



Understanding the Driving Reasons of Diabetes: Urban vs Rural

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Abstract

Diabetes, a major non-communicable disease, is developing by people in alarming rate around the world. It's also making people vulnerable to other deadly diseases. In the study, we gathered the evidence of diabetes prevalence in both urban and rural setting with the reasons behind it. We analysed different recent articles and news to get the today's driving reasons behind diabetes and divided the diabetes increasing causes in four sections: climate change, food adulteration, fast-food, and physical activity. We showed that urbanization is closely related to climate change which in turn increase the surrounding temperature and interrupt fresh food production. Main reason behind food adulteration is gaining more profit and fast-food trend is increasing exponentially among young generations. At the same time, urban people, especially the girls are lacking physical activity and more prone to develop diabetes disease. We have discussed the problems behind Bangladesh's current diabetes rate and suggested feasible solutions for it.

Keywords: Diabetes, Climate Change, Physical Activity, NCDs, Food Adulteration, Fast-food

Introduction

Elevated levels of blood sugar brought on by absolute or relative insulin shortage, in the setting of insulin resistance, beta-cell malfunction, or both, are the hallmarks of diabetes, a chronic metabolic condition. Diabetes is one of the rapidly growing diseases with highest prevalence in the world [1]. According to the International Diabetes Federation, approximately 465 million (9.3%) individuals worldwide were anticipated to have diabetes in 2019, and by 2045, that number is expected to rise to 693 million for adults [1]. Approximately 79% of diabetic's patients reside in low- or middle- income countries, while above 60% do so in Asian countries [2]. In 2016, World Health Organisations estimated that diabetes affected 8% of the entire population of Bangladesh and accounted for 3% of deaths of all-ages people [3]. Over 8.4 million of adults are estimated to have diabetes in Bangladesh, and the number is expected to reach 15 million by 2045 with 13% increased prevalence rate by 2030 [4]. Numerous organs, especially the kidneys, heart, nerves, blood arteries and eyes are connected to chronic impairment, failure, and dysfunction via diabetes [5]. Lower-extremity amputations (LEA), diabetic kidney disease (DKD), neuropathy and retinopathy along with vascular complications of microvascular and macrovascular systems are the most common causes of morbidity and mortality in those diagnosed with diabetes [1].

Because of the severity of diabetes's negative impacts, it is crucial to identify the factors of that problem and their relationship with diabetes in order to help in improving the country's health status. Several factors play role in developing diabetes. Among them the most common risk factors are unhealthy diet (food rich in sugar, fat), obesity, fast food, adulterated food, environmental factors, physical inactivity, family history and many more. Additionally, educational attainment and social status have an effect on diabetes prevalence [6]. Although diabetes affects both urban and rural people, it is more common among urban individuals than rural one as urbanization is directly responsible for predominant occurrence of diabetes. The climate change and resulting heat waves mainly occurred by expanded urbanization and industrialization. It is said that over 100,000 new patients of diabetes

may appear each year in the USA alone if the ambient temperature rises by 1°C [7]. Chemicals, other unhealthy components used in the food adulteration process, are generally harmful for human health and act as risk factors of diabetes. The primary components of fast foods are sugar, fat and salt that are the main contributors of diabetes. Study observed that urban students frequently eat fast food [44,47,50]. The level of physical inactivity is proportional to the risk of developing diabetes [6].

Bangladesh is a country with the fastest-growing economy and rapid urbanization. As a result, Bangladesh is facing increased prevalence of diabetes with the variation in urban and rural risk factors. Diabetes places a significant financial burden on the healthcare systems by raising the utilization and cost of the healthcare services. In our study, we aim to investigate the four common risk factors of diabetes, how they differ from urban to rural areas and possible solutions to prevent those risk factors from Bangladesh perspective.

Climate change

The term "climate change" refers to the alteration of weather mostly brought on by greenhouse gas emissions which trap heat in the earth's atmosphere causing global warming. Human activities associated with industrial activities, change in land-use, energy generation system and deforestation are principal producers of greenhouse gas emissions [8]. Most of the people live in urban regions and the number is projected to rise sharply. Several research have suggested that urbanization and climate change may be related in some way. Cities have higher temperatures, CO₂, and N deposition than the world average because of their physical characteristics and pollutant releases decades before the average. Urban areas experience significantly more warm nights than rural ones. When the climate warmed, the flux of air conditioning grew while the flux of space heating declined [9]. The consequences of urbanization and climate change in Istanbul and Ankara, Turkey's two major cities, are studied by Karaca et al. The southern section of Istanbul, which is recognised as the most populous and industrialized area of the city in comparison with its rural areas, has temperatures that are noticeably rising, whereas northern stations exhibit a cooling tendency rather than a warming trend. No warming trend is visible at the Ankara urban station [10]. Heat is often trapped at the surface by substances like stone, concrete, and asphalt, and a lack of vegetation limits heat loss through evapotranspiration. Urban areas experience a high proportion of water-resistant, non-reflective surfaces and a low proportion of vegetated, moisture-trapping surfaces compared to rural areas that contribute to form heat islands [11]. In addition to extreme temperature, other factors such as anomalies, humidity, weak winds, air pollution and radiation all vary between urban and rural settings and frequently reach remarkable heights during heatwaves.

From 2001 to 2018, there was a 168% raise in the global urban area, where Asia and Africa experienced the fastest expansion [12]. Bangladesh faces a notable decrease in vegetative and agricultural land as well as a corresponding increase in urban land surface due to the rapid rate of population growth and urban expansion. Researchers reported that large cities have higher urban heat island (UHI) than small cities and Dhaka, Mymensingh, Chattogram, and Barisal all have higher UHI intensities than other districts because of their substantial populations and random urbanization [13,14]. The forests, water bodies and agricultural fields were indicated as lower temperature zones, while river sand bars and densely populated regions were characterized as higher temperature zones in a study. High surface temperatures are expected to continue their upward trajectory, and a dry winter season may start to show. Therefore, severe floods, drought and other disasters affect the country [13].

Singh et. al. concluded that there is a strong relationship between urbanization and major health issues [15]. Global warming has a variety of negative repercussions, including loss of biodiversity, a decrease in agricultural production, desertification, acidification of the oceans, ecosystem degradation, deterioration of soil, depletion of freshwater supplies, and destruction of the ozone layer. Besides that, prolonged heat episodes lead to serious health problems and also influence heat-related morbidity and mortality. It is well recognized that individuals with diabetes seem to be more vulnerable to cardiovascular problems and dehydration in hot weather [16]. Due to defective thermoregulatory processes, decreased autonomic nervous system responses to high temperatures, and electrolyte imbalances, diabetes patients are especially susceptible to heat waves [17]. Several environmental factors may have a detrimental impact on the patient's capacity to control their metabolism, the availability of glucometers, insulin pumps, medications, patient's ability to obtain treatment and, stability and kinetics of insulin. Particulate matter and resulting air pollution are directly or indirectly associated with diabetes [17]. Fresh vegetables could become more difficult to find and more expensive to buy as a result of climate change and most of the people use processed, imported foods with poor nutritional value that act as a risk factor of obesity as well as diabetes [5].

There are several strategies that can be considered as possible solutions to solve the problem associated with climate change. Hydrogen cell and electric vehicles for transportation services, and air filtration bricks for building design can be used to alleviate air pollution [19]. As urban deforestation and fewer vegetative areas are one of the reasons for higher temperatures, planting trees may help to improve cooling activities [16]. Use of cool roofs and pavement, worked by enhancing reflectance and emittance of solar radiation and decreasing heat capture is a solution of subsiding UHI [19]. It is important to bring changes in policy making and urban planning based on the adaptive capabilities of cities [20]. Urban decentralization is another way to reduce the incidence of climate change [18].

Food Adulteration

The fundamental need of our body is food. Both nutritive and non-nutritive substances are present in foods. Food adulteration is referred to as decreasing the quality of food through addition of extraneous, inferior, or impure ingredients with food or through elimination of nutritive substances from food. Food adulteration is a serious problem all over the world as it has detrimental effects on health. Food adulteration encompasses a variety of actions, including mislabelling, preserving spoiled or expired food, and introducing harmful ingredients such as pesticides, colouring agents- textile dyes or clay powder, ripening agents' ethylene oxide, various inedible ingredients and so on [18]. There is distinction between urban and rural areas in the term of food adulteration. Due to the busier lifestyles and reliance on surrounding chain stores, grocery stores and open markets for obtaining food and spices, rural residents are less likely than urban residents to encounter food adulteration [19]. For example, a study demonstrated that adulteration activities have been more prevalent in urban than rural areas in the case of milk adulteration [20]. In villages, farmers use pesticides to protect plants from microbial development, insects and spoilage that act as food adulterants [21]. Although commercial food has diminished nutritious content due to unhealthy processing activists, it is more popular among the urban population as commercial food saves energy and time [22]. For instance, wax is applied to commercial fruits in order to maintain moisture, appearance, and storage process which is harmful for the human body [21].

Bangladesh is not an exception to the pervasive food adulteration that has affected the world for ages. Numerous studies found that almost 50% of foods are adulterated with harmful substances or pathogenic microbes in Bangladesh [22]. Other studies identified that in three-fourths of markets, necessary foods including meat, vegetables, fish, and poultry have formalin contamination [23]. In 2014, Transparency International Bangladesh (TIB) reported that at least 4.5 million individuals in Bangladesh were directly impacted by consuming adulterated food [24]. Food is adulterated by different practices in Bangladesh. For instance, hazardous pesticides are used to adulterate vegetables, DDT (Dichloro diphenyl trichloroethane) is employed at higher levels in dried fish, milk has been contaminated by the addition of polluted water and formalin [24]. Adulterated food may result in various kinds of health issues involving diarrhoea, cancer, cardiovascular disease, allergic reaction and many more. The increasing risk of diabetes is associated with the use of adulterated food. Honey is adulterated via commercial syrups and low-cost sugars that contribute to the risk of diabetes, hypertension as well as higher lipid profile. Sugars like sucrose, fructose are used in contaminated milk that can cause high sugar and diabetes as well [25]. Many food additives contain chemicals that cause endocrine disturbances and are related to the risk of diabetes [27]. Sometimes, diabetes is resulting from the exposure to pesticides which alter the insulin regulation system [27, 28]. Mainly, the different types of hazardous food adulterants are correlated directly or indirectly with the incidence of diabetes mellitus.

As food adulteration is a growing problem linked to public health issues, it is essential to take necessary steps for preventing the hazardous food adulteration system. Effort from both the public and the government is needed to solve the problem. Increasing public awareness regarding the danger of food adulteration is one of the most vital steps in the way of protecting food from contamination [29]. Other essentials include trained authorities with appropriate law enforcement, trained farmers, limit the use of pesticides, honesty of traders to maintain quality of food, implementation of protocol on food safety and appropriate distribution of food with reasonable prices [20].

Fast Food

A healthy diet may depend on having access to nutritious food. Fast food consumption has been linked to reduced intakes of fruits, fiber, vegetables, and milk as well as greater intakes of energy, salt, added sugars, fat, and sugar-sweetened beverages [30]. Fast food is getting popular among the general population, mostly younger. As a result, it is one of the industries with the quickest growth rates [31]. Since parents who are employed in nuclear families have less time to spare for preparing food at home, fast food chains have become more and more popular in recent years, while children spend the majority of their time

outside of home participating in tuition classes after school or taking part in leisure activities [31]. Previous investigations exhibited that urban adolescents consume more saturated fatty acids, trans-fatty acids and cholesterol, while rural adolescents take significantly reduced levels of micronutrients, u-3 and u-6 polyunsaturated fatty acids as well as higher amounts of fiber and carbohydrates.[32]. A greater proportion of rural teenagers' intake typical foods like chips, casados, sandwiches as fast foods. On the other hand, teenagers in urban regions are much more likely than those in rural areas to consider fried food and empanadas (chopped potato, mashed beans, cheese etc) to be fast food. While rural youths claimed purchasing fast food in neighbourhood convenience stores and school canteens, urban teens were prone to patronize international fast-food chains or franchises [32]. Although there is fewer number of restaurants in rural and farm areas in comparison with urban areas, fast-food consumption may not correlate with fast-food availability.

The sector of fast food is thought to be valued roughly Tk. 1000 crore and is continually expanding in Bangladesh where it first emerged in the early, according to a report conducted in 2013 [33]. Globalization, the explosive growth of corporate entities, information technology, a hectic lifestyle, the opportunity cost of women's time, and rising income levels of the people are the main driving forces behind the expansion of the fast-food culture in Bangladesh [33]. Burgers, fried chicken, pizzas, and sandwiches are some of the most popular fast foods among university students in Bangladesh [34]. Puri, Singara, Pajju, Samucha, and Paratha are all examples of traditional snack items of Bangladesh that are frequently deep-fried [35]. It has been observed from Bipasha et. al. that 98% of the students from private universities are used to consuming fast food where males are more prominent than females [36]. School going children are encouraged to eat fast food by the availability of fast food nearby school, eating fast food as a treat, easier purchasing of fast food through online order, as a symbol of social status and many other reasons [37]. However, fast food culture is now prevalent in Bangladesh, particularly in cities [35].

Medical problems are caused by frequent consumption of fast food; being chubby indicates obesity, GI Tract problems, decreasing hunger, removal of nutritious dietary components, chronic diseases including cancer and diabetes in later years of life and so on [5, 38]. It is discovered that fast food comprises significant levels of cholesterol and saturated fatty acids, primarily sourced from palm oil and animal fats [35]. Higher caloric density, excessive fat, trans-fatty acid, sodium, and higher portion sizes of fast food all have the possibility to take part in a diet with poor quality [39]. The CARDIA investigation found that rising fast-food consumption is associated with higher levels of insulin resistance, triglycerides, waist circumference and lower HDL cholesterol that act as risk factors of diabetes [40]. Research of Dominguez et. al. exhibited that taking an increased level of fast food before pregnancy may result in gestational diabetes [41]. According to Odegaard et al. study, individuals who use fast foods more than twice a week had a 27% enhanced risk of developing type 2 diabetes whereas a 56% higher risk of mortality from congenital heart defects in comparison to their counterpart [42]. Other findings suggested that there is an insignificant relationship between nearby fast-food restaurants and related risk of diabetes [39].

Necessary strategies should be taken to solve the growing problem of using unhealthy fast food. Strategies may include nutrition and agriculture policies that encourage the production and distribution of good foods, like prohibiting trans-fat, implementing agricultural subsidies, taxing unhealthy foods to increase access and affordability of fruits, legumes, vegetables, and whole grains [38]. Industries can participate to solve the problem by alleviating calories, sodium and fat from processed foods. Besides that, strong maintenance of the food environment ensured by government policies are important [43].

Physical activity

Physical activity (PA) is needed to live a healthy life. There are significant differences between urban and rural populations in the terms of physical activity and sedentary lifestyle. Urban people engaged in much fewer sedentary activities and showed less physical activity than rural individuals, indicated by several studies [44, 45, 46]. Physical activity and sedentary behaviour mainly rely on social, familial, geographical influences and lifestyle. While urban females preferred to focus their attention on less physically demanding social activities like conversing with peers, rural girls were prone to be involved with household and occasionally agricultural tasks that needed more energy utilization [46]. In contrast to their urban counterparts, youngsters in rural areas spend a longer period in paying attention to conventional media. Urban children are more likely to read books, play indoor games and watch television than rural children [47]. Rural women reported seven times and rural men reported five times much more physical activity than urban women and men, respectively [48]. However, urban people exhibited more physical activity than rural individuals in the terms of walkability and cycling that is observed in Duck et al. study [49].

The fourth largest cause of death worldwide is inadequate PA. Around the world, 23% of adults do not reach the minimal PA standards. Bangladeshi people are more technologically oriented than in the past due to rapid urban-industrial change and modernization, as evidenced by their elevated access to labour-saving technologies in professional and domestic settings, increased reliance on motorized transportation, and longer period spent engaging in screen-based recreational activities and as a consequence, people show less physical activity [50]. A study directed by WHO revealed that 58% of boys and 60% of girls were not active enough in Bangladesh [51]. It is found from the result of other research that one in three Bangladeshi teenagers were not sufficiently involved in physical activity with girls being less active than boys on average. Mostly, Bangladeshi girls involve themselves in physical activity like cooking or other household chores, while boys spend their time on running or playing outdoor games as a part of entertainment and physical activity as well [52].

Non-communicable diseases (NCDs) cause 60% of deaths worldwide [5]. The major risk factors of NCDs comprise increased urbanization and decreased physical activity [48]. Furthermore, decreased physical activity is also a leading risk factor of diabetes prevalence [53]. There are few scientific explanations for how sedentary lifestyle affects diabetes mellitus risk. It is well known that extended physical inactivity has an impact on the composition and function of muscle glucose transporter proteins. The lipoprotein lipase that functions in controlling blood lipid profile and glucose metabolism using cellular pathways distinct from the normal motor response, is reported to be reduced by extended muscular inactivity in an animal study [54]. There are various physical exercises such as aerobic exercise, resistance exercise that are helpful to control and treat diabetes. Physical activity may help to regulate diabetes mainly by enhanced vigour, cardiorespiratory fitness, improved glycaemic control and lipid profile, reduced insulin resistance, weight loss maintenance and decreased blood pressure [55].

A primary goal for public health is now encouraging PA participation. Proper implementation of National and International public health policy can help to promote physical activity among people [53]. It is crucial to develop recreational activities with suitable recreational infrastructure in metropolitan areas, even in the workplace as the urban people are physically inactive at work. Availability of free space for walking, biking, and easier accessibility of fitness centers in urban areas are also essential. In addition, it's indispensable to establish information, communication and education initiatives that are beneficial to impel the adoption of healthy lifestyles [48]. Overall, behavioural and lifestyle changes which include physical activities and exercise can be possible solutions for preventing that growing problem and associated medical issues.

Conclusion:

Among the NCDs, diabetes is the most common disease nowadays and young populations are also developing pre-diabetes around the world. But there are some differences between urban and rural population in terms of diabetes development. According to our study, urbanization is more closely related to diabetes development because of climate change, more food adulteration phenomenon, availability of fast-food and lack of opportunities of proper physical activities. Urban decentralization, tree plantation, introducing electric vehicles might be a solution to the climate problem but strict laws, trained authorities, well organized supply chain is needed for handling food adulteration problem. Though it is difficult to control young generations from having junk foods, proper regulations and awareness building can reduce the long-term effects of fast-food. Moreover, introducing more physical activity in curriculum and encouraging students in behavioural and lifestyle changing might be the best solutions for physical activity lacking problem.

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