10-Year Change in Waist Circumference and Cardiometabolic Profiles of Filipino Women

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Introduction

More than 75% of all deaths worldwide are due to noncommunicable diseases (NCDs) and these deaths are becoming more common in low-and middle-income countries [1]. In the recent report of the World Health Organization, NCDs are estimated to account 67% of the total deaths in the Philippines with the largest percentage from cardiometabolic illnesses [2]. Cardiometabolic diseases involve diseases of the heart and metabolic disorders such as diabetes.

Waist circumference (WC) is correlated with some cardiometabolic disease risk factors, including serum lipid, insulin and glucose levels, blood pressure, and percent body fat [3]. A panel reviewing articles and presentations from experts stated that WC provides a unique indicator of body fat distribution, which can identify patients who are at increased risk of obesity-related cardiometabolic disease, above and beyond the measurement of BMI [4]. In addition, it has been observed that each cm. increase in WC is positively associated with the risk of having hypertension, impaired fasting glucose, or both of these two illnesses after adjusting for possible confounders [5].

The relationships between WC and cardiometabolic diseases are also affected by demographic variables, including sex, race-ethnicity, and age, thus, specific relative risks between WC and these outcomes vary depending on the population sampled and the outcome measured [4].

Although it has been established that WC and some cardio-metabolic components are positively associated, very few studies looked into the effect of its change over time [6]. An example of such study is the analysis of 1,294 women participants of the Cebu Longitudinal Health and Nutrition Survey (CLHNS) wherein elevated systemic inflammation was strongly associated with the history of central adiposity [7].

Longitudinal studies are needed to explain how early nutrition and health and morbidity in adult years are associated or correlated. Results from these studies may help program planners determine target groups for their health programs. The aim of this study therefore is to determine how a 10-year change in WC of 1,794 Filipino women, aged 33-65 years in 2002, affects their cardiometabolic profiles in 2012.

Methodology

Data source: Data from the 2002 and 2012 surveys of the Cebu Longitudinal Health and Nutrition Survey (CLHNS) were used. The CLHNS started in 1983 with a cohort of 3,327 pregnant women in Metropolitan Cebu recruited from 33 randomly selected urban and rural villages. The women were interviewed during their last trimester of pregnancy, three days after they gave birth and every two months thereafter for two years. Subsequent follow-up surveys were conducted in 1991, 1994, 1998, 2002, 2005, 2012 and with an ongoing survey this year 2015. From 1983 to 2012, there were 21 full survey rounds conducted on these women. Adair et. al. [8] has a more detailed description of the CLHNS. Our study is composed of 1,794 nonpregnant women from the 2002 and 2012 surveys who had complete outcome and exposure data.

In this study, the *main outcomes* of interest include the following cardiometabolic disease risks: *total cholesterol*, high density lipoprotein cholesterol (*HDL)*, blood pressure (*BP)*, and *percent body fat* measurements in 2012. Continuous and binary measures of these risk factors were used in the analyses.

Published standard cut-offs [9] were used to categorize women with: *high total cholesterol* defined as having ≥200 mg/dL (5.2 mmol/L) values, *reduced HDL cholesterol* is defined as having a reading of <50 mg/dL (1.29 mmol/L) or taking medication for this lipid abnormality, *high BP* is defined as systolic or diastolic readings with values ≥140 mmHg and/or ≥90 mmHg, respectively or taking medication to lower BP, and lastly, *high percent body fat* with values ≥ 36%%.

Lipid profile values were taken by professional nurses trained to draw capillary blood using a point of care CardioChek Analyzer.

Height of women was measured using SECA stadiometer. The Tanita bioelectrical impedance analysis (BIA) scale was used to measure body composition including body weight, body fat, and total body water among others. A digital OMRON was used to take BP because the use of mercury sphygmomanometer is no longer advised. However, before the field operation, readings taken from OMRON were standardized based on the mercurial sphygmomanometer and were further validated [10]. All measurements were taken three times and the average of the three measurements was used for the analyses.

The *main exposure* variable was the absolute change in WC from 2002 to 2012. WC, the average of 3 measurements (to the nearest 0.1 cm), was taken by placing a plastic girth tape about two inches above the navel, after normal exhalation.

A written informed consent was obtained from the women and they agreed to participate. All protocols on the conduct of the survey were reviewed and approved by the University of North Carolina at Chapel Hill Institutional Review Board.

Regression analyses were adjusted for 2002 women's education, age, number of pregnancies, physical disability, and urbanicity index. The urbanicity index is a measure of the degree of urbanization where the women resided [11]. Continuous and binary measures were used in the analyses using STATA 11.0.

Results

Background characteristics of sample women (Table 1):

From 2002 to 2012, a significant change in the marital status of women was shown. As they grew older, almost 25 percent of them had no co-resident spouse compared to 10 percent in 2002. About three percent went to college in the last ten years. However, there was a decline in labor force participation wherein only six out of ten women were working in 2012 compared to eight out of ten in 2002.

The anthropometric measurements of women increased. In 2012, the mean WC was already above the normal risk cut-point for Asian women (≥80 cm.). On average, WC increased by about 3.6 cm in 10 years. In addition, although total energy intake decreased, their fat intake increased by about three percent.

An increasing trend in smoking was observed and the place of residence was becoming more urban in the ten-year period (2012-2002).

Table 1. Background characteristics of women in 2002 and 2012 (N=1,794)

Characteristics	Year	
	2002	2012
Socio-economic and demographic		
Age, mean (SD)	45.2 (6.2)	55.1 (6.0)
Married, %	89.6	75.1
With college education, %	10.4	13.4
Working, %	85.4	65.9
Total pregnancy, mean (SD)	6.5 (3.0)	6.6 (3.1)
Anthropometry/Body composition		
WC, mean (SD)	78.4 (9.6)	82.0 (11.5)
10-yr WC change, mean (SD)		3.6 (6.6)
Weight, mean (SD)	55.2 (10.6)	56.3 (11.6)
Height, mean (SD)	150.7 (6.2)	150.4 (5.0)
BMI, mean (SD)	24.3 (4.2)	24.8 (4.7)
Nutritional intake		
Total energy intake, kcal, mean (SD)	1268.7 (614.3)	1163.8 (577.7)
% fat intake, mean (SD)	14.7 (4.9)	17.7 (10.2)
Lifestyle		
Current smoker, %	14.0	27.6
Current drinker, %	40.4	46.0
Community		
Urbanicity	41.2 (14.2)	44.0 (12.6)

Self-reported Morbidity Profile (Table 2):

For each survey round, women's self-report on morbidity status was obtained. The prevalence of reported diabetes and high blood pressure among them increased in the 10-year period. Both cardiometabolic diseases more than doubled since 2002.

Table 2. Percent of women by self-reported morbidity status in 2002 and 2012

Morbidity	Year	
	2002	2012
Diabetes	2.9	9.8
Heart disease	8.4	6.6
Cancer	0.2	0.6
Tuberculosis	0.6	1.2
Hypertensive	14.6	32.6
Goiter	4.4	4.5
Anemia	6.8	4.8
Hepatitis	0.1	0.2
Arthritis	21.8	38.5
Urinary tract infection	7.0	13.8

Cardiometabolic disease risks profile (Table 3):

In 2012, majority of the women (94.4%) had at least one of the selected cardiometabolic disease risks. Almost half had high total cholesterol readings (≥200 mg/dL), and about 7 out of 10 had low HDL readings. Moreover, 4 out of 10 had high BP, and more than half with WC measurements ≥ 80 cm, which is above the cut-points for Asian women.

Table 3. Percent of women with selected CMD risk factors, 2012

Risks	All women
High cholesterol reading	47.2
Reduced HDL	69.2
High waist circumference	56.0
High BP	40.6
High percent body fat	43.8

Association between 10-year change in WC and selected cardiometabolic disease risk factors:

Shown in **Table 4**, the women's change in WC measurements from 2002 to 2012 was positively associated with cardiometabolic disease risk factors in 2012. A centimeter increase in WC in the ten-year period was positively associated with total cholesterol, diastolic BP, and percent body fat (1.07, 0.20, and 0.57 respectively). After adjusting for confounders, the association between WC and total cholesterol, WC and percent body fat slightly attenuated but those of WC and BP measures slightly increased.

To determine if the magnitude of effect of change in WC is the same for all cardiometabolic disease risks, regression analyses using *z*-scores for all outcomes were performed **(Table 5)**. Higher coefficient was observed in percent body fat compared to TC reading and BP measures (0.07 and 0.02 respectively).

Furthermore, for binary outcomes adjusted for women's selected characteristics in 2002, results showed that increase in WC is associated with elevated TC, low HDL-C, high BP, and greater percent body fat **(Table 6)**.

Table 4. Estimated effects of 10-yr change in WC on selected cardiometabolic disease risk factors of women

	Cardiometabolic disease risk factors, 2012 β (95% CI)				
WC change	Total cholesterol	HDL-C reading	BP systolic	BP diastolic	Percent body fat
Unadjusted	1.07* (0.71, 1.42)	0.00 (-0.11, 0.11)	0.12 (-0.05,0.29)	0.20* (0.11, 0.29)	0.57* (0.53, 0.62)
Adjusted**	0.99* (0.63, 1.36)	-0.03 (-0.15, 0.08)	0.23* (0.06,0.40)	0.22* (0.13, 0.31)	0.52* (0.48,0.57)

**P* value <0.01
**Adjusted for 2002 women's education, age, number of pregnancies, physical disability, and urbanicity index

Table 5. Estimated effects of 10-yr change in WC on selected cardiometabolic disease risk factors of women (standardized)

	Cardiometabolic disease risk factors (z-scores), 2012 β (95% CI)				
WC change	Total cholesterol	HDL-C reading	BP systolic	BP diastolic	Percent body fat
Unadjusted	0.02* (0.01, 0.03)	0.00 (-0.01, 0.01)	0.01 (-0.00,0.01)	0.02* (0.01, 0.02)	0.08* (0.07, 0.08)
Adjusted**	0.02* (0.01, 0.03)	-0.00 (-0.01, 0.01)	0.01* (0.00,0.02)	0.02* (0.01, 0.02)	0.07* (0.06,0.07)

**P* value <0.01
**Adjusted for 2002 women's education, age, number of pregnancies, physical disability, and urbanicity index

Table 6. Estimated effects of 10-yr change in WC on selected cardiometabolic disease risk factors of women (binary outcomes)

WC change	Cardiometabolic disease risk factors, 2012 β (95% CI)				
	High TC	Low HDL-C	High BP systolic	High BP diastolic	High % body fat
Unadjusted	1.04* (1.02,1.05)	1.01 (1.00,1.03)	1.02 (1.00,1.03)	1.02 (1.00,1.04)	1.17* (1.15,1.19)
Adjusted**	1.03* (1.02,1.05)	1.02* (1.00,1.04)	1.02* (1.01,1.04)	1.02* (1.00-1.05)	1.16* (1.14,1.18)

**P* value <0.01

**Adjusted for 2002 women's education, age, number of pregnancies, physical disability, and urbanicity index

Summary and Discussion

In 2012, the women in this study were 43-75 years of age and less had spouse co-residing with them compared to 2002. About 3 out of 10 stayed in households with no spouse and the major reason was widowhood. This scenario coincides with the result of the 2010 national census of population and housing wherein among persons aged 60 years old and over, a higher proportion are females (55.8 percent) [12].

Based on self-reported morbidity status, the prevalence of diabetes and hypertension considerably increased within the 10-year period. The number with diabetes increased four-fold while those who were hypertensive more than doubled.

A 4-point increase in urbanicity index was observed reflecting the increasing urbanization of the communities where our sample women resided. Lifestyle and other environmental factors associated with increased urbanization may contribute to the increased cardiometabolic risks of the population. A study between urban and rural population revealed that elevated triglycerides, low HDL, cholesterol and overall obesity were more prevalent in the former population than in the latter [13]. Moreover, it is quite alarming that the proportion of women who were smoking considerably increased. Smoking is a known cardiometabolic risk factor [14].

From 2002 to 2012, WC increased by almost 4 cm, on average. The estimated effects of 10-year change in WC on selected cardiometabolic disease risk factors showed significant positive association. Taking into account the women's 2002 characteristics, an increased WC was associated with adverse cardiometabolic characteristics i.e. elevated total cholesterol readings, high diastolic and systolic BP measurements, and greater percentage body fat. These therefore support the findings from a cross-sectional study conducted on the same group of women in 2005 wherein a cm. increase in WC has a positive association on the risk of having hypertension and pre-diabetes [5].

Reduction of these disease risk factors may have biological implication and health benefits. Medical studies have demonstrated that a substantial reduction in cholesterol levels within the optimal values through cholesterol-lowering drugs provides superior efficacy for atherosclerosis regression and may provide enhanced reduction in clinical coronary event cases [15]. Moreover, a multifactorial risk reduction strategy targeting each risk factor and emphasizing both lifestyle and pharmacologic therapy is also recommended in individuals with cardiometabolic risks [16]. Some studies also confirmed that a drop in systolic pressure of 20 mmHg, and a 10-point decline in diastolic pressure reduced the risk of strokes, coronary artery disease and other vascular problems by more than 50 percent [17].

The Philippines, like most developing countries, is undergoing epidemiological transition wherein acute infectious diseases are reduced and chronic noncommunicable diseases are increased, thus causing a gradual shift in the age pattern of mortality from younger to older ages [18,19]. Heart and vascular diseases are ranked first and second leading causes of death in the country. Alarmingly, lifestyle-related risk factors like smoking, sedentary physical activity, and consequently increased body fat have been in the rise [14]. Coupled with demographic changes wherein there is an increasing proportion and number of older persons, a continued rise in the cardiovascular disease burden can be expected in the country. Thus, policy makers and program planners need to strengthen evidence-based initiatives designed to prevent cardiovascular disease risks, including the prevention of increased WC.

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