Experimental Gerontology 64 (2015) 70–77

Contents lists available at ScienceDirect

Experimental Gerontology

journal homepage: www.elsevier.com/locate/expgero

Diabetes mellitus and its association with central obesity and disability among older adults: A global perspective

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ARTICLE INFO

Article history:
Received 1 December 2014
Received in revised form 11 February 2015
Accepted 13 February 2015
Available online 16 February 2015

Section Editor: Holly M. Brown-Borg

Keywords:
Diabetes mellitus
Disability
Waist-to-height ratio
Waist circumference
Obesity
Older adults

ABSTRACT

The aim of the study was to evaluate the association between various factors and diabetes type II (DM) with a particular emphasis on indicators of central obesity, and to compare the effect of DM on disability among elder populations (≥50 years old) in nine countries. Data were available for 52,946 people aged ≥18 years who participated in the WHO Study on global AGEing and adult health and the Collaborative Research on Ageing in Europe studies conducted between 2007 and 2012. DM was defined as self-report of physician diagnosis. Height, weight, and waist circumference were measured. Disability status was assessed with the WHODAS II questionnaire. The overall prevalence of DM was 7.9% and ranged from 3.8% (Ghana) to 17.6% (Mexico). A 10 cm increase in waist circumference and waist-to-height ratio of >0.5 were associated with a significant 1.26 (India) to 1.77 (Finland), and 1.68 (China, Spain) to 5.40 (Finland) times higher odds for DM respectively. No significant associations were observed in Mexico and South Africa. DM was associated with significantly higher disability status in all countries except Mexico in the model adjusted for demographics and smoking. The inclusion of chronic conditions associated with diabetes in the model attenuated the coefficients in varying degrees depending on the country. A considerable proportion of the studied older population had DM. Central obesity may be a key factor for the prevention of DM among older populations globally. Prevention of DM especially among the older population globally may contribute to reducing the burden of disability.

1. Introduction

According to the World Health Organization, approximately 347 million people have diabetes mellitus (DM) worldwide and 80% of diabetics live in low- and middle-income countries (WHO, 2013). Results from the World Health Survey (WHS) indicated that the global prevalence of DM is almost 4% in populations 18 years or older (Liu et al., 2012). Prevalence figures of 20% in males and almost 17% in females among adults aged ≥65 years have been reported in the US (SHIELD study), and studies from Europe have reported even higher figures among those in this age group (nearly 30%) (Bays et al., 2007; Tyrovolas et al., 2009). These figures are expected to increase at alarming rates by the year 2025, because of population growth, aging, increase in unhealthy lifestyle patterns (i.e., sedentary life, unhealthy nutrition, etc.), and obesity. DM has been associated with cardiovascular disease (CVD), as well as with blindness, micro- and macro-vascular disease, kidney failure and stroke events (Toutouzas et al., 2005).

In the past years, multiple studies have shown that sociodemographic, bio-clinical, and lifestyle factors (i.e., obesity, physical activity, education, etc.) are related to the development of DM in varying degrees (Wood, 2001; Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, 1997; Pitsavos et al., 2007). Furthermore, global studies have reported that increased body mass index (BMI) is one of the factors most strongly associated with DM (Liu et al., 2012). However, studies have also shown that BMI may be a poorer predictor of mortality and metabolic diseases such as DM, compared to waist circumference or waist-to-height ratio which are considered to be a closer reflection of central obesity (Qiao and

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http://dx.doi.org/10.1016/j.exger.2015.02.010
0531-5565/

Nyamdorj, 2010; Hadaegh et al., 2006; Cai et al, 2013; Schneider et al., 2010). Central obesity (known as accumulated visceral adipose tissue) is strongly related to increased mortality and various clinical conditions (such as insulin resistance, dyslipidemia, and hypertension) (Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, 1997). Recently, one study indicated that the prevalence of central obesity in the older European populations was quite high, close to 40% in males and 60% in females (Saaristo et al., 2008).

To date, global epidemiological data on the role of waist-to-height ratio on DM among older populations are scarce (Liu et al., 2012; Yusuf et al, 2004; Espelt et al., 2013). Furthermore, a few studies on diabetes epidemiology in low- and middle-income countries do exist (Tao et al., 2013; Amoah et al, 2002; Assari, 2014; Assari et al., 2014) but the majority of these studies are small, and do not always include older individuals, or do not follow a common research protocol. Also, despite the fact that DM is related to major causes of disability (Anton et al., 2013), until now, there has been little research on the cross-country differences of the effects of DM on disability especially among older populations (Assari et al, 2014). This is an important research gap as disability is known to be associated with various health deficiencies, quality of life as well as institutionalization, and use of health services (Guralnik et al., 1994; Branch and Jette, 1982).

The Collaborative Research on Ageing in Europe (COURAGE) and WHO Study on global AGEing and adult health (SAGE) studies, from which our data was derived, are among the few large population-based nationally-representative health studies (e.g., WHS study) that apply standard design and survey procedures across all survey populations. Given the rapid increase of DM globally, the metabolic complexity of the disease and its related co-morbidities, as well as the lack of global evidence on the association between DM and disability among older populations, the aim of the present study was to evaluate the association between central obesity including waist circumference, waist-to-height ratio and DM, as well as to assess the effect of DM on disability among older adults (≥50 years old) in nine high-, middle- and low-income countries from Asia, Africa, Europe, and Latin America.

2. Research design and methods

2.1. The SAGE and COURAGE surveys

The SAGE survey was conducted between 2007 and 2010 in China, Ghana, India, Mexico, Russia, and South Africa, and the COURAGE survey was conducted between 2011 and 2012 in Finland, Poland, and Spain. The two surveys followed similar methodologies and used the same standardized questionnaire to collect information on health and well-being among adult non-institutionalized populations. Both studies were population-based household surveys including adults ≥18 years of age, with oversampling of those 50 years or older. Nationally-representative samples, with no replacement, were selected by multi-stage clustered sampling. The response rate ranged from 51% (Mexico) to 93% (China), and 53% (Finland) to 70% (Spain) in the SAGE and COURAGE studies respectively. Trained interviewers collected data through face-to-face interviews. For those who were unable to participate in the survey due to limited cognitive function, information was obtained through a proxy respondent using a shorter questionnaire. These participants were excluded from the current analysis as most information pertaining to the current analysis were not collected.

Sampling weights were generated to adjust for the population structure reported by the United Nations Statistical Division and the census of the National Institute of Statistics for the SAGE and COURAGE respectively. The research review board of each location and the WHO Ethical Review Committee provided ethical approval to conduct the study. Informed consent was obtained from all participants. Further details of the two surveys are provided elsewhere (Basu and Millet, 2013; Perales et al., 2014).

2.1.1. Clinical and anthropometric measures

Height and weight were measured with the use of a stadiometer and a routinely calibrated electronic weighting scale respectively. Waist circumference was measured using an inelastic tape at the navel level, and recorded to the nearest 0.1 cm. Waist-to-height ratio was calculating by dividing the waist circumference (cm) by height (cm), and was dichotomized as ≤0.5 and >0.5 (Browning et al., 2010). BMI was calculated as weight in kilograms divided by height in meters squared. BMI was categorized as the following: <18.5 kg/m^2 (underweight), 18.5–24.9 kg/m^2 (normal weight), 25.0–29.9 kg/m^2 (overweight), 30.0–34.9 kg/m^2 (obesity class I), and ≥35.0 kg/m^2 (obesity class II+). Blood pressure was measured 3 times in the SAGE survey and 2 times in COURAGE survey, with a less than one-minute interval using standard protocols. Mean systolic and diastolic pressure were obtained by calculating the mean of all the available measurements. Hypertension was a dichotomous variable and was defined as at least either one of the following: mean systolic blood pressure ≥ 140 mm Hg, mean diastolic blood pressure ≥ 90 mm Hg, and self-reported medical diagnosis of hypertension. The diagnosis of angina was based on the algorithms of the Rose questionnaire (Rose, 1962) and/or self-reported diagnosis. Depression was based on the algorithms for DSM-IV major depressive disorder and/or self-reported diagnosis. Cataract was defined as having cloudy or blurry vision and vision problems with light, such as glare from bright lights, or halos around lights in the past 12 months and self-reported diagnosis in the past five years. The diagnosis of arthritis, DM, and stroke were based on self-reported diagnosis.

2.1.2. Socio-demographic, dietary and other lifestyle characteristics

Education was based on the highest level of education completed and was categorized as primary or less, secondary, and tertiary or higher. Wealth quintiles were created based on country-specific income. Respondents were also categorized as living in either urban or rural areas. Level of physical activity was assessed with the Global Physical Activity Questionnaire using conventional cut-offs and categorized as low, moderate, and high (http://www.who.int/chp/steps/GPAQ/en/). Information on smoking habits was obtained with two questions: "Have you ever smoked tobacco or used smokeless tobacco?" and "Do you currently use (smoke, sniff or chew) any tobacco products such as cigarettes, cigars, pipes, chewing tobacco or snuff?" Those who answered 'no' to the first question were considered 'never' smokers, and those who answered 'yes' to both questions were considered 'current' smokers. Those who answered 'yes' to the first question but 'no' to the second were categorized as having 'quit'.

2.1.3. Functioning and disability

The 12-item validated version of the World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) was used to assess functioning and disability (Ustün et al., 2010). This scale ranged from 0 (no disability) to 100 (maximum disability).

2.2. Statistical analysis

Data were available for 52,946 individuals. After the exclusion of those aged <50 years, the final analytical sample size was 42,116 (China 13,175, Finland 1452, Ghana 4305, India 6560, Mexico 2313, Poland 2910, Russia 3938, South Africa 3838, Spain 3625). Country-wise analyses were conducted to account for the heterogeneity between countries. Age and sex adjusted, and crude prevalence of DM was calculated. In addition, the age and sex adjusted prevalence of the country-wise highest decile of the WHODAS II score by DM status was calculated. The highest decile of the WHODAS score was used as this cut-off has been suggested to represent significant clinical disability (Andrews et al., 2009). All age and sex adjusted prevalence were calculated using the United Nation population pyramids for the year 2010 (http://esa.un.org/wpp/Excel-Data/population.htm) as the standard population.