus among middle-aged Japanese: A population-based prospective study in the JPHC study cohort. Endocr J 2009;56:459-68.
24. Available from: http://www.en.wikipedia.org/w/index.php?title=Diabetes_mellitus. [Last accessed on 2014 Feb 18, 18:40].
25. Mohanty B. Concept of Mano-Abhighatkara Bhavas on Ama (free radical) Utpatti Particular to *Madhumeha* (Diabetes Mellitus). MD Dissertation. Jamnagar: Department of Basic Principles, IPGT and RA, GAU; 2001.
26. Acharya YT. Charaka Samhita, Sutra Sthana, Ch. 23, Ver. 4-5. Reprint ed. Varanasi: Chaukhambha Orientalia; 2004. p. 122.
27. Xu Q, Song Y, Hollenbeck A, Blair A, Schatzkin A, Chen H. Day napping and short night sleeping are associated with higher risk of diabetes in older adults. Diabetes Care 2010;33:78-83.
28. Ayas NT, White DP, Al-Delaimy WK, Manson JE, Stampfer MJ, Speizer FE, *et al.* A prospective study of self-reported sleep duration and incident diabetes in women. Diabetes Care 2003;26:380-4.
29. Sridhar GR, Madhu K. Prevalence of sleep disturbances in diabetes mellitus. Diabetes Res Clin Pract 1994;23:183-6.
30. Scheen AJ, Byrne MM, Plat L, Leproult R, Van Cauter E. Relationships between sleep quality and glucose regulation in normal humans. Am J Physiol 1996;271 (2 Pt 1):E261-70.
31. Tanna I, Chandola HM, Joshi JR. Clinical efficacy of Mehamudgara vati in type 2 diabetes mellitus. Ayu 2011;32:30-9.
32. Available from: http://www.superhumancoach.com/negative-effects-of-cottonseed-oil/. [Last accessed on 2014 Feb 18, at 22:33].
33. Available from: http://www.en.wikipedia.org/w/index.php?title=Diabetes_mellitus. [Last accessed on 2014 Feb 18, at 14:53].
34. Gupta A. Astanga Sangraha, Sutra Sthana. Ch. 9, Ver. 9. Reprint ed. Varanasi: Chaukhamba Krishandas Academy; 2005. p. 96.
35. Colledge NR, Walker BR, Ralston SH. Davidson's Principles and Practice of Medicine. 21st ed., Ch. 21. Edinburgh: Churchill Livingstone Elsevier; 2010. p. 802-3.
36. Available from: http://www.medicalindia.org/Diabetes.pdf. [Last accessed on 2014 Feb 19, at 21:13].
37. Available from: http://www.diet.com/g/binge-eating. [Last accessed on 2014 Feb 19, at 21:20].
38. Kahleova H, Hrachovinova T, Hill M, Pelikanova T. Vegetarian diet in type 2 diabetes – Improvement in quality of life, mood and eating behaviour. Diabet Med 2013;30:127-9.
39. Wiwanitkit V. A noted for study on the prevalence of diabetes mellitus in a sample of vegetarians. Diabetol Croat 2007;36:11-3.
40. Shukla CP. '*Madhumeha*', Ayu. Jamnagar: Gujrat Ayurved University; 1972. p. 13-28.
41. Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, *et al.* Diabetes Mellitus, Figure 338-2,3. Harrison's Principles of Internal Medicine. Ch. 338, 17th ed., New York: McGraw-Hill Professional; 2008. p. 2275-2279.
42. Bharti, Singh RH. Constitutional study of patients of diabetes mellitus vis-à-vis *Madhumeha*. Anc Sci Life 1995;15:35-42.
43. McKeon PO, Medina JM, Hertal J. Hierarchy of research design in evidence-based sports medicine. Athl Ther Today 2006;11:42-5.

हिन्दी सारांश

टाईप २ डायाबिटिस का जामनगर, गुजरात निवासियों में बढ़ता हुआ संकट–एक प्रतिनिध्यात्मक अवलोकन

रोहित शर्मा, प्रदीपकुमार प्रजापति

निश्चित रूप से दुनिया में डायाबिटिस का रोग लोगों की अस्वास्थ्यपूर्ण जीवनशैली के कारण बढ़ रहा है। इसी को ध्यान में रखते हुए यह अध्ययन किया गया जिसमें आई.पी.जी.टी.एन्ड आर.ए.,जामनगर ओ.पी.डी. के ३५० टाईप २ डायाबिटिस के रोगीयों के निदान को जाँचा गया। परीक्षण से इस क्षेत्र के निवासियों में मिथ्या आहार विहार में लिप्त रहना टाईप २ डायाबिटिस बढ़ने का मुख्य निदान पाया गया। डायाबिटिस के प्रति लोगों की अल्पजागरुता और प्रभाव के कारण इसे विश्व के अग्रणीय रोगों में गिना जाता है।