HHS Public Access

Author manuscript

JAMA. Author manuscript; available in PMC 2015 October 16.

Published in final edited form as:

JAMA. 2014 September 17; 312(11): 1151–1153. doi:10.1001/jama.2014.8362.

Trends in Mean Waist Circumference and Abdominal Obesity Among US Adults, 1999-2012

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Waist circumference is a simple and valuable anthropometric measure of total and intra-abdominal body fat.[1] The clinical guidelines from the National Heart, Lung, and Blood Institute on the identification, evaluation, and treatment of overweight and obesity in adults recommend that clinicians assess waist circumference of their patients.[2] Although the prevalence of abdominal obesity has increased in the United States through 2008,[3] its trend in recent years is unknown. Therefore, our objective was to provide recent information about the trends in mean waist circumference and prevalence of abdominal obesity among adults in the United States from 1999 to 2012.

Methods

We used data from seven 2-year cycles of the National Health and Nutrition Examination Survey (NHANES) starting with 1999-2000 and concluding with 2011-2012.[4] NHANES is a national health survey of the civilian non institutionalized US population in which a sample is selected by using a complex, multistage, probability sampling design. The examination response rates across the survey cycles ranged from 69.5% to 79.6%. The surveys received institutional review board approval and participants provided written informed consent.

In the mobile examination center, the waist circumference of participants was measured just above the iliac crest to thenearest1 mm using a steel measuring tape. Abdominal obesity was defined as a waist circumference greater than 102 cm in men and greater than 88 cm in women.[2]

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Author Contributions: Dr Ford had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Ford, Maynard.

Acquisition, analysis, or interpretation of data: All authors.

Drafting of the manuscript: Ford.

Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Ford.

Administrative, technical, or material support: Maynard.

Study supervision: Ford.

Conflict of Interest Disclosures: The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none were reported.

Disclaimer: The findings and conclusions reported in this article are those of the authors and do not necessarily represent the official position of the US Centers for Disease Control and Prevention.

Because the unadjusted and age-adjusted results were similar, we report only the latter. Tests for linear trend were conducted using orthogonal polynomial coefficients. Analyses, which take into account the complex sampling design of the surveys, were conducted using SAS version 9.3 (SAS Institute Inc) and SUDAAN version 11.0.0 (Research Triangle Institute) software. Two-sided $P < .05$ was considered statistically significant.

Results

Data from 32 816 men and nonpregnant women aged 20 years or older were analyzed. The overall age-adjusted mean waist circumference increased progressively and significantly from 95.5 cm (95% CI, 94.2-96.8 cm) in 1999-2000 to 98.5 cm (95% CI, 97.5-99.4 cm) in 2011-2012 (Table 1). Significant increases occurred in men, women, non-Hispanic whites, non-Hispanic blacks, and Mexican Americans.

Particularly large increases between the first and last surveys were observed in non-Hispanic white women aged 40 to 49 years (6.6 cm), non-Hispanic black men aged 30 to 39 years (8.1 cm), Mexican American men aged 20 to 29 years (8.7 cm), Mexican American women aged 70 years or older (11.2cm), and non-Hispanic black women aged 30 to 39 years (11.6 cm).When limited to the period from 2003 to 2012, during which levels of general obesity plateaued, significant increases in mean waist circumference were still noted among all adults ($P = .02$ for linear trend), women ($P \leq .01$ for linear trend), non-Hispanic blacks ($P = .02$ for linear trend), and Mexican Americans ($P = .01$ for linear trend).

The overall age-adjusted prevalence of abdominal obesity increased significantly from 46.4% (95% CI, 42.1%-50.8%) in 1999-2000 to 54.2% (95% CI, 51.3%-57.0%) in 2011-2012 (Table 2). Significant increases were present in men, women, non-Hispanic whites, non-Hispanic blacks, and Mexican Americans.

Discussion

Previous analyses of data from NHANES show that the prevalence of obesity calculated from body mass index (BMI) did not change significantly from 2003-2004 to 2011-2012.[5] Positive developments in energy expenditure and intake have given hope that the decades-long increase in the prevalence of obesity in the United States may have crested.

In contrast, our analyses using data from the same surveys indicate that the prevalence of abdominal obesity is still increasing. The reasons for increases in waist circumference in excess of what would be expected from changes in BMI remain speculative, but several factors, including sleep deprivation, endocrine disruptors, and certain medications, have been proposed as potential explanations.[6]

Limitations to this analysis include the absence of data for Asians prior to 2011-2012, specific Asian populations, and specific Hispanic populations. Because of the nature of the sampling design, institutionalized adults were not included in the surveys.

At a time when the prevalence of obesity may have reached a plateau, the waistlines of US adults continue to expand. Our results support the routine measurement of waist

circumference in clinical care consistent with current recommendations as a key step in initiating the prevention, control, and management of obesity among patients.[2]

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Table 1

Age-Adjusted Waist Circumference Among Adults in the National Health and Nutrition Examination Survey 1999-2012[a]

	Mean Waist Circumference (95% CI), cm						
	1999-2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2011-2012[b]
Overall	95.5 (94.2-96.8)	95.9 (95.3-96.6)	97.2 (96.4-97.9)	97.3 (96.2-98.5)	97.7 (96.9-98.5)	97.9 (97.2-98.7)	98.5 (97.5-99.4)
Men	99.0 (97.9-100.2)	99.4 (98.7-100.2)	100.5 (99.8-101.1)	101.3 (100.2-102.5)	100.9 (100.0-101.8)	100.9 (99.8-102.0)	101.0 (100.1-102.0)
Women	92.2 (90.5-93.9)	92.6 (91.8-93.5)	94.0 (93.0-95.1)	93.6 (92.2-94.9)	94.8 (93.8-95.8)	95.1 (94.3-95.9)	96.0 (95.0-97.1)
Non-Hispanic white[c]	95.5 (93.9-97.0)	96.1 (95.3-97.0)	97.2 (96.3-98.1)	97.4 (96.1-98.7)	97.9 (96.7-99.0)	97.9 (97.1-98.8)	98.6 (97.4-99.7)
Men	99.8 (98.6-101.0)	100.5 (99.5-101.6)	101.4 (100.6-102.2)	102.0 (100.9-103.2)	101.9 (100.9-102.8)	101.7 (100.4-103.0)	101.6 (100.5-102.8)
Women	91.2 (89.1-93.3)	91.8 (90.7-92.9)	93.1 (91.7-94.6)	93.0 (91.3-94.6)	94.2 (92.5-95.9)	94.3 (93.3-95.3)	95.6 (94.1-97.0)
Non-Hispanic black[c]	96.9 (95.7-98.1)	96.4 (95.1-97.8)	99.1 (97.8-100.5)	98.9 (97.9-100.0)	99.2 (98.1-100.3)	100.2 (98.9-101.6)	100.9 (99.8-101.9)
Men	95.2 (94.2-96.2)	95.8 (94.6-97.0)	98.1 (96.1-100.1)	99.3 (97.7-100.8)	98.3 (97.0-99.7)	99.2 (97.9-100.5)	99.6 (98.3-100.9)
Women	98.4 (96.4-100.3)	97.1 (94.9-99.3)	100.0 (98.3-101.7)	98.6 (97.4-99.8)	100.1 (98.4-101.8)	101.2 (99.2-103.2)	102.0 (100.8-103.2)
Mexican American[c]	96.1 (94.8-97.3)	96.3 (95.3-97.3)	98.3 (96.8-99.7)	97.5 (96.4-98.6)	99.2 (98.1-100.3)	99.4 (98.2-100.5)	100.6 (99.0-102.3)
Men	98.6 (97.6-99.7)	98.1 (97.2-99.0)	99.1 (97.4-100.8)	98.8 (97.0-100.6)	101.4 (99.5-103.3)	100.8 (99.4-102.3)	101.7 (99.3-104.1)
Women	93.3 (90.9-95.8)	94.4 (92.6-96.2)	97.3 (95.2-99.5)	96.0 (94.8-97.3)	96.8 (95.8-97.8)	97.9 (96.8-99.0)	99.2 (97.1-101.3)

[a] Age adjustment was performed using the direct method using the projected year 2000 US population aged 20 years or older. $P < .001$ for linear trend for all groups except non-Hispanic whites ($P \leq .01$ for trend) and non-Hispanic white men ($P = .01$ for trend).

[b] During 2011-2012, the age-adjusted mean waist circumference was 87.4 cm (95% CI, 86.4-88.4 cm) for all Asian participants, 90.2 cm (95% CI, 89.0-91.3 cm) for Asian men, and 84.9 cm (95% CI, 83.6-86.1 cm) for Asian women.

[c] Race and ethnicity were self-reported (fixed categories were presented to participants).

JAMA. Author manuscript; available in PMC 2015 October 16.

Table 2

Age-Adjusted Prevalence of Abdominal Obesity Among Adults Using National Institutes of Health Criteria and the National Health and Nutrition Examination Survey 1999-2012[a]

	Prevalence of Abdominal Obesity (95% CI), %						
	1999-2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010	2011-2012[b]
Overall	46.4 (42.1-50.8)	48.4 (46.9-49.9)	52.1 (49.8-54.5)	51.6 (48.6-54.7)	52.7 (50.1-55.2)	52.8 (50.4-55.3)	54.2 (51.3-57.0)
Men	37.1 (33.0-41.5)	39.1 (37.1-41.1)	42.5 (40.3-44.7)	44.8 (41.3-48.5)	43.4 (40.4-46.5)	43.0 (39.8-46.3)	43.5 (41.0-46.1)
Women	55.4 (50.6-60.0)	57.1 (54.7-59.5)	61.3 (57.9-64.6)	58.2 (55.0-61.4)	61.6 (58.5-64.6)	62.3 (59.9-64.7)	64.7 (60.9-68.3)
Non-Hispanic white[c]	45.8 (40.7-51.0)	48.4 (46.6-50.2)	51.8 (48.6-54.9)	51.2 (47.6-54.7)	53.3 (49.9-56.7)	52.3 (49.5-55.2)	53.8 (49.9-57.6)
Men	38.6 (34.0-43.4)	42.4 (40.0-44.9)	45.1 (42.4-47.8)	46.2 (42.6-49.8)	46.6 (43.1-50.1)	45.3 (41.3-49.4)	44.5 (41.7-47.4)
Women	52.9 (46.9-58.9)	54.1 (51.3-56.8)	57.9 (52.8-62.8)	56.3 (52.0-60.5)	59.7 (55.0-64.2)	59.3 (56.4-62.0)	63.3 (57.7-68.5)
Non-Hispanic black[c]	52.4 (49.4-55.3)	52.3 (49.5-55.0)	57.5 (55.1-59.8)	57.1 (54.4-59.7)	57.4 (55.0-59.8)	60.2 (55.8-64.4)	60.9 (58.5-63.3)
Men	31.5 (28.3-34.8)	30.6 (26.9-34.6)	35.1 (29.9-40.7)	40.0 (35.2-45.1)	38.9 (35.0-42.9)	39.5 (35.9-43.2)	41.5 (38.0-45.0)
Women	69.7 (65.3-73.8)	70.1 (65.3-74.4)	75.7 (71.5-79.4)	71.0 (67.3-74.4)	72.3 (68.5-75.8)	77.7 (71.6-82.8)	76.9 (73.3-80.1)
Mexican American[c]	48.1 (44.5-51.8)	49.9 (47.2-52.6)	55.0 (49.9-59.9)	51.4 (48.8-54.0)	55.5 (49.3-61.6)	58.4 (55.6-61.1)	57.4 (52.8-61.9)
Men	35.8 (32.5-39.2)	34.5 (31.1-38.1)	38.0 (30.6-46.0)	34.8 (29.7-40.2)	41.6 (35.2-48.3)	43.4 (38.9-48.0)	43.2 (36.0-50.7)
Women	60.2 (53.3-66.7)	66.9 (61.8-71.6)	73.8 (65.0-81.1)	70.5 (65.4-75.1)	71.0 (66.2-75.5)	75.5 (72.0-78.6)	71.6 (64.6-77.6)

[a] Age adjustment was performed using the direct method using the projected year 2000 US population aged 20 years or older. $P \leq .01$ for linear trend for all groups.

[b] During 2011-2012, the age-adjusted prevalence of abdominal obesity was 24.8% (95% CI, 22.0%-27.7%) for all Asian participants, 14.0% (95% CI, 10.8%-17.9%) for Asian men, and 34.0% (95% CI, 30.7%-37.4%) for Asian women.

[c] Race and ethnicity were self-reported (fixed categories were presented to participants).