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Original Article

Diabetes mellitus and high blood pressure in relation to BMI among adult non-pregnant women in Bangladesh

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ABSTRACT

Purpose: To investigate the association between overweight and obesity (in terms of BMI) and diabetes, HBP and diabetes-HBP comorbidity among adult women non-pregnant in Bangladesh.

Methods: Information about demographics, socioeconomic, blood pressure and blood glucose levels were collected for 2022 women ageing above 35 years were collected from Bangladesh Demographic and Health Survey (BDHS 2011). The primary outcome variables were diabetes and high blood pressure. Diabetes was defined as fasting plasma glucose value ≥ 7.0 mmol/L and HBP as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg. Blood pressure and plasma glucose measurement were performed by standard clinical procedures. Data were analysed using cross-tabulation, chi-square tests and logistic regression methods.

Results: Mean age of the participants was 41.42 (SD = 4.37). 38.7% of the women had BMI values ≥ 25 . The prevalence of HBP, diabetes, and diabetes-HBP comorbidity was respectively 18% and 5.1%, and 2%. The adjusted odds of having diabetes, HBP and Diabetes-HBP comorbidity were respectively 2.14 ($p = 0.002$; 95%CI = 1.31–3.48), 2.3 ($p < 0.0001$; 95%CI = 1.70–2.98), and 3.4 ($p = 0.004$; 95%CI = 1.47–7.81) times higher among overweight/obese women compared to those with normal weight.

Conclusions: Overweight and obesity account for a major proportion of diabetes, HBP and the comorbidity of these two among non-pregnant women. There remains a considerable risk for future expansion of diabetes and HBP as the prevalence of overweight/obesity is rising constantly. Maintaining a healthy BMI needs to be regarded as among the most important diabetes and HBP preventive strategies among Bangladeshi women.

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1. Introduction

The burden of overweight and obesity and associated non-communicable disease (NCDs) are accounting for an increasing proportion of morbidity and mortality in both developed and developing countries. Compared to 1990 estimates, global burden of mortality attributable to NCD has increased by 30.0% in 2010 [1,2].

Abbreviations: DBP, Diastolic Blood Pressure; HRQOL, Health, Related Quality of Life; LMICs, Low- and Middle-income Countries; NHANES, National Health and Nutrition Examination Surveys; NCDs, Non-communicable Diseases; SBP, Systolic Blood Pressure; SHIELD, Study to Help Improve Early Evaluation and Management of Risk Factors Leading to Diabetes; SWB, Social Wellbeing; WHO, World Health Organization.

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Nearly half of the total disease burden (45%) among adults disease burden in low- and middle-income countries (LMICs) globally is attributable to NCDs [2,3,8]. Globally, diabetes and hypertension remain two leading causes of death and disability adjusted life years (DALYs), and the prevalence is expected to rise considerably in the coming decades. The International Diabetes Federation (IDF) estimated that in 2013, diabetes caused 5.1 million deaths exacting a US\$ 548 billion spending on healthcare [1]. From its 2000 estimates, global prevalence of type-2 diabetes is expected to double in 2025 to represent about 5–7.6% of the total global population by then [10]. The number of adults with hypertension in 2025 was predicted to increase by about 60% to a total of 1.56 billion (1.54–1.58 billion) [12]. In 2005, the prevalence of overweight and obesity were respectively 23.2% and 9.8%, which is projected to rise to 33% and 14.2% by 2030 [11]. Once regarded as diseases of the industrialised nations, the burden of diabetes and HBP are now rising disproportionately in the LMICs [2], with nearly four-fifth of all diabetic adults

now living in low- and middle-income countries (LMICs) [3]. For instance in South Asia, home to world largest proportion of poor population (<\$1.25/day), diabetes is the tenth most important cause of death [12], and prevalence is estimated to increase by over 151% between year 2000 and 2030 [2].

Though the prevalent epidemiological pattern in Bangladesh is characterized by widespread undernutrition and higher proportions of morbidity and mortality from infectious type communicable diseases, rates of overweight/obesity and associated NCDs are now expanding in epidemic proportions [1]. According to a longitudinal surveillance report by International Center for Diarrheal Diseases in Bangladesh (ICDDR, B), NCDs accounted for 8% of the total mortality in the surveillance areas in 1986 [5]. The burden of mortality attributable to NCDs increased by over two-fifth (41%) in 1996 and over two-third (68%) in 2006 [6]. National prevalence of diabetes and HBP has increased from 3.8% and 11.0% in 1995 to 9% and 15.3% in 2010 [6]. Among the countries in the Southeast Asian region, Bangladesh now has the second highest population living with diabetes after India [1]. In 2013, the number of people with diabetes in Bangladesh was 5.10 million, which is expected to increase to 8.20 million (13% of the total adults) by 2035 [3], and by 2030 it is projected to become the 8th highest ranking country in the world in terms of the number of people with DM [4].

Growing evidence suggests that the burden of NCDs are significantly higher among overweight and obese individuals [6,7,16]. The World Health Organization (WHO) recognizes overweight as one of the top of 10 health risks globally and one of the top five in the LMICs [17]. During past few decades, Bangladesh has been experiencing a rising prevalence of overweight which has been reported to be due to steady growth in disposable income in parallel with rapid urbanization, emerging middle class, and certain dietary and nutritional transition [9]. Combined prevalence of adult overweight and obesity among men and women has increased by five times since the early 1990s (3.66% in 1992 to 16.94% in 2011) [13]. Similar to other south Asian societies, women in Bangladesh are especially susceptible to exposure to obesogenic factors such as lower rates of literacy and outdoor employment, fewer opportunities for physical activity, and lack of power to make own health decisions due to traditional sociocultural circumstances. Owing to their lower socioeconomic position, the consequences of NCDs are more profound among women which adversely affect their health-related quality of life (HRQoL) and social wellbeing (SWB) with certain impacts on their children. Not surprisingly, several studies found that the prevalence of overweight, obesity and HBP were noticeably higher among women [15,18]. While there exists several studies exploring the risk factors of diabetes and HBP in the general population, none of them focused on the impact of overweight and obesity on NCDs among women. A major constraint for conducting nationally representative clinical studies in Bangladesh is the lack of adequate research infrastructure. However, the 2011 Bangladesh Demographic and Health Survey (BDHS) included blood pressure and hematological parameters for the first time which is crucial for understanding the situation NCDs in the country. Therefore, in this study we used data from BDHS 2011 survey with the aim to investigate the association between BMI and diabetes, HBP and diabetes-HBP comorbidity among adult women (>34 years) in Bangladesh.

2. Methods

2.1. About the survey, sampling, and data collection

Nationally representative cross-sectional data were collected from Bangladesh Demographic and Health Survey (BDHS) 2011.

BDHS was the sixth survey of its kind conducted in the country, however, the first one to provide BP and diabetes biomarkers. DHS has been operating in the country since 1993 to provide quality information on adult men and women and under-5 children on a wide-ranging topic including demographic, socioeconomic, nutritional, family planning, health service use behaviour. The aim is to help evaluate the health needs of the population and monitoring the progress of public health programs. Data collection for BDHS 2011 lasted from July 8 through December 27 of 2011. The survey was implemented by the joint efforts of National Institute of Population Research and Training (NIPORT), and Mitra and Associates with technical assistance from ICF International (USA), and financial support from the United States Agency for International Development (USAID), Bangladesh.

Sample was selected from both urban and rural areas covering all seven administrative divisions in the country: Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, and Sylhet. The survey employed a special sampling frame by using enumeration areas (EAs), which was a collection of about 120 households [20]. Initially, 600 EAs were selected with the probability proportional to the of EAs. In the second stage, on average 30 households were selected systematically from each EA and finally 17,964 households were selected for interview. However, interviews were successfully completed in 17,141 households (response rate of 98%). More details on the survey and sampling technique are available elsewhere [19,21].

2.2. Variables

Outcome variable: 1. Diabetes (refers to T2DM throughout the manuscript), 2. HBP, and 3. Diabetes-HBP comorbidity.

2.2.1. HBP

HBP was defined as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg. Participants were also inquired if they were told by doctor/nurse of having HBP and if taking any medication for HBP. For BP measurements, BDHS 2011 used WHO recommended LIFE SOURCE[®] UA-767 Plus Blood Pressure Monitor model (clinically validated by the British Hypertension Society (BHS)), which is an automatic device designed to measure blood pressure for small, medium, and large arm circumferences. However, the diagnosis of hypertension is not same as conventional clinical procedure as blood pressure was taken solely on the day of the survey, while clinical diagnosis involves monitored blood pressure over a prolonged period of time. However, three measurements of both systolic and diastolic blood pressure were taken during the survey at approximately 10-min intervals between measurements from which the average of the second and third measurements was used to report final blood pressure values.

2.2.2. Diabetes

Diabetes was defined as fasting plasma glucose value ≥ 7.0 mmol/L. Same as for HBP, participants were inquired if they were told doctor/nurse of having diabetes and if taking any medication for it. BDHS 2011 used HemoCue 201+ blood glucose analyzer to measure blood glucose level. HemoCue[®] (HemoCue Inc., Mission Viejo, CA, USA) is a user-friendly and highly reliable point-of-care testing (POCT) system used to measure glucose levels in whole blood [22]. Micro cuvettes were used to collect capillary whole blood from participants after an overnight fast from the middle or ring fingers treated by proper antiseptic method (cleaned with a swab containing 70% isopropyl alcohol). First two drops of blood were rejected and the third drop.

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