

# Diet quality is associated with lower visceral and overall adiposity among a multiethnic adult population

## Association between diet quality and visceral adiposity among a multiethnic adult population

Chloe E. Panizza<sup>1</sup>, Michael C. Wong<sup>1</sup>, Nisa Kelly<sup>1</sup>, Yong En Liu<sup>1</sup>, Dylan A. Lowe<sup>2</sup>, Ethan J. Weiss<sup>2</sup>, Steven B. Heymsfield<sup>3</sup>, Samantha Kennedy<sup>3</sup>, Carol J. Boushey<sup>1</sup>, Gertraud Maskarinec<sup>1</sup>, John A. Shepherd<sup>1</sup>.

<sup>1</sup>University of Hawaii Cancer Center, Hawaii, USA. <sup>2</sup>University of California-San Francisco, California, USA.

<sup>3</sup>Pennington Biomedical Research Center, Baton Rouge, USA.

### Background

- Excess visceral adipose tissue (VAT) is associated with chronic diseases<sup>1-3</sup>
- Limited research has explored the relationship between the Healthy Eating Index-2010 (HEI-2010) scores, DXA-based VAT, and overall adiposity among a multiethnic adult population

### Objective

- Examine the association between HEI-2010, DXA-based VAT, overall adiposity, and visual representation (VR) of body shape, among a multiethnic adult population ranging 18-80 yr

### Methods

- Secondary, cross-sectional analysis of Shape Up! Adults Study (NIH R01 DK109008)
- 540 adults (18-80 yr; white, African American, Asian American, Latino, Native Hawaiian or Other Pacific Islander (NHOPI))
- Recruited across three sites (Honolulu County, San Francisco, Baton Rouge)
- Measurements: whole body DXA, anthropometry, questionnaires (food frequency, physical activity, characteristics), 3D optical images of body shape (VR representations)
- Analyses included all participants and stratified by age (18<40, 40<60, 60<80 yr)
- Descriptive statistics and linear models to assess association between HEI-2010 tertiles, VAT, and overall adiposity
- HEI-2010 tertile 1 represented the lowest quality diet group and HEI-2010 tertile 3 the highest
- PCA derived principle components described the variance of body shape in both men and women
- Manifold regression provided VR of body shape for comparison of body shape with the highest and lowest HEI-2010 scores
- Models adjusted for known confounders

### Results

Table 1. Descriptive characteristics

Characteristic	All	18<40 yr	40<60 yr	60<80 yr
N, % <sup>***</sup>	468	196 (41.9)	151 (32.3)	121 (25.9)
Age, yr, mean (± SD) <sup>***</sup>	45.6 ± 16.6	28.7 ± 6.2	50.9 ± 6.2	66.5 ± 4.2
Energy, kcal, median (IQR) <sup>***</sup>	1702 (1237-2452)	1838 (1359-2803)	1717 (1210-2545)	1609 (1005-1963)
VAT, cm <sup>2</sup> , mean (± SD) <sup>***</sup>	92.4 ± 58.5	62.7 ± 38.0	109.4 ± 62.4	119.3 ± 59.8
HEI-2010, mean (± SD) <sup>***</sup>	67.2 ± 11.5	64.9 ± 10.3	66.9 ± 11.5	71.1 ± 12.1
HEI-2010, range	28.9-90.3	30.6-88.8	28.9-86.2	32.4-90.3
HEI-2010 tertile <sup>1</sup>				
Tertile 1 <sup>***</sup>	156 (33.3)	80 (40.8)	44 (29.1)	32 (26.5)
Tertile 2 <sup>***</sup>	156 (33.3)	75 (38.3)	58 (38.4)	23 (19.0)
Tertile 3 <sup>*</sup>	156 (33.3)	41 (20.9)	49 (32.5)	66 (54.5)
Sex				
Men <sup>***</sup>	204 (43.6)	92 (46.9)	60 (39.7)	52 (43.6)
Women <sup>***</sup>	264 (56.4)	104 (53.1)	91 (60.3)	69 (56.4)
Ethnicity				
White	183 (39.1)	71 (36.2)	57 (37.7)	55 (45.5)
Black	126 (26.9)	49 (25.0)	42 (27.8)	35 (28.9)
Asian	109 (23.3)	46 (23.5)	35 (23.2)	28 (23.1)
Latino or NHOPI <sup>***</sup>	50 (10.7)	30 (15.3)	17 (11.3)	3 (2.5)
BMI, kg/m <sup>2</sup>				
<25	194 (41.5)	80 (40.8)	60 (39.7)	54 (44.6)
25<30 <sup>**</sup>	154 (32.9)	69 (35.2)	45 (29.8)	40 (33.1)
≥30 <sup>*</sup>	120 (25.6)	47 (24.0)	46 (30.5)	27 (22.3)

<sup>1</sup>N (% column) for all such values. <sup>\*\*\*</sup>P value < 0.001 for analysis of variance between age groups (18<40, 40<60, 60<80) for quantitative variables and test of proportions for discrete variables. <sup>\*\*</sup>P value < 0.01 for test of proportions between age groups (18<40, 40<60, 60<80). <sup>\*</sup>P value < 0.05 for test of proportions between age groups (18<40, 40<60, 60<80). VAT: visceral adipose tissue; HEI-2010: Healthy Eating Index-2010; NHOPI: Native Hawaiian or Other Pacific Islander

### Results cont.

Table 2. DXA-based body measures by HEI-2010 tertiles and age groups

Body measure	HEI-2010 Tertiles	All (n=468)	18<40 y (n=196)	40<60 y (n=151)	60<80 y (n=121)
VAT (cm <sup>2</sup> ) <sup>1</sup>	T1	101 95-108	68 61.4-74.6	119 104-134	138 120-155
	T2	96 90-102	63 56.0-69.2	117 104-131	117 98-136
	T3	87 80-94	60 51.3-69.5	104 89-118	115 99-131
	P-trend <sup>1</sup>	0.001 <sup>2,3</sup>	0.089	0.100	0.006 <sup>3</sup>
VAT/SAT <sup>1</sup>	T1	0.4 0.3-0.4	0.3 0.2-0.3	0.4 0.4-0.5	0.4 0.4-0.5
	T2	0.4 0.3-0.4	0.3 0.2-0.3	0.4 0.4-0.5	0.4 0.3-0.5
	T3	0.3 0.3-0.4	0.3 0.3-0.4	0.3 0.3-0.4	0.4 0.4-0.5
	P-trend <sup>1</sup>	0.235	0.230	0.008 <sup>2,3</sup>	0.571
Total body fat (kg) <sup>4</sup>	T1	22.9 20.9-24.9	20.1 17.1-23.1	24.3 19.9-28.7	24.6 19.9-29.3
	T2	22.1 20.1-24.0	19.1 16.1-22.1	25.6 21.8-29.4	19.6 14.6-24.6
	T3	18.4 16.3-20.6	15.8 11.7-19.9	20.1 16.1-24.0	19.1 14.9-23.2
	P-trend <sup>1</sup>	0.000 <sup>2,3</sup>	0.033 <sup>3</sup>	0.107 <sup>3</sup>	0.011 <sup>3</sup>

<sup>1</sup>Adjusted for gender, race, physical activity level, age, alcohol, total energy intake, and total body fat. <sup>2</sup>Significant difference by GLM between HEI-2010 tertile 3 and HEI-2010 tertile 2. <sup>3</sup>Significant difference by GLM between HEI-2010 tertile 3 and HEI-2010 tertile 1. <sup>4</sup>Adjusted for gender, race, physical activity level, age, alcohol, and total energy intake. VAT: visceral adipose tissue; SAT: subcutaneous adipose tissue

Figure 1. Visual representation of body shape for women 18-80 yr (n=233)

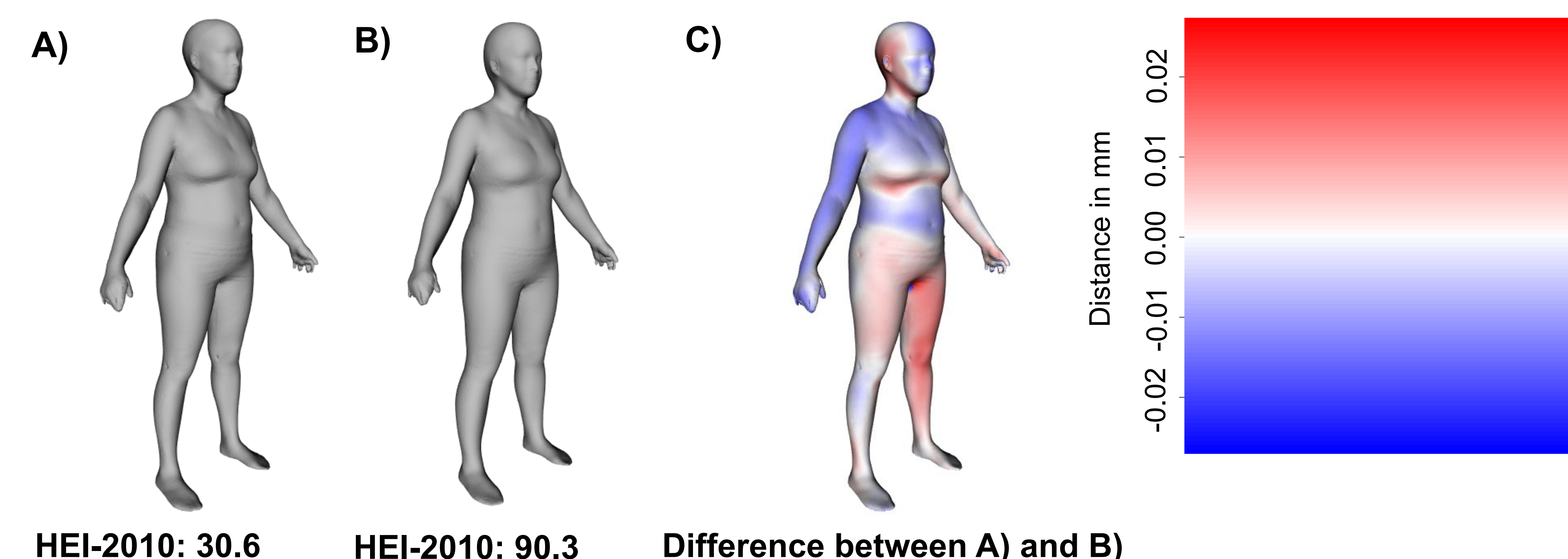
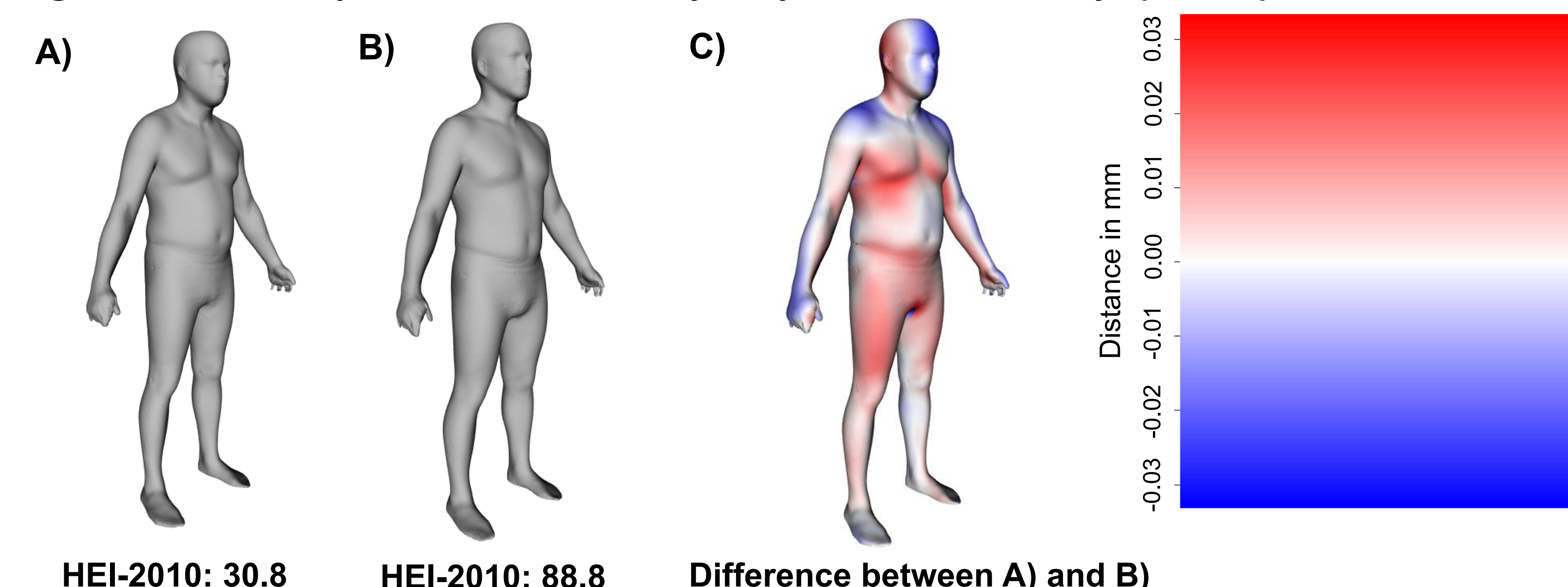


Figure 2. Visual representation of body shape for men 18-80 yr (n=181)



### Conclusion

- Following a higher quality diet is associated with lower VAT and overall obesity
- Following a higher quality diet may help to preferentially promote storage of SAT vs. VAT in adults 40<60 yr and minimize VAT accumulation in adults 60<80 yr
- VR showed lower abdominal adiposity for men and women with the highest vs. lowest HEI-2010 scores

### Supported by

This research was funded by the National Institute of Diabetes and Digestive and Kidney Diseases (NIH R01 DK109008)

### References

- Després, J.-P. Cardiovascular disease under the influence of excess visceral fat. *Crit Pathw Cardiol* 2007;6:51-9.
- Needland, I.J., et al. Dysfunctional adiposity and the risk of prediabetes and type 2 diabetes in obese adults. *JAMA* 2012;308:1150-9.
- Montague, C.T., O'Rahilly, S. The perils of portliness: causes and consequences of visceral adiposity. *Diabetes* 2000;49:883-8.