

Supplementary Online Content

Neeland IJ, Turer AT, Ayers CR, et al. Dysfunctional adiposity and the risk of prediabetes and type 2 diabetes in obese adults. *JAMA*. doi:10.1001/2012.jama.11132.

eTable 1. Baseline characteristics of obese participants from DHS-1 without type 2 diabetes or cardiovascular disease who did and did not return for the DHS-2 visit

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eFigure. Unadjusted associations of visceral fat mass with incident pre-diabetes or type 2 diabetes stratified by sex, race, BMI category, presence of metabolic syndrome, and weight gain, among those with normal fasting glucose at baseline. Odds ratios represent a 1-standard deviation increment in the log-transformed visceral fat mass variable, which is approximately equal to 1.4 kg

This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Baseline characteristics of obese participants from DHS-1 without type 2 diabetes or cardiovascular disease who did and did not return for the DHS-2 visit

Variable	Participated in DHS-2 (n=732)	Did not participate in DHS-2 (n=345)	P-value
Baseline			
Age (years)	43 (36, 51)	41 (34, 50)	0.03
Male, No. (%)	258 (35.2)	146 (42.3)	0.03
Race, No. (%)			
White	212 (29.0)	83 (24.1)	0.09
Black	395 (54.0)	180 (52.2)	0.58
Hispanic	120 (16.4)	77 (22.3)	0.02
Weight (kg)	98.4 (87.5, 109.8)	98.0 (87.1, 109.3)	0.69
Body Mass Index (kg/m ²)	35.0 (32.0, 38.9)	34.4 (31.8, 38.6)	0.21
Waist Circumference (cm)	109.0 (101.0, 117.5)	108.7 (101.5, 116.5)	0.68
Waist/Hip ratio	0.91 (0.85, 0.98)	0.92 (0.87, 0.98)	0.08
Impaired Fasting Glucose, No. (%)	211 (28.8)	96 (27.8)	0.50
Family History of Diabetes, No. (%)	290 (44.1)	129 (42.6)	0.66
Hypertension, No. (%)	258 (35.8)	132 (38.7)	0.36
Metabolic Syndrome, No. (%)	348 (47.5)	164 (47.5)	1.00
Total Fat Mass (kg)	35.5 (29.2, 43.4)	34.1 (28.0, 42.7)	0.08
Abdominal Visceral Fat (kg)	2.5 (1.9, 3.1)	2.5 (2.0, 3.1)	0.84
Glucose (mg/dL)	93 (87, 101)	93 (85, 100)	0.30
HOMA-IR	4.0 (2.7, 5.8)	4.0 (2.8, 5.8)	0.87
Fructosamine (μmol/L)	200 (189, 212)	200 (189, 212)	0.94
Adiponectin (ng/ml)	5.8 (4.2, 8.4)	5.5 (3.8, 8.1)	0.10
hs-CRP (mg/L)	4.3 (2.1, 9.4)	4.2 (2.0, 9.3)	0.57
Total Cholesterol (mg/dL)	177 (155, 203)	183 (156, 210)	0.15
Triglycerides (mg/dL)	101 (73, 149)	105 (76, 157)	0.19
HDL-C (mg/dL)	46 (39, 54)	45 (37, 53)	0.06

Data are presented as median (25th, 75th percentile) or proportion (%) where appropriate

Abbreviations: HDL-C= high-density lipoprotein cholesterol; HOMA-IR=homeostasis model assessment of insulin resistance; hs-CRP= high-sensitivity C-reactive protein

eTable 2. Characteristics of obese individuals with normal baseline fasting glucose who remained free from pre-diabetes or diabetes, those who developed pre-diabetes, and those who progressed to diabetes at follow-up.

Variable	No Pre-diabetes or Diabetes (n=312)	Incident Pre-diabetes (n=161)	Incident Diabetes (n=39)	P-trend
Baseline				
Age (years)	41 (34, 48)	44 (37, 52)	44 (39, 51)	0.001
Male, No. (%)	76 (24.4)	69 (42.9)	17 (43.6)	<0.001
Race, No. (%)				
White	101 (32.4)	38 (23.6)	9 (23.1)	0.04
Black	164 (52.6)	98 (60.9)	22 (56.4)	0.13
Hispanic	44 (14.1)	24 (14.9)	7 (17.9)	0.60
Weight (kg)	95.3 (86.0, 107.1)	98.4 (88.9, 109.8)	105.2 (89.5, 113.5)	0.02
Body Mass Index (kg/m ²)	34.7 (31.8, 38.2)	35.1 (32.1, 38.5)	35.5 (32.9, 40.9)	0.30
Waist Circumference (cm)	107.3 (98.5, 116.0)	107.5 (101.5, 117.0)	112.0 (104.0, 121.0)	0.006
Waist/Hip ratio	0.88 (0.83, 0.94)	0.93 (0.86, 0.99)	0.95 (0.88, 1.01)	<0.001
Family History of Diabetes, No. (%)	97 (35.1)	71 (48.0)	23 (62.2)	0.001
Hypertension, No. (%)	77 (25.0)	66 (41.5)	19 (50.0)	<0.001
Systolic Blood Pressure (mmHg)	121 (113, 131)	124 (115, 135)	133 (121, 146)	<0.001
Metabolic Syndrome, No. (%)	94 (30.1)	67 (41.6)	15 (38.5)	0.04
Statin Use, No. (%)	11 (3.6)	11 (7.1)	3 (7.9)	0.08
Physical Activity (METs*min/week)	106 (0, 480)	84 (0, 426)	160 (0, 420)	0.94
DEXA Fat Measures				
Total Fat Mass (kg)	36.1 (30.5, 43.4)	34.5 (28.3, 42.4)	36.1 (30.2, 44.8)	0.16
Total Lean Mass (kg)	54.3 (48.8, 64.6)	60.3 (50.8, 69.9)	59.6 (51.7, 72.5)	<0.001
Percent Body Fat (%)	40.8 (34.9, 44.8)	38.5 (29.5, 44.4)	41.7 (29.0, 44.0)	0.01
Lower Body Fat Mass (kg)	13.3 (10.6, 16.5)	12.0 (9.0, 16.3)	11.3 (9.9, 15.4)	0.01
Truncal Fat Mass (kg)	17.7 (14.9, 21.3)	16.9 (14.8, 20.8)	17.8 (16.2, 22.4)	0.76
MRI Fat Measures				
Abdominal Subcutaneous Fat (kg)	6.7 (5.2, 8.7)	6.4 (5, 8)	8.2 (5.6, 9.9)	0.79
Abdominal Visceral Fat (kg)	2.2 (1.7, 2.8)	2.6 (1.9, 3.2)	2.8 (2.2, 3.3)	<0.001
Liver Fat (%)	3.9 (2.7, 6.8)	5.2 (3.3, 9.3)	5.7 (4.6, 11.3)	<0.001
Insulin Resistance				
Glucose (mg/dL)	88 (83, 93)	93 (88, 97)	91 (83, 96)	<0.001
Insulin (μU/mL)	15.0 (9.8, 22.2)	18.0 (13.3, 23.5)	19.9 (13.3, 22.9)	<0.001
HOMA-IR	3.2 (2.1, 4.7)	4.1 (3.0, 5.2)	4.2 (3.0, 5.5)	<0.001
Fructosamine (μmol/L)	195 (187, 207)	201 (189, 216)	205 (190, 214)	<0.001
Adipokines and Other				
Leptin (μg/L)	28.1 (16.4, 40.8)	25.9 (10.8, 42.5)	23.5 (10.1, 38.0)	0.08
Adiponectin (ng/mL)	6.5 (4.6, 9.5)	5.4 (4.1, 7.7)	4.7 (3.9, 8.4)	<0.001
hs-CRP (mg/L)	4.8 (2.2, 10.0)	4.3 (1.9, 11.0)	3.6 (1.7, 9.0)	0.21

eTable 2. Characteristics of obese individuals with normal baseline fasting glucose who remained free from pre-diabetes or diabetes, those who developed pre-diabetes, and those who progressed to diabetes at follow-up (continued).

Variable	No Pre-diabetes or Diabetes (n=312)	Incident Pre-diabetes (n=161)	Incident Diabetes (n=39)	P-trend
<i>Lipids</i>				
Total Cholesterol (mg/dL)	175 (151, 203)	179 (159, 204)	191 (153, 203)	0.16
HDL-C (mg/dL)	47 (40, 57)	45 (39, 54)	48 (40, 54)	0.11
HDL – Large (nmol/L)	6.3 (4.2, 8.8)	5.0 (3.5, 7.4)	5.5 (3.8, 8.1)	0.003
Triglycerides (mg/dL)	95 (69, 135)	109 (74, 155)	107 (85, 157)	0.005
VLDL – Large (nmol/L)	1.7 (0.6, 4.9)	3.1 (0.9, 7.2)	4.2 (0.9, 7.5)	<0.001
LDL-C (mg/dL)	104 (85, 127)	111 (87, 132)	116 (85, 136)	0.24
LDL – Large (nmol/L)	444.3 (328.1, 603.6)	429.1 (295.1, 543.7)	446.4 (340.9, 535.6)	0.32
<i>Cardiac and Vascular MRI Measures</i>				
LV Mass/BSA (g/m ²)	74.8 (66.4, 83.3)	78.6 (69.8, 92.9)	81.2 (73.6, 91.4)	0.001
LV Wall Thickness (mm)	11.2 (10.4, 12.3)	11.9 (10.9, 13.1)	12.4 (11.4, 13.3)	<0.001
Aortic Compliance (ml/mmHg)	26.8 (19.6, 36.1)	23.6 (15.1, 30.0)	22.4 (15.1, 28.5)	<0.001
<i>Subclinical Atherosclerosis</i>				
Coronary Artery Calcium Prevalence, No. (%) ^a	35 (13.2)	28 (19.9)	8 (25.8)	0.04
Aortic Plaque Prevalence, No. (%) ^a	64 (25.0)	45 (36.6)	13 (43.3)	0.02
Aortic Wall Thickness (mm)	1.6 (1.5, 1.8)	1.7 (1.5, 1.9)	1.7 (1.6, 1.9)	0.001
Framingham 10-year CHD Risk Estimate (%)	0 (0-2)	1 (0-5)	2 (1-6)	<0.001
<i>Follow-Up</i>				
Weight (kg)	97.6 (85.3, 109.3)	104.2 (89.2, 117.8)	107.0 (93.9, 126.1)	<0.001
BMI (kg/m ²)	35.2 (31.9, 39.6)	36.5 (33.1, 40.9)	37.0 (34.1, 44.8)	0.001
Waist Circumference (cm)	104.1 (95.3, 113.0)	108.6 (99.1, 119.4)	116.8 (109.2, 127.6)	<0.001
Glucose (mg/dL)	90 (85, 94)	101 (93, 105)	136 (110, 175)	<0.001
Hemoglobin A1C (%)	5.4 (5.1, 5.5)	5.8 (5.5, 6.0)	6.6 (6.2, 7.7)	<0.001
HDL-C (mg/dL)	51 (42, 58)	47 (41, 56)	46 (41, 54)	0.03
Triglycerides (mg/dL)	96 (73, 141)	113 (83, 154)	131 (105, 170)	<0.001
<i>Changes from Baseline</i>				
Weight Change (kg)	1.6 (-4.1, 7.7)	4.5 (-0.5, 10.5)	7.2 (3.5, 17.4)	<0.001
BMI Change (kg/m ²)	0.2 (-1.8, 2.6)	1.3 (-0.6, 2.9)	2.2 (0.1, 5.6)	<0.0001
Waist Circumference Change (cm)	-1.9 (-8.5, 4.1)	-1.0 (-5.3, 5.3)	5.1 (-3.4, 9.8)	0.001
Glucose Change (mg/dL)	1 (-4, 7)	7 (2, 15)	44 (24, 82)	<0.0001
HDL-C Change (mg/dL)	2 (-4, 8)	2 (-6, 7)	0 (-5, 5)	0.14
Triglycerides Change (mg/dL)	6 (-21, 31)	7 (-22, 32)	28 (-16, 62)	0.04

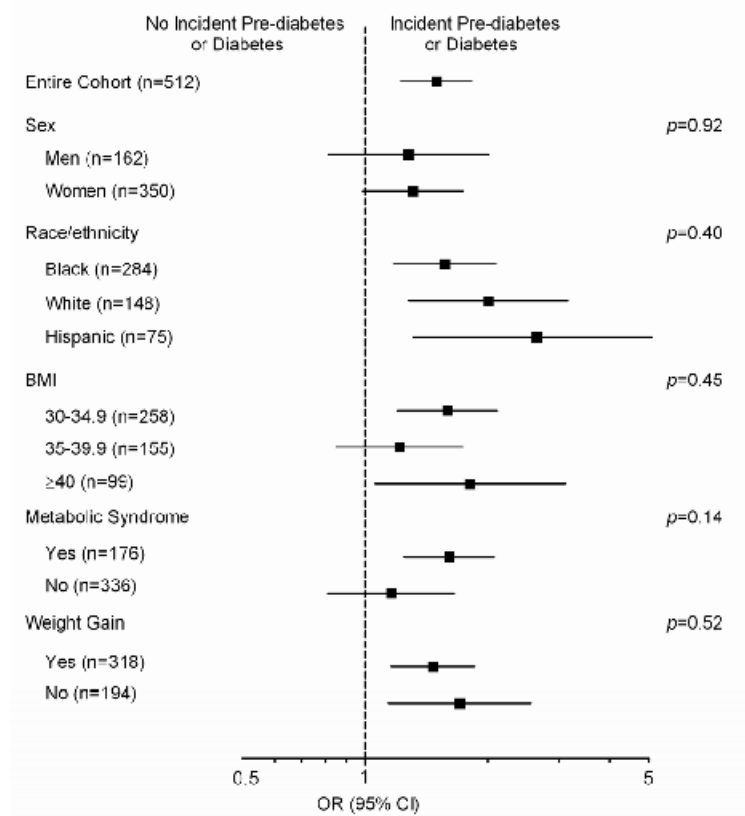
eTable 2. Characteristics of obese individuals with normal baseline fasting glucose who remained free from pre-diabetes or diabetes, those who developed pre-diabetes, and those who progressed to diabetes at follow-up (continued).

Data are presented as median (25th, 75th percentile) or proportion (%) where appropriate

^aSome participants with missing values

Abbreviations: CHD=coronary heart disease; HDL-C= high-density lipoprotein cholesterol; HOMA-IR=homeostasis model assessment of insulin resistance; hs-CRP= high-sensitivity C-reactive protein; LDL-C= low-density lipoprotein cholesterol; LV= left ventricular; METs= metabolic equivalence units; VLDL= very low-density lipoprotein

eFigure. Unadjusted associations of visceral fat mass with incident pre-diabetes or type 2 diabetes stratified by sex, race, BMI category, presence of metabolic syndrome, and weight gain, among those with normal fasting glucose at baseline. Odds ratios represent a 1-standard deviation increment in the log-transformed visceral fat mass variable, which is approximately equal to 1.4 kg.



Odds ratios (OR) represent a 1-standard deviation increment in the log-transformed visceral fat mass variable, which is approximately equal to 1.4 kg.

p -value is for interaction between sub-groups

BMI= body mass index