Dietary Assessment for –omics studies

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Challenges

- Usual intake
- Valid and reliable nutrient intake
- Diverse populations
- Minimize burden
- Minimize cost

Methods

- Diet records
  - Require literacy, cooperation, poor return
- 24 hour recalls
  - Valid but short term measure
  - Multiple measures have high burden
- Food frequency
  - Long term measure of usual intake
  - Use of different forms may bias group comparisons

Validity coefficients for Insulin Resistance Atherosclerosis Study FFQ

	Energy	Tot Fat	Tot CHO	Vit C	Vit E
Urban non-Hispanic White – Oakland, CA	0.61	0.66	0.64	0.50	0.40
Urban African-American – Oakland, CA	0.37	0.59	0.38	0.22	0.24
Rural non-Hispanic White – Colorado	0.56	0.58	0.62	0.62	0.29
Rural Hispanic – Colorado	0.27	0.40	0.25	0.43	0.21

Mayer-Davis et al. *Ann Epidemiol* 1999;9:314–324.

Validity coefficients for the Multiethnic Cohort in Hawaii and Los Angeles FFQ

Men	Energy	Protein	Tot Fat	Fiber	Vit C	Calcium
African Americans	0.16	0.17	0.29	0.36	0.41	0.25
Japanese Americans	0.34	0.31	0.41	0.58	0.67	0.47
Latinos	0.33	0.27	0.33	0.47	0.48	0.34
Whites	0.48	0.51	0.57	0.59	0.63	0.52

Stram et. al. *Am J Epidemiol* 2000. 51:358-70

Validity coefficients for the Multiethnic Cohort in Hawaii and Los Angeles FFQ

Women	Energy	Protein	Tot Fat	Fiber	Vit C	Calcium
African Americans	0.17	0.22	0.24	0.34	0.38	0.33
Japanese Americans	0.19	0.25	0.32	0.56	0.55	0.59
Latinos	0.40	0.35	0.57	0.40	0.30	0.34
Whites	0.28	0.38	0.39	0.46	0.66	0.49

Stram et. al. *Am J Epidemiol* 2000. 51:358-70

Validity coefficients for Block and Harvard FFQs in the WIC Dietary Assessment Valiation Study

		Energy	Protein	Vit A	Vit C	Iron	Calcium
Harvard	African American	0.18	0.22	0.00	-0.36	0.02	0.27
	Hispanic	0.19	0.13	0.40	0.28	0.28	0.18
	White	0.27	0.33	0.28	0.33	0.27	0.40
Block	African American	0.53	0.46	0.28	0.32	0.40	0.46
	Hispanic	0.14	0.09	0.15	0.17	-0.01	0.15
	White	0.44	0.53	0.62	0.20	0.47	0.56

"Hispanic women, however, were substantially more error-prone than the other groups, a difference statistically significant by analysis of variance"

Gladys Block

TUFTS University

FOOD FREQUENCY QUESTIONNAIRE

STUDY NAME:
Please do not write outside the boxed area.

PARTICIPANT NAME:

Please use a number 2 pencil.
Completely fill in bubbles, and erase completely if you make changes.
Do not fold, tear, or staple form.

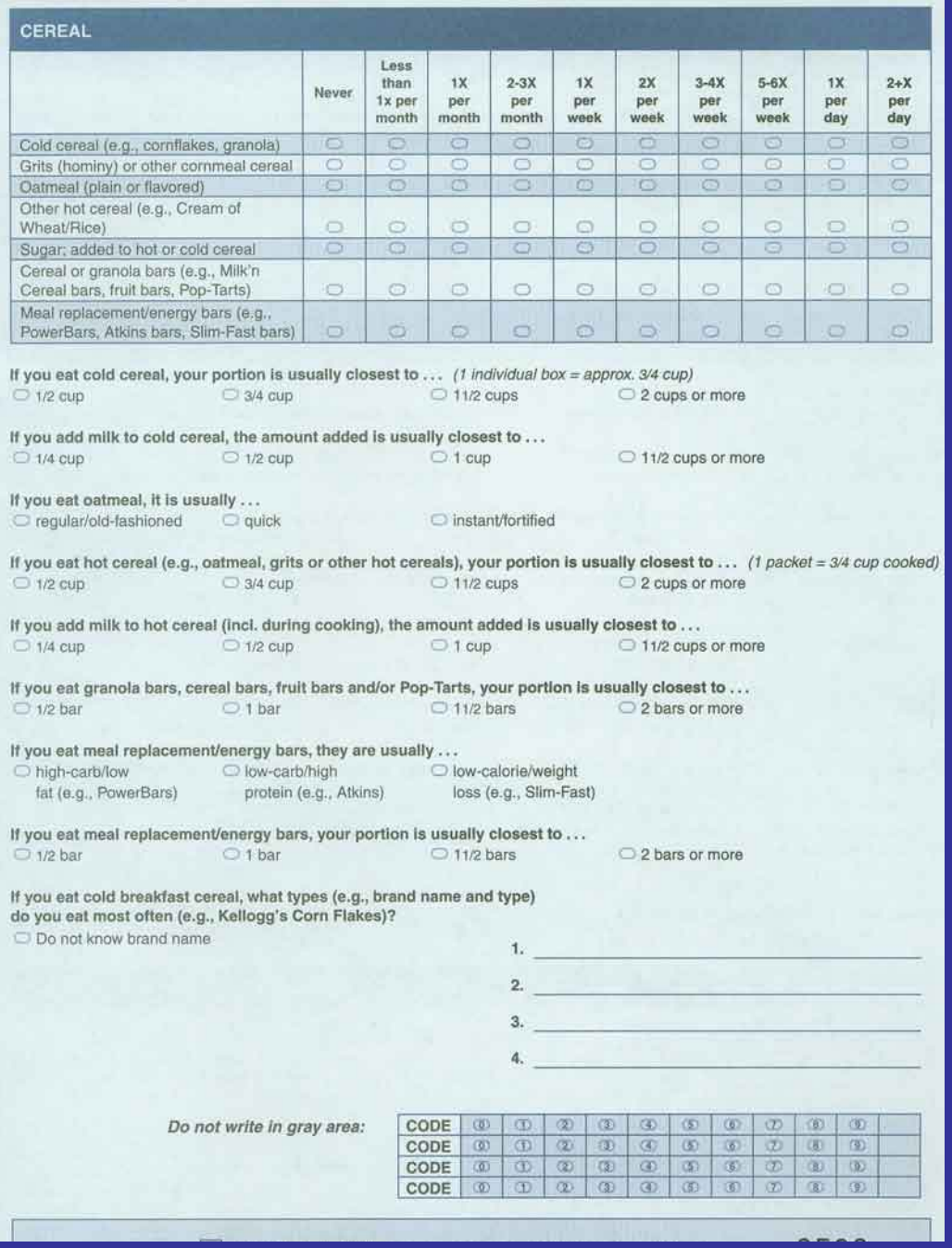
Today's Date			Sex	Protocol Number	Identification Number	Visit Number	Interviewer ID
Mo	Day	Year	○ Male ○ Female				

Age
○ 19 - 30
○ 31 - 50
○ 51 - 70
○ 71 - 80
○ > 80

Dietary Assessment & Epidemiology Research Program
Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University
Version 1/04

0503

Use of FFQs for multi-ethnic populations are currently inadequate and may lead to bias, particularly in comparing across groups and in combining groups in relation to outcomes.



CEREAL

	Never	Less than 1x per month	1X per month	2-3X per month	1X per week	2X per week	3-4X per week	5-6X per week	1X per day	2+X per day
Cold cereal (e.g., cornflakes, granola)	○	○	○	○	○	○	○	○	○	○
Grits (hominy) or other cornmeal cereal	○	○	○	○	○	○	○	○	○	○
Oatmeal (plain or flavored)	○	○	○	○	○	○	○	○	○	○
Other hot cereal (e.g., Cream of Wheat/Rice)	○	○	○	○	○	○	○	○	○	○
Sugar; added to hot or cold cereal	○	○	○	○	○	○	○	○	○	○
Cereal or granola bars (e.g., Milk'n Cereal bars, fruit bars, Pop-Tarts)	○	○	○	○	○	○	○	○	○	○
Meal replacement/energy bars (e.g., PowerBars, Atkins bars, Slim-Fast bars)	○	○	○	○	○	○	○	○	○	○

If you eat cold cereal, your portion is usually closest to ... *(1 individual box = approx. 3/4 cup)*
○ 1/2 cup ○ 3/4 cup ○ 1 1/2 cups ○ 2 cups or more

If you add milk to cold cereal, the amount added is usually closest to ...
○ 1/4 cup ○ 1/2 cup ○ 1 cup ○ 1 1/2 cups or more

If you eat oatmeal, it is usually ...
○ regular/old-fashioned ○ quick ○ instant/fortified

If you eat hot cereal (e.g., oatmeal, grits or other hot cereals), your portion is usually closest to ... *(1 packet = 3/4 cup cooked)*
○ 1/2 cup ○ 3/4 cup ○ 1 1/2 cups ○ 2 cups or more

If you add milk to hot cereal (incl. during cooking), the amount added is usually closest to ...
○ 1/4 cup ○ 1/2 cup ○ 1 cup ○ 1 1/2 cups or more

If you eat granola bars, cereal bars, fruit bars and/or Pop-Tarts, your portion is usually closest to ...
○ 1/2 bar ○ 1 bar ○ 1 1/2 bars ○ 2 bars or more

If you eat meal replacement/energy bars, they are usually ...
○ high-carb/low fat (e.g., PowerBars) ○ low-carb/high protein (e.g., Atkins) ○ low-calorie/weight loss (e.g., Slim-Fast)

If you eat meal replacement/energy bars, your portion is usually closest to ...
○ 1/2 bar ○ 1 bar ○ 1 1/2 bars ○ 2 bars or more

If you eat cold breakfast cereal, what types (e.g., brand name and type) do you eat most often (e.g., Kellogg's Corn Flakes)?
○ Do not know brand name

1. _____
2. _____
3. _____
4. _____

Do not write in gray area:

CODE	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨	
CODE	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨	
CODE	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨	
CODE	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨	

Need more attention to differences in cultural ways of eating

- Ethnic foods
- portion sizes
- recipes and preparation
- fortified foods

SUMMARY

1a. How often do you add salt to your food at the table?
○ never ○ sometimes ○ often/always

2a. If you add spreads or oil during cooking (incl. vegetables, rice, pasta and/or beans), they are usually *(Specify one or two only) . . .*
○ stick margarine ○ lard, salt pork or bacon fat ○ margarine-like ○ canola oil ○ other vegetable oil
○ tub margarine ○ spread, light ○ shortening
○ margarine-like spread ○ butter ○ olive oil ○ corn oil

SUMMARY QUESTIONS *(Please note that the frequency headings are different)*

	Never	Less than 1x per week	1-2X per week	3-4X per week	5-6X per week	1X per day	2X per day	3X per day	4+X per day
3a. Not including lettuce or potatoes, how often do you eat vegetables?	○	○	○	○	○	○	○	○	○
3b. Not including juices, how often do you eat fruit?	○	○	○	○	○	○	○	○	○
3c. How often do you eat out (incl. restaurants, fast food and/or take-out)?	○	○	○	○	○	○	○	○	○

4. Do you follow a specific diet regimen (e.g., kosher, vegetarian)?
○ kosher ○ vegetarian/vegan ○ weight reduction ○ physician-prescribed diet

5. Where do you usually eat breakfast?
○ home ○ work ○ cafeteria ○ fast food chain ○ restaurant

6. Where do you usually eat lunch?
○ home ○ work ○ cafeteria ○ fast food chain ○ restaurant

7. Where do you usually eat dinner?
○ home ○ work ○ cafeteria ○ fast food chain ○ restaurant

8. Are there any other foods you eat at least once per week (not mentioned in the previous sections)? If so, please describe:

1. _____
2. _____
3. _____

Do not write in gray area:

CODE	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨	
CODE	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨	
CODE	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨	

Differences in home prepared foods vs eating out

Types of fat used are particularly important for many –omics studies

Database Food Weights

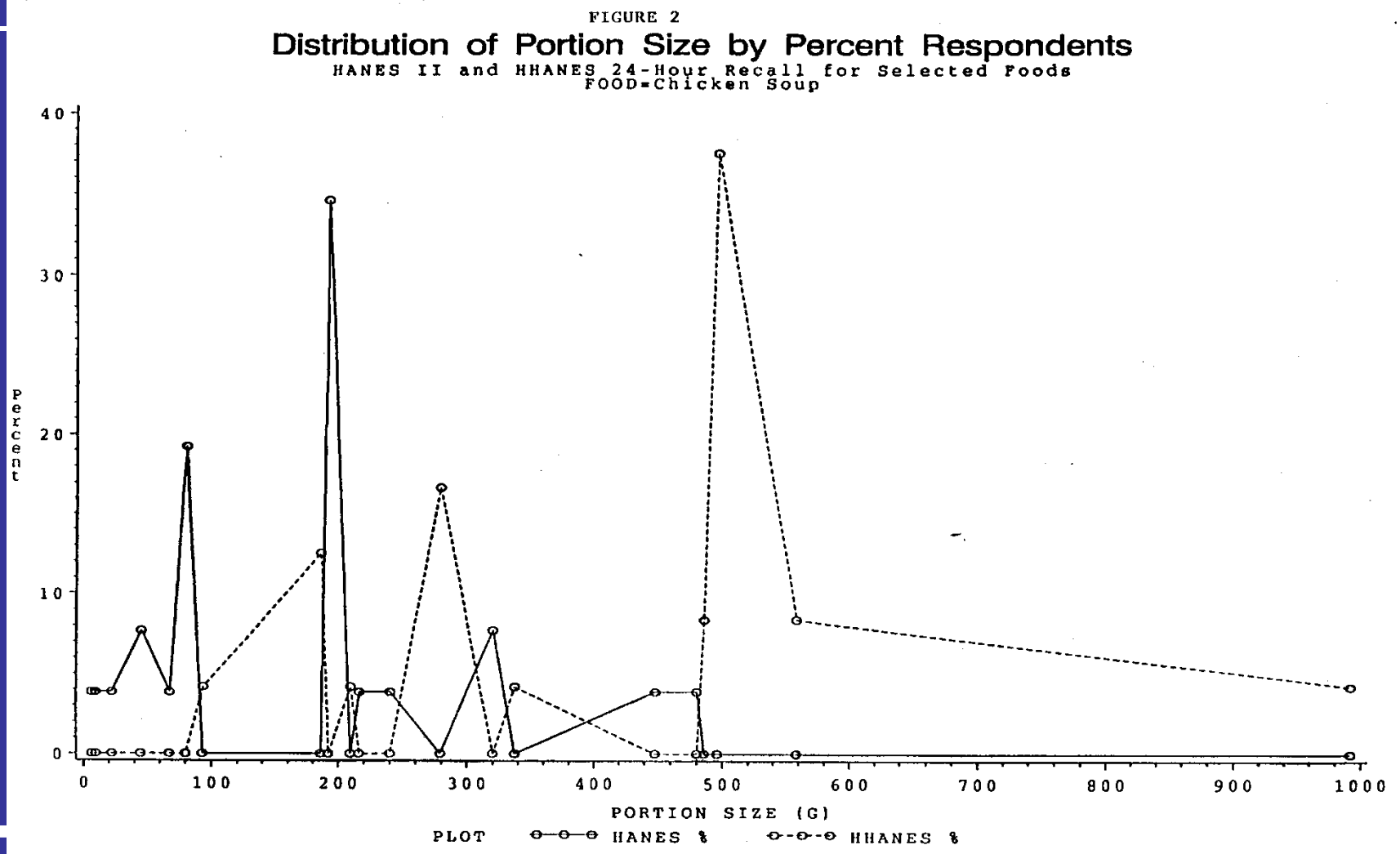
- Original
- Beans
  - Kidney 0.28
  - Pinto 0.26
  - Baked beans 0.26
  - Lima 0.15
  - Lentils 0.05

- Puerto Ricans
- Beans
  - Kidney 0.60
  - Pinto 0.05
  - Pink 0.28
  - White 0.07

Foods Used by Hispanics, Added to the FFQ

- Mango
- Fruit nectar
- Avocado
- Cassava
- Green plantain
- Ripe plantain
- Meat pie, fritter
- Homemade soup
- Custard
- Rice with chicken
- Rice with pigeon peas
- Rice with beans
- Rice with meat

Portion Size: Chicken Soup



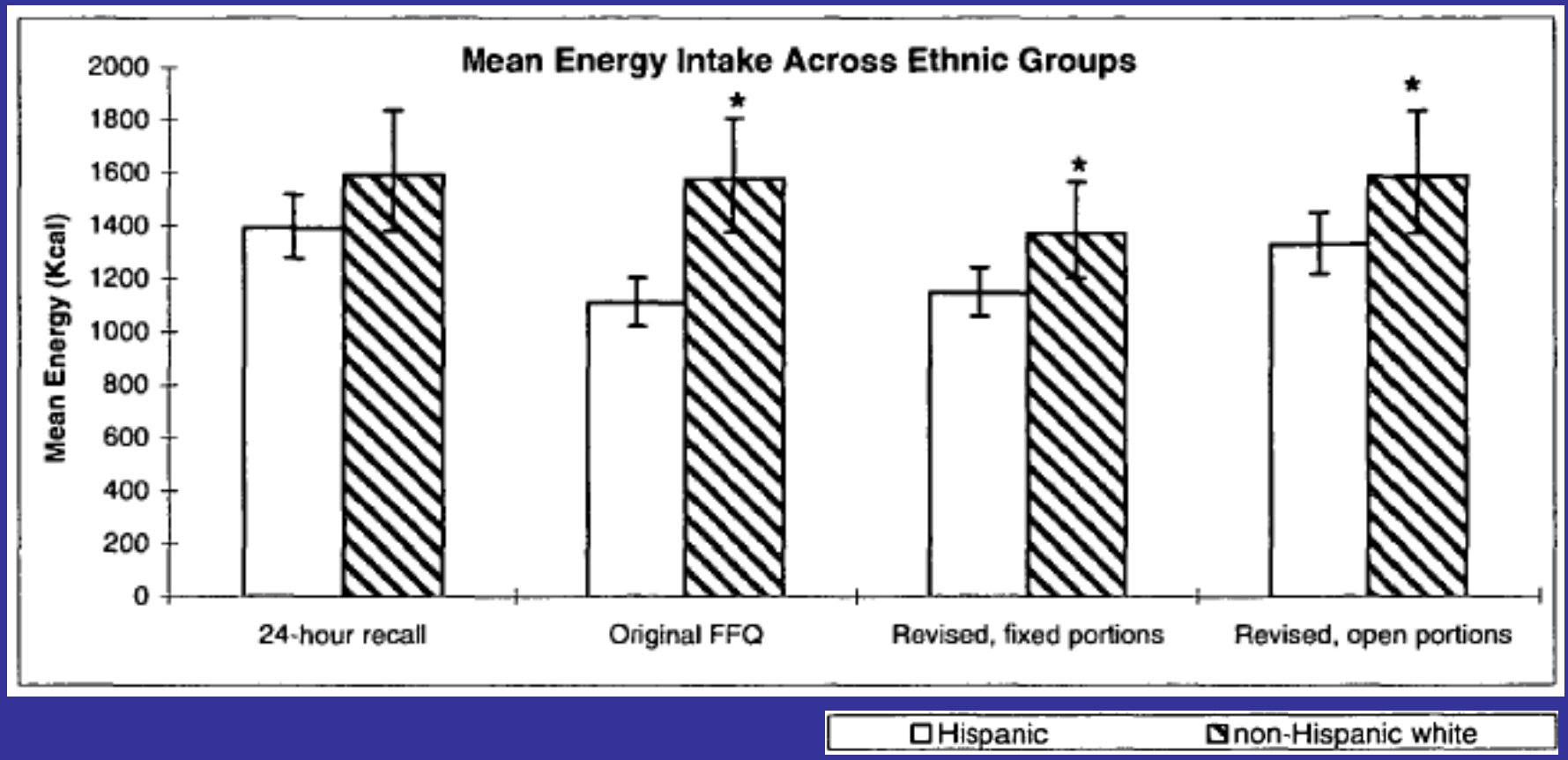
Comparison of mean intakes by differing methods in Hispanic elders

Mean ± SE	24-hr recall	Original FFQ	Revised FFQ	Revised FFQ open portions
Energy (kcal)	1464 ± 64	1163 ± 45****	1202 ± 44****	1409 ± 64
Protein (g)	60.0 ± 3.0	14.6 ± 2.4****	53.5 ± 2.5***	62.0 ± 3.4*
Fat (g)	52.5 ± 2.9	48.7 ± 2.4	43.3 ± 2.1****	51.4 ± 2.9
Carbohydrate (g)	191 ± 8.7	134 ± 5.6****	151 ± 5.6****	176 ± 8.2**
Vitamin A (µg RAE)	732 ± 120	330 ± 44****	454 ± 75****	487 ± 76*
Calcium (mg)	573 ± 31	454 ± 32****	431 ± 26****	549 ± 31**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$, by paired f-test statistics for Ho: mean from food frequency = mean from 24-hour recall. For differences with non-normal distributions, significance levels were determined with the non-parametric sign test.

Tucker et al. *AM J Epidemiol* 1998.148(5)

Mean energy estimates of intake across for Hispanic and non-Hispanic white elders in the North East US



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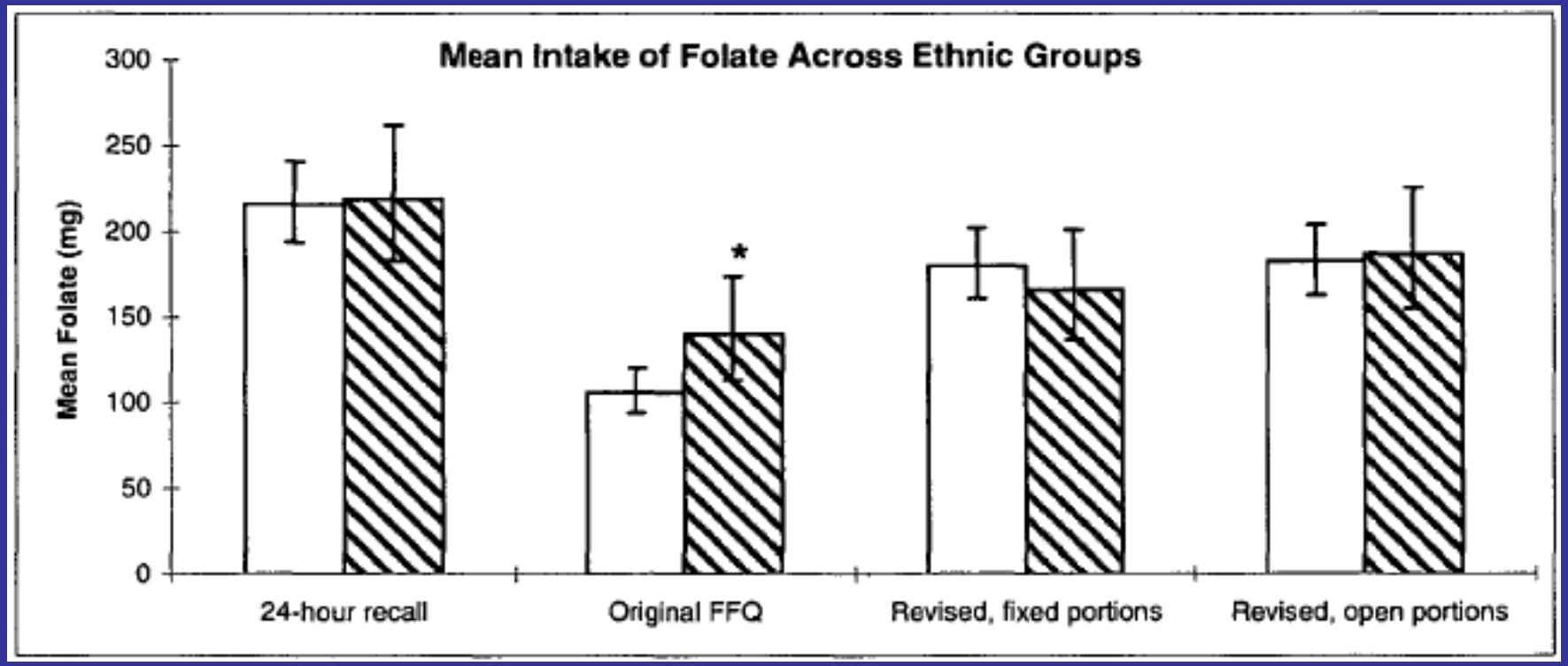
Mean folate estimates of intake across for Hispanic and non-Hispanic white elders in the North East US



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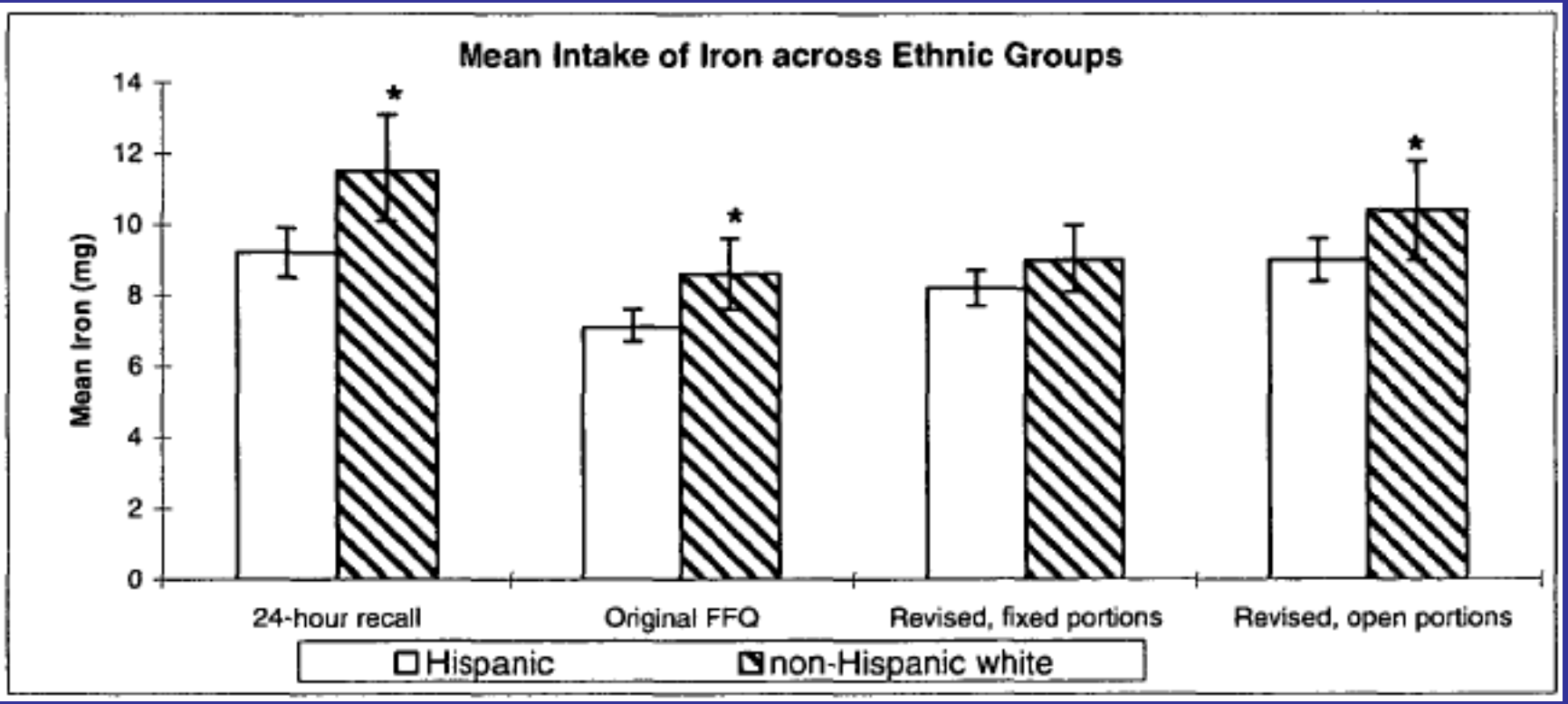


Tucker et al. *AM J Epidemiol* 1998.148(5)

Pearson correlations between FFQ & 24-hr recall in Hispanic elders

	Original FFQ	Revised FFQ	Revised FFQ open portions
Energy (kcal)	0.83	0.89	0.95
Protein (g)	0.80	0.91	0.97
Fat (g)	0.79	0.85	0.87
Carbohydrate (g)	0.76	0.84	0.92
Vitamin A (µg RAE)	0.62	0.83	0.85
Calcium (mg)	0.83	0.86	0.93

Tucker et al. *AM J Epidemiol* 1998.148(5)

Delta NIRI Need for region-specific FFQ

- Widely used FFQs capture foods commonly consumed in the United States
  - Extensive misclassification possible for specific minorities or subgroups
- Foods of Our Delta Study (FOODS 2000)
  - Dietary survey of residents of the Delta region
  - Commissioned by the USDA Delta Nutrition Intervention Research Initiative (Delta NIRI)

Source: Willett, 1984; Champagne, 2004; Tucker, 2005

Portion sizes

- Inclusion of four portion sizes to capture variation reported
- Standard reference amounts used instead of small, medium, large etc.
- Median portion (from FOODS 2000) considered the reference

  1st choice: half of reference

  2nd choice: reference

  3rd choice: 1.5 X reference

  4th choice: 2 X reference

Pearson's correlations for energy & macronutrient intakes between the FFQs & the mean of four 24-hour recalls for the Diet & Physical Activity Sub-Study participants

Nutrient	Men		Women	
	Short FFQ	Long FFQ	Short FFQ	Long FFQ
Energy	0.35	0.32	0.29	0.28
De-attenuated	0.41	0.38	0.33	0.33
Protein				
Energy adjusted	0.31	0.36	0.30	0.41
Energy adjusted & de-attenuated	0.39	0.45	0.37	0.50
Carbohydrate				
Energy adjusted	0.61	0.58	0.38	0.45
Energy adjusted & de-attenuated	0.70	0.67	0.44	0.53
Fat				
Energy adjusted	0.40	0.37	0.32	0.36
Energy adjusted & de-attenuated	0.49	0.46	0.39	0.44

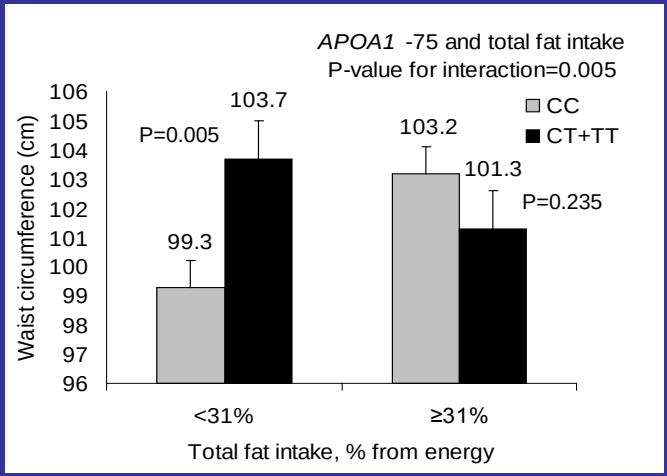
Source: Carithers, T (in review)

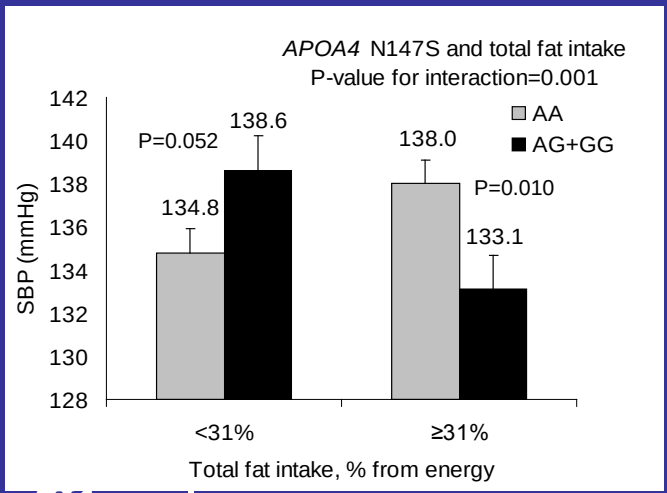
Pearson's correlations for dietary vitamin & mineral intakes between the FFQs & the mean of four 24-hour recalls for the Diet & Physical Activity Sub-Study participants – cont.

Nutrient	Men		Women	
	Short FFQ	Long FFQ	Short FFQ	Long FFQ
Vitamin B12				
Energy adjusted	0.29	0.36	0.18	0.35
Energy adjusted & de-attenuated	0.40	0.49	0.27	0.51
Calcium				
Energy adjusted	0.38	0.45	0.38	0.44
Energy adjusted & de-attenuated	0.48	0.57	0.49	0.56
Iron				
Energy adjusted	0.46	0.59	0.31	0.40
Energy adjusted & de-attenuated	0.57	0.73	0.37	0.49
Potassium				
Energy adjusted	0.30	0.50	0.34	0.49
Energy adjusted & de-attenuated	0.37	0.61	0.40	0.58

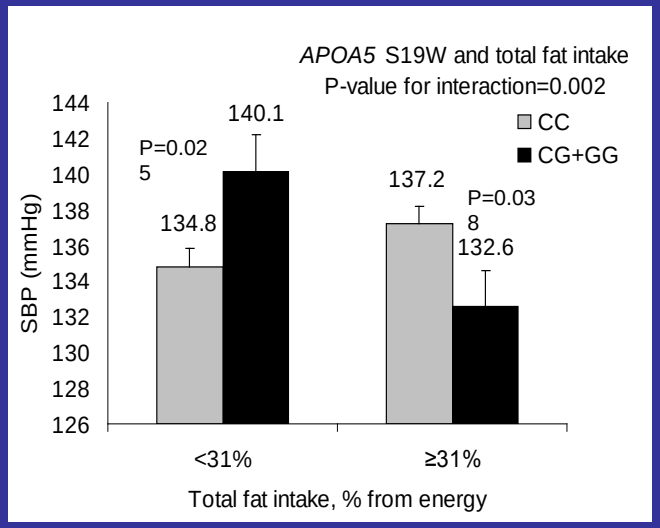
Interaction of SNPs and dietary fat

Josiemer Mattei





Parameters of allostatic load by SNP and total fat intake category (below or above population median)



Close to 70% of this Puerto Rican sample carry each of these common alleles. Thus, observing a diet low in fat may be valuable in maintaining lower SBP and WC in this population

Recalls vs FFQ

- Recalls allow open ended capture of diverse diets
  - But not usual intake
  - Not clear that adjustment for day to day variation will be sufficient for genetic interaction studies as intakes are usually dichotomized
- Currently available FFQs may lead to bias because they do not equally represent diets of different groups

Solution??

- Very difficult to get valid estimates for diverse populations with paper FFQ
- Requires much more detail than most FFQs currently include
- Online, can skip to tailor questions to individual level much more quickly