

THE RELATIONSHIP BETWEEN THE DIABETIC PATIENTS AND THE BUILT ENVIRONMENT: THE ISLAMIC VIEW

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Abstract

Diabetes mellitus, is a serious disease that may lead to severe conditions such as blindness, end-stage of renal disease, limb amputation and a variety of debilitating neuropathies. Previous research indicated that diabetes is caused by a complex interaction of patient's genetics, life-style and environmental factors. It also highlighted that providing quality and healthy built environment to citizens including diabetic patients would prevent the decline of the patient condition. Accordingly, the Islamic built laws derived from Islamic Sharia have set the grounds of how to provide healthy built environment for citizens. Little research was conducted in the Kingdom of Saudi Arabia (KSA) in regards to the effect of environmental conditions on the health status of diabetic people. In 2011, the present researchers have surveyed a number of diabetic patients to find out the possible impact of built environment settings on the patient's lifestyle thus how far it would affect the progress of the diabetes. The results showed a close link between a poor home and environmental settings, the patient's lifestyle, and the health status. The paper argues that certain changes to the built environment must be done and to provide a healthy and safe environment for diabetic patients. The Islamic built laws would largely help in provisioning such healthy environment that helps people to live to abandon their bad habits and adopt healthier lifestyle.

Keywords: *diabetes, urban pollution, lifestyle, sick building syndrome, sustainable environment, Islamic built laws*

Abstrak

Diabetes mellitus merupakan penyakit serius yang mungkin membawa kepada kondisi yang parah seperti kebutaan, stadium akhir ginjal, amputasi karena lumpuh, dan bermacam kelemahan yang lain. Penelitian sebelumnya mengindikasikan bahwa diabetes disebabkan oleh interaksi yang kompleks pada genetika pasien, gaya hidup, dan faktor lingkungan. Juga menggambarkan bahwa menyediakan kualitas dan lingkungan binaan yang sehat kepada masyarakat termasuk pasien diabetes akan mencegah penurunan kondisi pasien. Oleh karena itu, Islam mendirikan hukum yang berasal dari Islami Sharia yang mengatur dasar-dasar bagaimana menyediakan lingkungan yang sehat untuk masyarakat. Penelitian kecil dilakukan di Kerajaan Saudi Arabia (KSA) sehubungan dengan efek kondisi lingkungan pada status kesehatan orang diabetes. Pada 2011, peneliti telah mensurvei jumlah pasien diabetes untuk menemukan kemungkinan dampak dari pengaturan lingkungan binaan dari gaya hidup pasien hingga sejauh mana hal itu akan memberi dampak kemajuan diabetes itu sendiri. Hasilnya menunjukkan hubungan yang dekat antara rumah miskin dan pengaturan lingkungan, gaya hidup pasien, dan status kesehatan. Makalah ini berpendapat bahwa perubahan tertentu pada lingkungan binaan harus dilakukan untuk menyediakan lingkungan yang aman dan sehat untuk pasien diabetes. Hukum bangunan islami akan membantu secara luas dalam penyediaan semacam lingkungan yang sehat yang membantu masyarakat untuk hidup meninggalkan kebiasaan buruk dan mengadopsi gaya hidup yang lebih sehat.

Kata kunci: *diabetes, polusi kota, gaya hidup, sindrom bangunan sakit, lingkungan yang berkelanjutan, hukum bangunan islam.*

Introduction

Diabetes is one of the most serious common non-communicable diseases that face people worldwide and diabetic people are patients whose life relies on continuous support, care and

monitoring. Researchers highlighted that diabetes is caused by a complex interaction of patient's genetics, life-style and environmental factors. The bio-psychosocial model is a new paradigm that recognizes that disease and behaviour are functions

and result from the interaction among biological, psychosocial, developmental, socio-cultural and ecological factors¹. Urban sprawl has been linked to a variety of health-related concerns including air pollution, water quality, traffic accidents, and mental health issues². The study indicates that urban design and aspects of the built environment can also play an important role in the development of diabetes type 2 and its risk factors³. The sick built environment may also enforce people to adopt habits and lifestyle that is unhealthy and complicate their health status. Studies of the built environment acknowledge that aspects of our physical surroundings can shape choices about diet and physical activity - both important contributors to the development of diabetes³.

So the built environment should be properly designed to create a healthy environment and lifestyle. This includes the study of physical surroundings features such as proximity of grocery stores, safe and pleasant opportunities for physical activity, and time spent commuting. Changes should be made to the built environment to positively influence health outcomes and to be made more activity-friendly by improving sidewalks and bicycle paths, building recreation spaces, and instituting mixed land-use patterns in more suburban areas to provide better walking destinations³. The Islamic built laws set rules for building up a healthy relationship between human to human; and the human with the environment. This paper focuses on the built environment and lifestyle factors that would contribute to the development of diabetes and discusses possible solutions that improve the health status of diabetic patients.

The Diabetes Types and Complications

Diabetes mellitus (DM) is defined by American Diabetic Association (ADA) and adopted by World Health Organization (WHO) as the following: an individual is said to have normal blood glucose when fasting plasma glucose (FPG) is <6.1 mmol/L (110 mg/dL), impaired fasting glucose (IFG) when FPG is between 6.1-6.9 mmol/L (110 and 125 mg/dL), and DM when FPG is ≥ 7.0 mmol/L (126 mg/dL) or a random value at or above 11.1 mmol/L (200 mg/dL) [4]. There are - in general- two types of diabetes. In Type 1 Diabetes, the person's own body has destroyed the insulin-producing beta cells in the pancreas. Although type 2 diabetes mellitus can be caused by genetic factors, unhealthy lifestyle happens to be the main cause. A person with Diabetes Type 2 has one of two problems, and sometimes both: a) not enough insulin is being produced; and b) the insulin is not working properly. Diabetes mellitus is the most common non-communicable disease worldwide and the fourth to

fifth leading cause of death in developed countries. The International Diabetes Federation (IDF) indicates that the prevalence of diabetes mellitus has reached epidemic levels globally. Estimates for 2010 indicate that 285 million adults have diabetes in the seven regions of the IDF. These numbers represent an increase of 39 million from 2007 and an expected continued increase to 439 million in 2030⁵. While the direct symptoms of diabetes, such as thirst, frequent urination and fatigue, can be mild and may cause little interruption to activities of daily living, it is the complications of the disease, including blindness in adults⁶ non-traumatic lower-limb amputation⁷ and kidney failure resulting in transplantation and dialysis⁸. In addition, the risk of coronary heart disease is two to four times higher in diabetic patients. The risk of stroke or peripheral vascular disease also increases strongly. In fact, the management and treatment of diabetes mellitus mainly type 2 is can considered more than the mere control of blood glucose values, asking for a multidisciplinary approach (i.e. shared care) to reduce macro- and micro-vascular risk factors⁹.

Diabetes and socio-economic factors

Diabetes mainly type 2 is a lifestyle disorder, many studies indicates that, the incidence of this disease is projected to increase as populations age, urbanization increases, diets become 'westernized' and levels of physical activity decrease¹⁰. Passive entertainment exemplified by television viewing and computer games along with intake of meals, all contribute to disorders of lifestyle¹¹, this imbalance between energy intake (i.e. feeding) and energy expenditure (i.e. physical activity) unfortunately leads to obesity¹². Moreover, a growing body of evidence suggests an association between diabetes, diabetes related conditions such as obesity and cardiovascular and; characteristics of the socioeconomic and built environment¹³.

Previous surveys from KSA suggested that diabetes is present in epidemic proportions throughout the country with exceedingly high rates concentrated in urban areas¹⁴. A Study showed that, prevalence of diabetes mellitus is highest among the Northern Saudi population¹⁵. Another study showed that, incidence of diabetes was higher among African American women in low socioeconomic status (SES) versus higher SES neighbourhoods¹⁶, greater risk of coronary heart disease in socioeconomically disadvantaged versus more affluent census block groups¹⁷, and higher rates of obesity in socioeconomically deprived neighbourhoods compared to more affluent neighbourhoods¹⁸. Other investigations indicate higher rates of diabetes^{19,20} and obesity^{19,21&22} in rural areas relative to urban

centres. Poorer health status in socioeconomically deprived and rural environments may reflect, in part, the inaccessibility of such built environmental features as public pools, recreation centres, physical fitness facilities, parks, sidewalks, and streetlights²³. Stewart et al¹³ conducted a study that explores potential county-level associations between diabetes prevalence among adult African Americans and five measures of the socioeconomic and built environment—persistent poverty, unemployment, rurality, number of fast food restaurants per capita, and number of convenience stores per capita. They found Diabetes prevalence rates in South Carolina are among the highest in the nation and there is association between the socioeconomic measures and diabetes¹³.

Environmental pollution and diabetes

B.1. Urban pollution

Diabetes is influenced not only by factor in each individual, but by the environment that surrounds the individual. There are many causes to Urban Contamination such as exposure to a chemical or other toxic substance originating from a source outside the building, e.g. motor vehicle exhaust fumes, construction activity, underground petrol spillage²⁴. One important regulated pollutant is particles equal or less than 10 microm in diameter (PM10), formed as a result of fossil-fuel combustion by motor vehicles and stationary sources such as power plants. PM10 are generated from combustion emissions such as automobile exhaust or wood or coal burning and industrial emissions from smelters, paper and steel mills, or cement plants. PM10 can deposit in the lower airways changing portions of the lung, even reaching the circulatory system and, therefore, are considered to be of greater health significance¹⁹. Many researchers have found association with environmental pollution and the pathogenesis of diabetes²⁵ and especially with those considered as a sensitive population such as children and with cardiovascular diseases. Balfour and Kaplan²⁶ reported that poor lighting, excessive noise, heavy traffic, and lack of public transit are associated with loss of physical function in adults over 55 years of age. They suggest that these detrimental environmental features discourage neighbourhood excursions. In addition, individuals with diabetes are at greater risk of dying²⁷ and being hospitalized for heart disease during periods of high environmental pollution²⁸. This phenomenon has been explained partially due to the association between exposure to environmental pollution and markers of cardiovascular risk related to decreased heart rate variability^{29,30} and increased levels of thrombotic and inflammatory factors^{31,32} since

inflammation is the key pathway leading to atherosclerosis and subsequent adverse cardiovascular events. The diabetic subjects with cardiovascular diseases are more susceptible to the detrimental effects of environmental pollution than diabetics without cardiovascular diseases^{33&34}. Other studies in children have showed that environmental pollution is linked with the development of type 1DM³⁵.

A lot of recent studies have showed a relationship between PM10 and diabetes mellitus^{20, 21,22&23}. The long-term exposure to environmental pollution particles, 2.5 mm in aerodynamic diameter (PM2.5) has been found to be associated with a higher relative risk of mortality among people with diabetes compared with the general population³⁶. Also similar association found between prevalence of T2DM and PM2.5³⁷. A study by Brook et al.³⁸ investigates the relation between diabetes and traffic-related NO₂ in two different cities; Toronto and Hamilton. They found significant association between the diabetes prevalence and exposure to traffic-related NO₂. Lee et al³⁹ have found similar association between the organic pollutants and prevalence of T2DM (see similar findings by⁴⁰). Hathout et al³⁵ found association between Prevalence of T1DM and substances O₃, SO₂ and substances NO₂, SO₂ and SO₄⁴¹. This possible association between environmental pollution and increased incidence of diabetes should motivate policy makers to issue prevention policies to reduce air pollution and therefore, its, harmful consequences.

B.2. Sick building syndrome

Buildings are complex environments which can trap and concentrate pollutants as well as generate them. Outside pollutants find their way into buildings through air intakes and inadequate filtering systems. As long as ample ventilation ensures a constant supply of fresh air, indoor pollution problems may be kept to a minimum. However, general ventilation is often inadequate and office equipment may have no local exhaust system venting fumes to the outside⁴². Youle⁴³ has found that air-conditioning systems giving rise to symptoms of sick building syndrome.

Researchers have found association between the ventilation rates, CO₂-concentrations with health problems in commercial and institutional⁴⁴ and Office Buildings⁴⁵. Sick building syndrome has a number of health symptoms such as: lethargy and tiredness, headache, dry blocked nose, sore dry eyes, sore throat, dry skin and/or skin rashes, allergy etc.^{46, 47, and 48}. Allergic reaction in sensitive individuals was associated with chest tightness, difficulty in breathing, fever and headache. These health problems may aggravate diabetes. Certain

materials are identified as causes of Contamination inside the buildings: exposure to chemical or other toxic agent generated within the office space, e.g. methyl alcohol from spirit duplicator, methacrylate from a copier, sulphur dioxide from a heating system, amines used in a humidification system, chlordane used as a pesticide²⁴.

Potential Solutions

The green and sustainable buildings design aim is to design buildings that reduce the overall impact of the built environment on human health and the natural environment by: efficiently using energy, water, and other resources, protecting occupant health and improving employee productivity, and reducing waste, pollution and environmental degradation. These buildings theoretically use zero energy and do not release harmful substances to the environment, enrich the environment in a way or another thus it mimics the nature. Such buildings should provide healthy indoor environment to its inhabitants and expose them to adequate amount of natural light and ventilation, views of greenery, and close proximity to outdoor green space. Landscape architecture appears to be the primary key at the finest scale to sound mind and body and simply viewing nature reduces the stress of daily urban life^{49,50}. Jackson and Kochtitzky⁵¹ advocate providing neighbourhood opportunities for walking to accomplish routine activities such as shopping and going to work. Andersen et al.⁵² report that lifestyle activities such as structured aerobic exercise are effective in losing weight. Critical to this strategy is conducive neighbourhood design. Physical activity is defined as the total of planned and repetitive movements of skeletal muscles, which are performed using energy. The beneficial effects of exercise in patients with type 2 diabetes have been recognized long time ago. Today, the beneficial role of exercise has been fully documented and exercise should be incorporated systematically in the treatment of patients with diabetes^{53,54,55,56and57}. Moreover, exercise has a significant role in the regulation of blood glucose, improves insulin action, metabolism of proteins and fats, prevents complications of diabetes, improves muscle flexibility and strength, has beneficial effects on the cardiovascular system and increases life expectancy of the patients. In addition, physical activity is beneficial for the mental state of the individual, because it increases the energy of the human body, improves self-esteem and decreases depression^{53,54,55&56}. It is widely accepted that healthy nutrition is the basis for the treatment of type 2 diabetes. It contributes positively to the maintenance of blood glucose within normal range

and minimizes the complications of the disease. Unfortunately the diet in urban dwellers are usually contains a greater proportion of refined carbohydrates, less fibre and more fat in comparison to that in rural environment⁵⁸.

Consequently, the Islamic built laws that are extracted from the Islamic Sharia principals has modified the built form according to the Islam's philosophy, ideology, law, and the requirements of socio-cultural forces in Muslim life [59].

Islamic built laws were used to define the rights, responsibilities of people and how to respond to one's needs without conflicting other people's interests [60] and not to harm people physically and psychologically. These laws provide a flexible framework to the property user/owner that enables him/ her to change his property without harming his neighbours and violating their rights. Ahmed [61] suggests the Islamic built laws can be listed as the following:

- No-Harm principle: No-Harm principle means that residents' initiated action, which is considered harmful to others or to the environment, should be prevented when affected people asked to be stopped [62, 63 and 64]. This include any annoying and bad smells, smokes, and sounds; and use of the property or a part of it for industrial or commercial use etc.
- Openings and projections: Akbar [65] states that any individual could project part of his upper floor, such as Mashrabiya's or cantilevers, on to a through street as long as no damage is caused to the public. Projecting cantilevers over main roads are permissible because the roads are the remains of 'dead' lands that could have been 'revived' in the past⁶⁶. He/ she can also open windows and doors on to these roads providing they do not cause harm to their neighbours.
- Right of appropriation of open spaces, *finas*: As long as this causes no harm, residents should be free to appropriate open spaces and *finas* in their residential settlements for a wide range of social and economic activities determined and permitted by the residents themselves without outside intervention^{65,59}.
- Right of easement (*servitude*) (*Irtifak*): Right of easement (*servitude*) is an exclusive benefit of a property over another adjacent to it, where the two are owned by different owners. This benefit belongs to the first property, even if its owner changes, unless this benefit has been relinquished through a conventional transaction⁶⁶.
- Right of pre-emption (*shufah*): The right of pre-emption (*shufah*) is the right of a neighbour or a partner to substitute himself/ herself for the

buyer of an adjacent property or structure when offered for sale by another neighbour or partner^{63,66}.

Unfortunately, these principals are not addressed in the present building laws of the KSA. The present built laws set general guidelines on how to consider the home owner's rights with regards to the construction or alteration of his/her property. These laws specify what designers should do regarding the building setback distances, distance between other properties, and height restrictions of building and so on. These laws do not, for instance, define how the property should be designed to fit the Islamic lifestyle, traditions and norms. There is also no sustainability code such as BREEAM (i.e. BRE Environmental Assessment Method) or LEED (i.e. Energy and Environmental Design) that can be used to assess the building's performance and find out how far it would negatively impact the environment.

The Research Objectives and Methodology

The research has a set of objectives and these are:

- To find out the relation between the frequency and progress of diabetes symptoms, the patient's lifestyle, and built environment settings
- To make recommendations on how to enhance the built environment to be healthy, supportive and assistive

To achieve the research objectives, a survey questionnaire was carried out to assess the patient's views about the potential impact of built environment on the progress of the diseases. The survey was used to target 36 patients in March/April 2011. A questionnaire was prepared to inspect the diabetic patients' views about their environment and lifestyle. During the appointment with each diabetic patient at diabetes' clinic, King Fahid Teaching Hospital of the University of Dammam, the patient was asked to fill in the questionnaire. Thirty three patients filled in the questionnaire and three returned invalid questionnaires. The sample size however, (i.e. number of respondents) was small and the following simple statistical tests were applied: Mean, percentage, Chi-square Pearson and Cramer's test of correlation.

The Field Survey Results

Patients are from Dammam and Al Khobar cities and few are from AlAhsa city and Al Qateef city. The analysis of the questionnaire results showed that 21% of the respondents are between 20 to 40 years old, 55% are between 41-60 years old and the rest are between 61-80 years old. Around a third of the respondents use insulin and tablets. Around 50% use

tablets and less than a quarter use insulin. Around a one third of the respondents have high last Fasting blood Glucose reading i.e. more than 200 mg/dL. And a one third of them have medium reading i.e, 151-200 mg/dL and the rest have low reading. Around 21% of the respondents said the Onset date of the disease is from one to five years, 42% said it is from 6-10 years ago, 12% said that they have it from 11 to 15 years whereas 21% said they have more than 15 years ago. 91% of the respondents have lived in their present address more than 5 years and 6% have been less than 5 years whereas the rest did not reveal the period. 24% have experienced accidents since the onset of the disease and 73% have not. 30% said that the highway is less than 500 meters from their homes, whereas 80% of the respondents said that the main road is less than 500 meters from their homes. 41% of the respondents pointed out that the public amenities are less than 200 meters and 44% said it is less than 500 meters. Around the third said the public gardens are less than 500 meters.

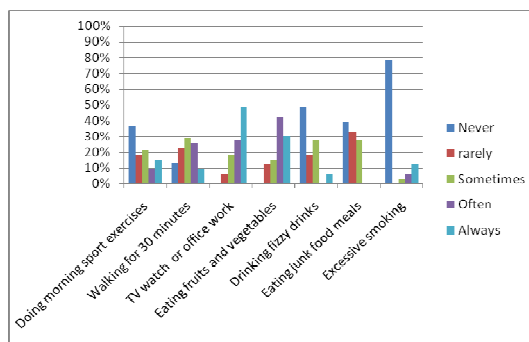


Figure1. The Frequency Daily Lifestyle Habits

However, 42% of the participants said it is more than 2000 meters from home. 41% said that the Recreation and sport Centre is more than 2000 meters from home, whereas around 22% said it is less than 500 meters from home.

More than half of the participants said that they have never or rarely done any morning exercises on daily basis. Only a quarter of the respondents have done frequently/ always morning exercises. More than a third of the surveyed patients said they never/ rarely walk for 30 minutes every day. Around the quarter said they did it frequently and only 10% said they always do it. Around 75% of the respondents said they often/ always watch TV or carry out office work on daily basis. 72% said they often/ always eat fruits and vegetables every day. 27% said they sometimes drink fizzy drinks and eat junk food every day. Around 20% said they smoke excessively on daily basis. Since they have lived in their homes, the respondents complained mostly from the following environmental issues: noise from the traffic, little sun penetration to

their homes, noise from neighbours, difficulty to wonder around within the neighbourhood, the lack of cleanness of the neighbourhood. The least complains were about the followings: the uncomfortable home furniture, poor air quality in the house, and unpleasant outside views. Around the third said they always/ often suffer from the following health problems since they have had the diabetes: Paraesthesia, blurred vision, extreme tiredness, and extra fat problems since the onset of the diseases. 44% of the respondents said they suffer always/ often from blood pressure problems and 19% experience drowsiness since they have the diabetes. However, around half of them said that they sometimes have stress and around the third have extreme tiredness. Few of the respondents said they experience loss of sensation particularly in the foot limbs or Cardiatric problems.

In regards to cross tabulation results, only significant links between variables less than 0.05 are reported here. The examination of data shows that the older patients drink less fizzy drinks than younger patients and this can be considered as a healthy phenomenon. The older patients seem to be more sensitive to the environmental conditions and complain more about the pollutant neighbourhood than the younger patients. Also, they suffer Extreme tiredness and loss of sensation particularly in the foot limbs more than younger patients. Patients with lower last fasting blood Glucose reading, walk more frequently than patients with higher Glucose reading. Al khober and Dammam's patients tend to walk more frequently than AL Ahsaa and Al Qateef patients. However, they watch more TV or carry out office work than AL Ahsaa and Al Qateef patients. Al Qateef patients drink more frequently fizzy drinks and do excessive smoking more than other patients. However, as the sample of Al Qateef is small, the results cannot be generalized to the whole population. Al Qateef patients have suffered more frequently than other patients from the following sick indoor conditions: annoying air draft, hot air conditions, poor air quality, unpleasant odours and extreme tiredness. Patients who tend to watch more frequently the TV or carry on office work are those who live in an area whereas the recreation and sport Centre is farther. Patients who experience more frequently the loss of sensation particularly in the foot limbs, said that they suffer more frequently from too little indoor air/ ventilation, annoying air draft and noise from neighbours. Patients, who experience more frequently from blood pressure problems, said they suffer more frequently from neighbours' noise and those who

experience more frequently from drowsiness said that they have higher difficulty in wandering around within the neighbourhood.

Discussion and Conclusion

The study supported with the literature review showed the negative possible impact of the existing built environment in the Eastern province, KSA on the diabetic patients. The survey Results showed that public gardens and recreation and sport Centres are not well located within the urban context. This would make it difficult for the patients to enjoy walking to and within these centres and parks particularly during the harsh hot weather that last around 6 month in KSA. Therefore, it is no surprise to find that patients who tend to watch more frequently the TV or carry on office work are those who live in an area whereas the recreation and sport Centre is far from their homes. In respect to the lifestyle activities, more than half of the participants said that they have never or rarely done any morning exercises and more than the third said they never/ rarely walk for 30 minutes on daily basis. Around three quarters of the respondents often/ always watch TV or carry out office work every day meanwhile around the same percentages often/ always eat fruits and vegetables on daily basis. Around the third said they always/ often suffer a number of health problems. The respondents complained mostly from a number of environmental issues such as noise from the traffic and neighbours, little sun penetration to their homes, difficulty to wonder around within the neighbourhood, and the lack of cleanness of the neighbourhood. The results showed that the frequency of the symptoms is higher for patients who suffer more frequently from indoor/ outdoor environmental/ urban conditions. The older patients seem to be more sensitive to the environmental conditions than the younger patients. Patients who experience more frequently from drowsiness said that they have higher difficulty in wondering around within the neighbourhood. The literature review showed similar results as it highlighted the close links between the sick built environment and the development of diabetes represented by the frequency of its' symptoms. The researchers would like to point out the importance of providing healthy built environment to citizens. However, this built environment whether it is indoor or outdoor should be supportive and can assist diabetic patients in their daily life. To create a healthy built environment, corrective measures are suggested and it includes the

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