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Vegetable rich food pattern and health outcomes among Chinese adults

Overview

- Diet – disease association is widely studied, but often focuses on:
  - Single nutrient
  - Single food

- Overall diet is of interest: interaction between nutrients and foods; cumulative effects

Identification of dietary patterns

- Knowledge based
  - Healthy Eating Index

- Data driven methods
  - Factor analysis
  - Cluster analysis
  - Reduced Rank Regression
  - Method review by Newby et al

Newby PK, Tucker KL. Empirically derived eating patterns using factor or cluster analysis: a review. *Nutr Rev.* 2004; **62**(5)**:** 177-203

Dietary patterns and health outcomes
- findings from a Chinese cohort study

- Dietary patterns and …
  - Obesity, weight gain
  - Sleep
  - Mortality

Jiangsu Nutrition Study - JIN

- Based on 2002 Chinese National Nutrition Survey
  - 6 counties, 2 cities
- Five year follow-up in 2007, two new regions joined
- 2012, mortality survey
- Run by Jiangsu Provincial Center for Disease Control and Prevention
- Funding:
  - Jiangsu Provincial Nature Science Foundation
  - Jiangsu Health Bureau
  - International Glutamic Technical Committee
  - The University of Adelaide

Background - study area

Area: ~ 0.1 million square km

Population: 73.55 million - density: 700 persons/square km (highest in China)

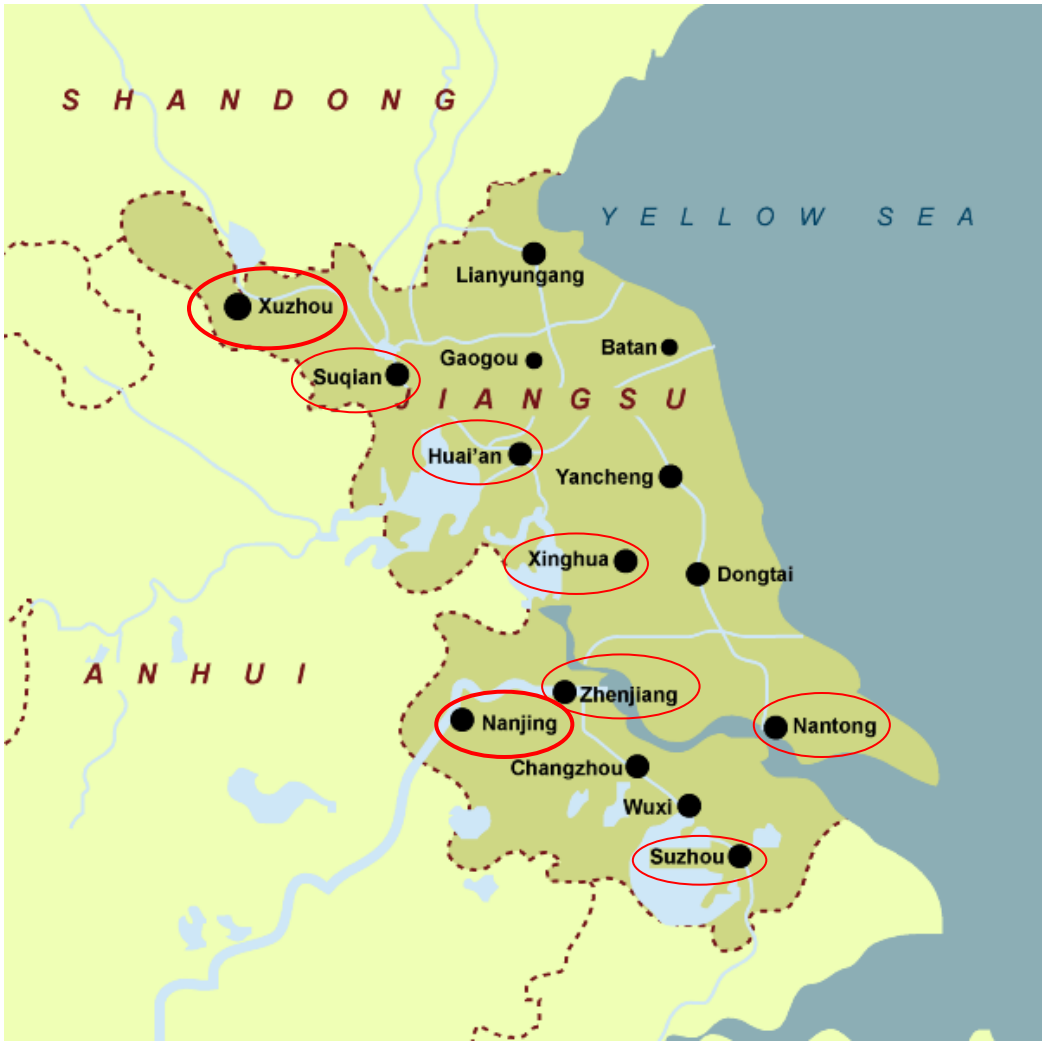
13 cities, 56 counties

Per capita GDP: 9,344 Yuan

Life expectancy at birth: Males 70 years; Females 75 years

Jiangsu contributes 10% of Chinese GDP!

Study sites

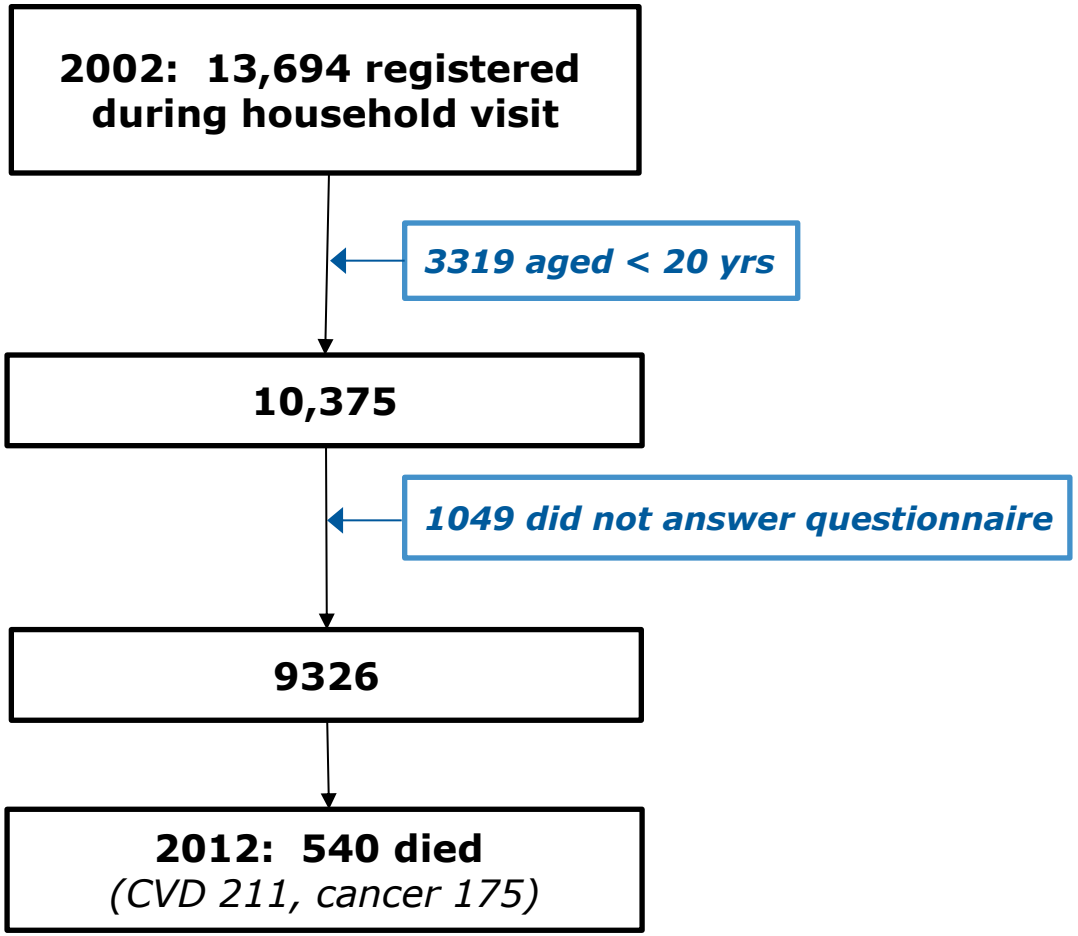


- Data collection run by Jiangsu Provincial Center for Disease Control and Prevention, and local CDCs.
- Funding support - Jiangsu CDC

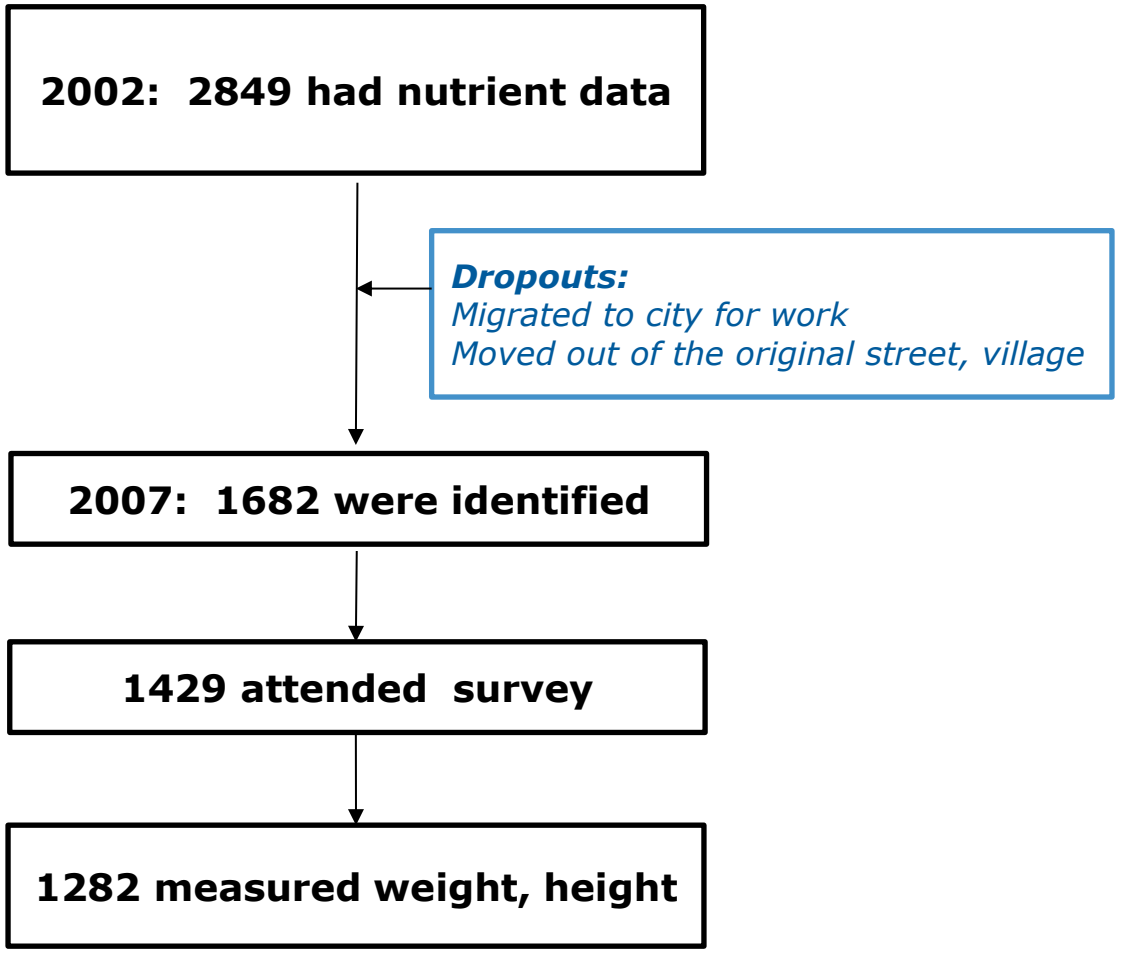
Methods - Jiangsu Nutrition Study dataset

- 2002 national survey on nutrition and health
  - Nationwide, 31 provinces
- 5 year follow up in 2007
  - Only province in China –did follow up survey
- Household based
- Interview conducted by health workers
- 6 counties and 2 cities
- 20 years and above at baseline

Study sample (overall)



Study sample (nutrition subset)



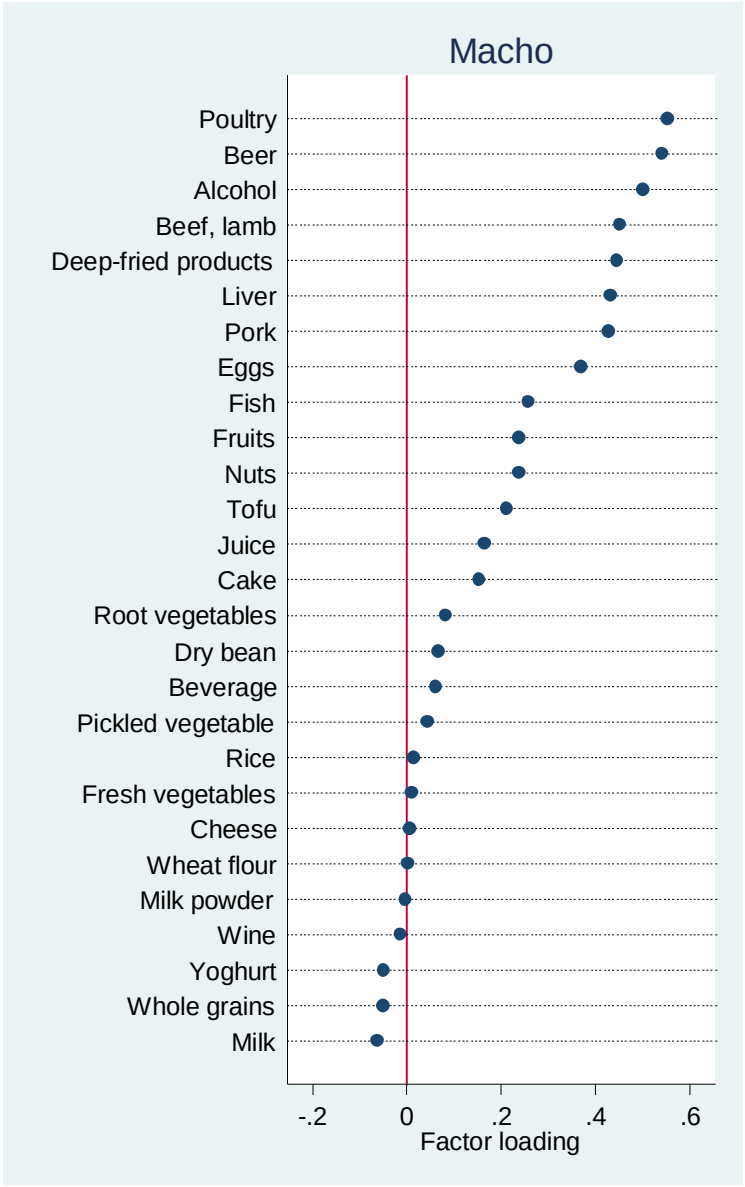
Measurements

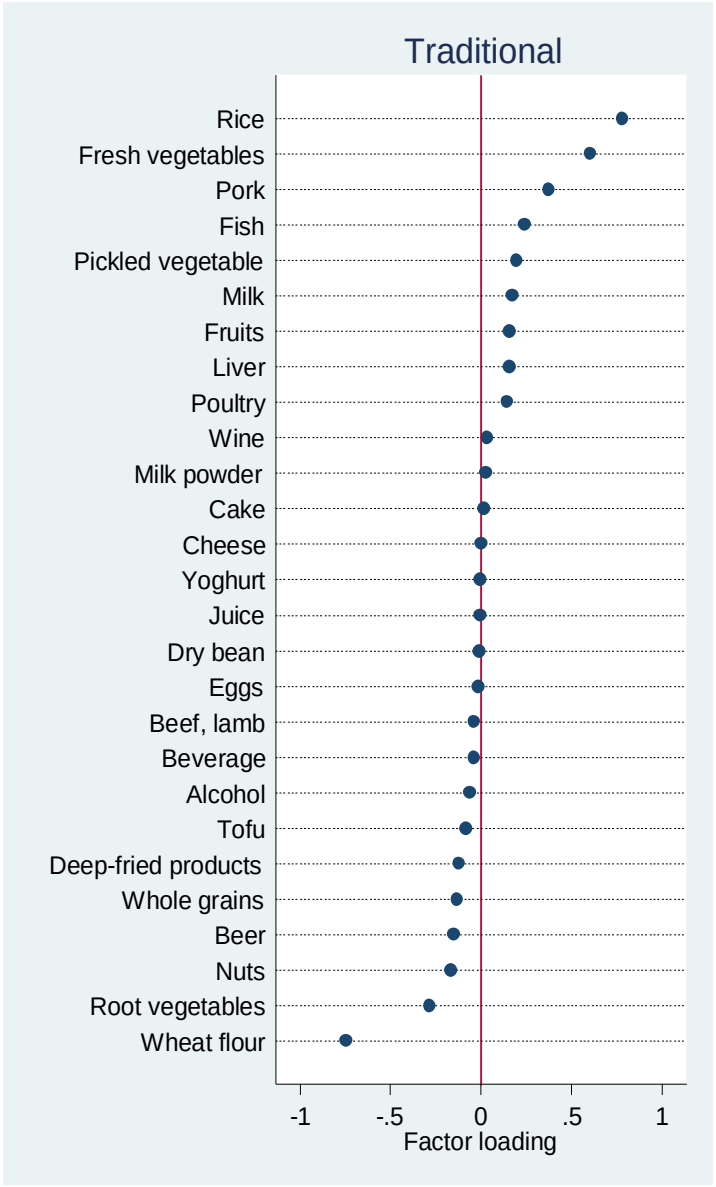
- In 2002, baseline data collected by health workers
  - Height, weight, waist circumference, Hb
  - Sociodemographic information
  - Dietary information
    - FFQ (validated) - 33 food groups
    - 3 day weighted food record: nutrient intake
- In 2007, follow-up data collected
  - Height, weight, waist circumference, Hb
  - Diet - FFQ, but not weighted food record*
- In 2012, death survey (household visit, CDC death records)

Factor analysis

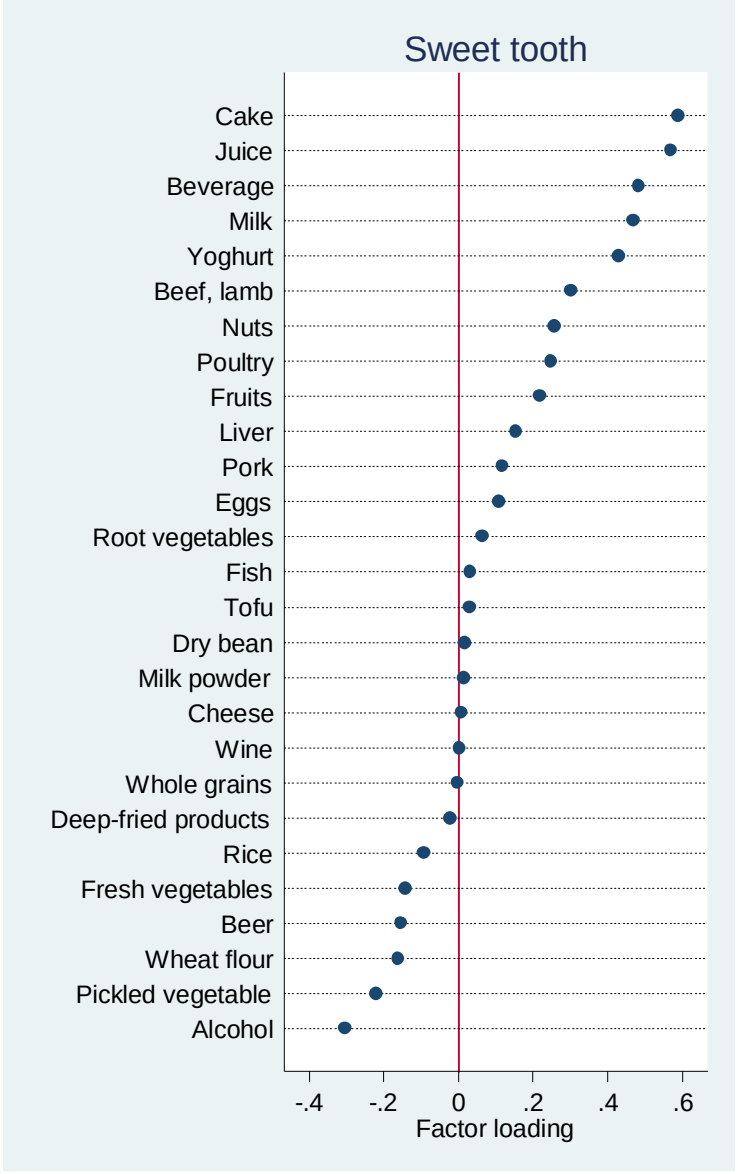
- 25 food groups (8 groups merged)
- Principal component analysis method
- Varimax rotation - for explanation
- Tried 2-8 common factors solutions
  - Finally chose 4 common factors solution
  - Easy/can be interpreted

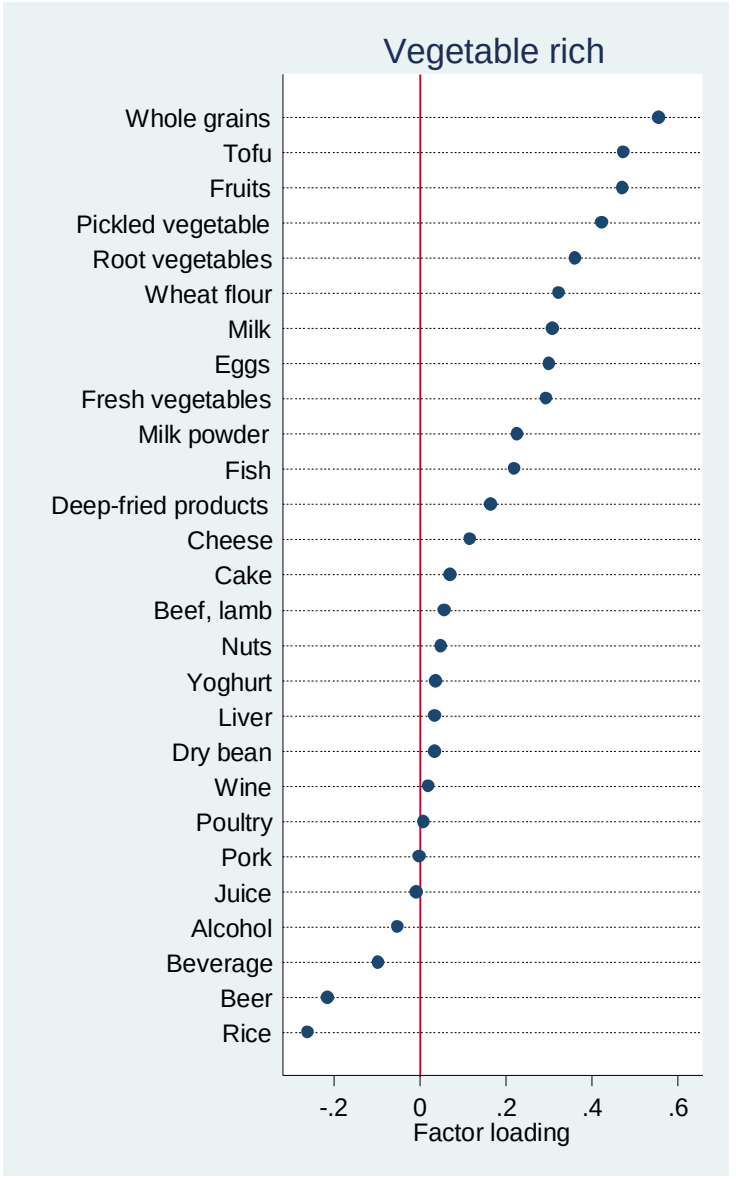
Factor loadings



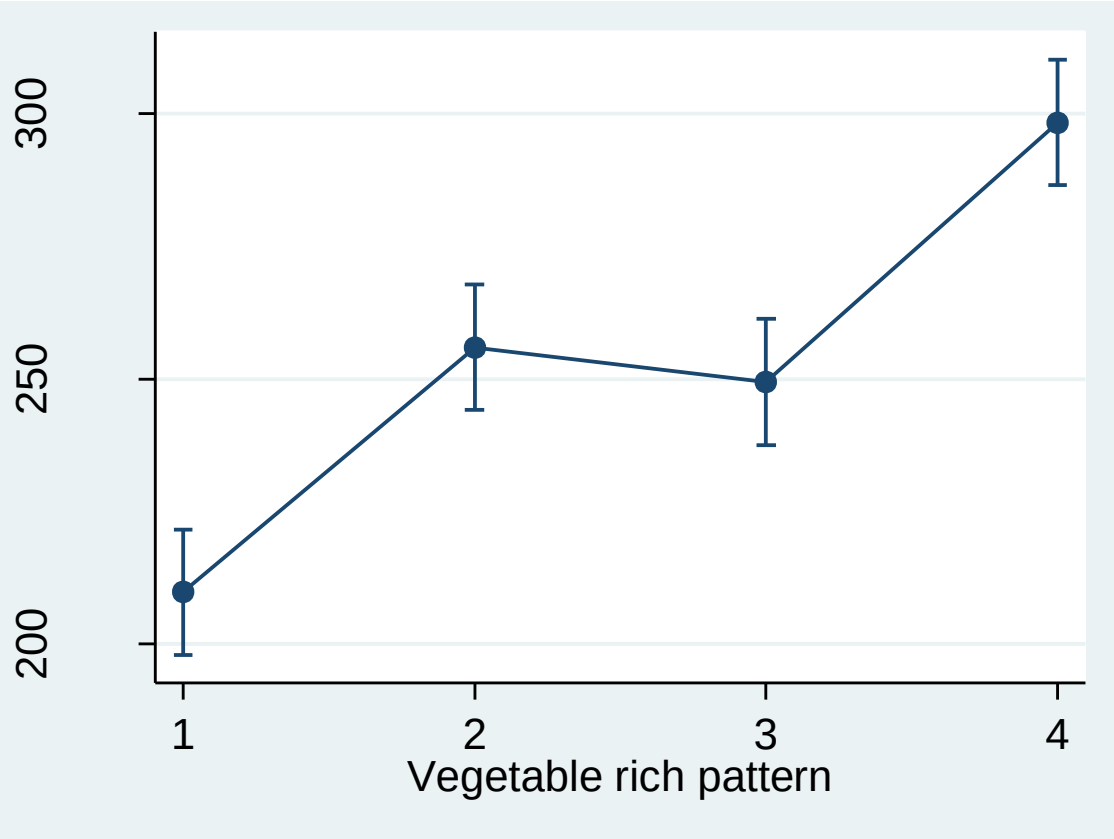


Factor loadings





Marginal mean intake of vegetable by quartiles of dietary pattern



Vegetable rich pattern and obesity
(cross-sectional association)

	Intake of vegetable-rich food pattern quartiles				*P for trend*
	Q1 (low)	*Q2*	*Q3*	*Q4 (high)*	
General obesity[a]					
Men ($n=1308$)	5.9	7.3	7.7	11.3	0.065
Women ($n=1541$)	8.0	12.1	11.9	18.0	<0.001
All	6.9	9.9	10.1	15.0	<0.001
Central obesity[b]					
Men ($n=1308$)	15.6	18.8	20.3	23.8	0.060
Women ($n=1541$)	35.2	36.8	36.7	43.8	0.065
All	25.3	28.4	29.9	34.8	<0.001

Abbreviation: Q, quartile. [a]General obesity was defined as body mass index (BMI) $\geqslant 28\,kg\,m^{-2}$, BMI is calculated as weight in kilograms divided by the square of the height in meters. [b]Central obesity was defined as waist circumference $\geqslant 90$ cm for men or $\geqslant 80$ for women.

Shi Z, et al. Int J Obes (Lond). 2008;32:975-84

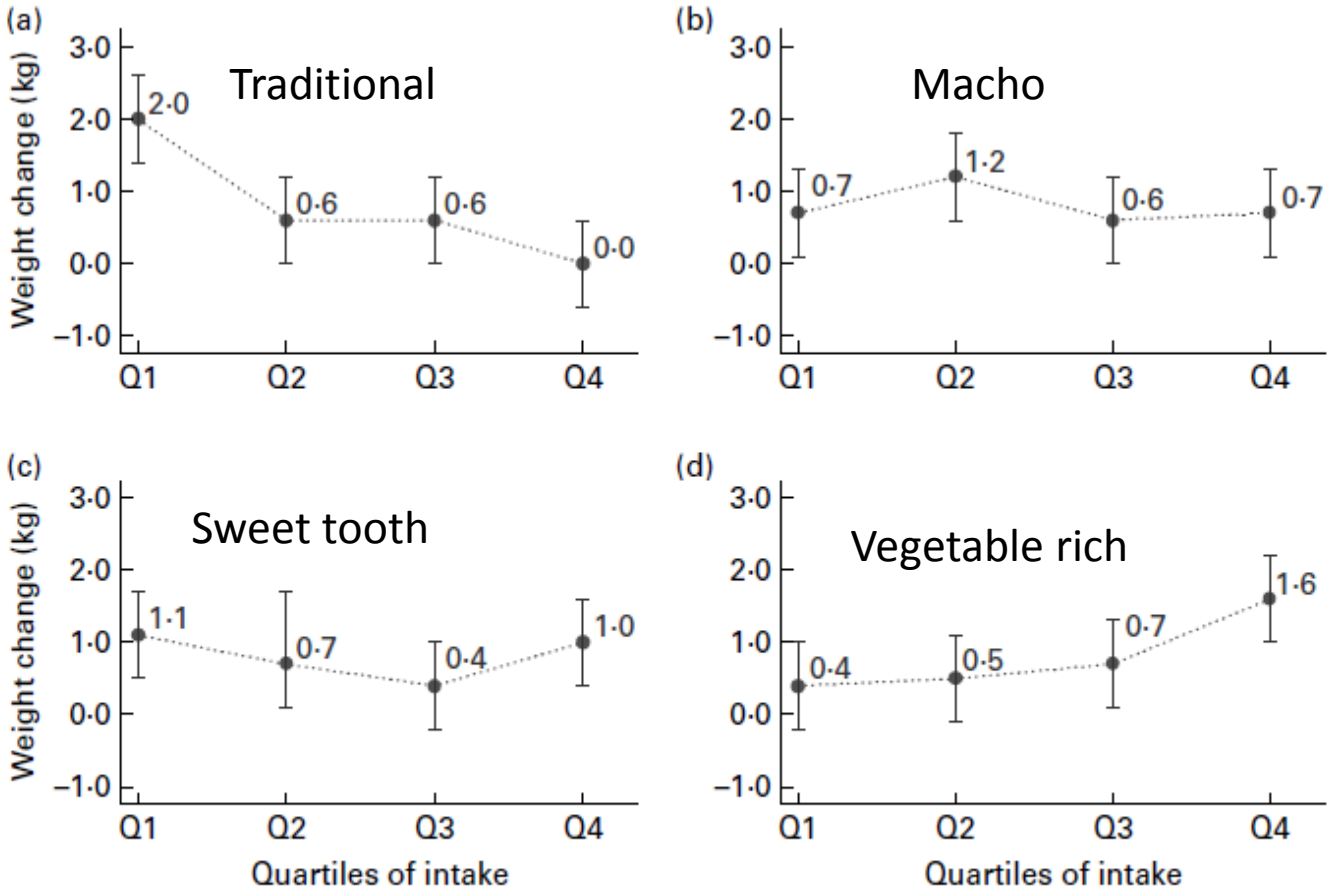
Vegetable rich pattern and obesity
(cross-sectional association)

	Quartiles of vegetable rich pattern				
	Q1	***Q2***	***Q3***	***Q4***	P for trend
General obesity	1	1.54 (1.07-2.21)	1.47 (1.02-2.13)	2.06 (1.46-2.89)	<0.001
Central obesity	1	1.14 (0.96-1.35)	1.17 (0.99-1.39)	1.31 (1.11-1.54)	0.002

Odds ratio (95%CI)

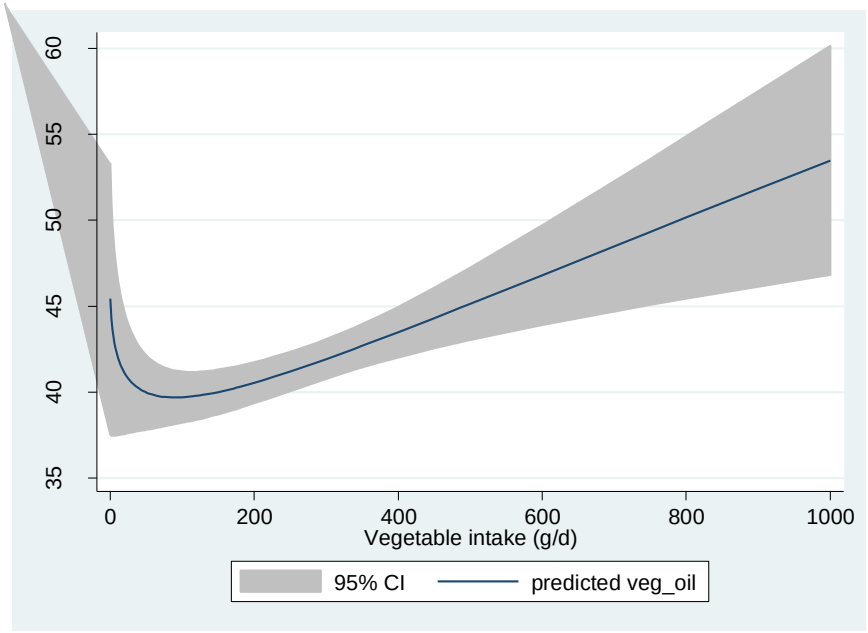
Shi Z, et al. Int J Obes (Lond). 2008;32:975-84

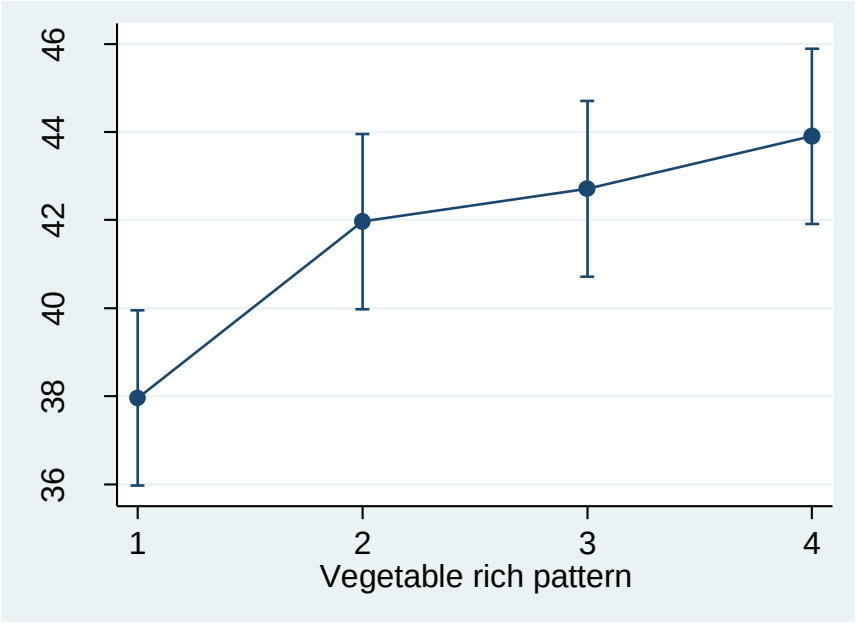
Dietary patterns and 5-year weight change



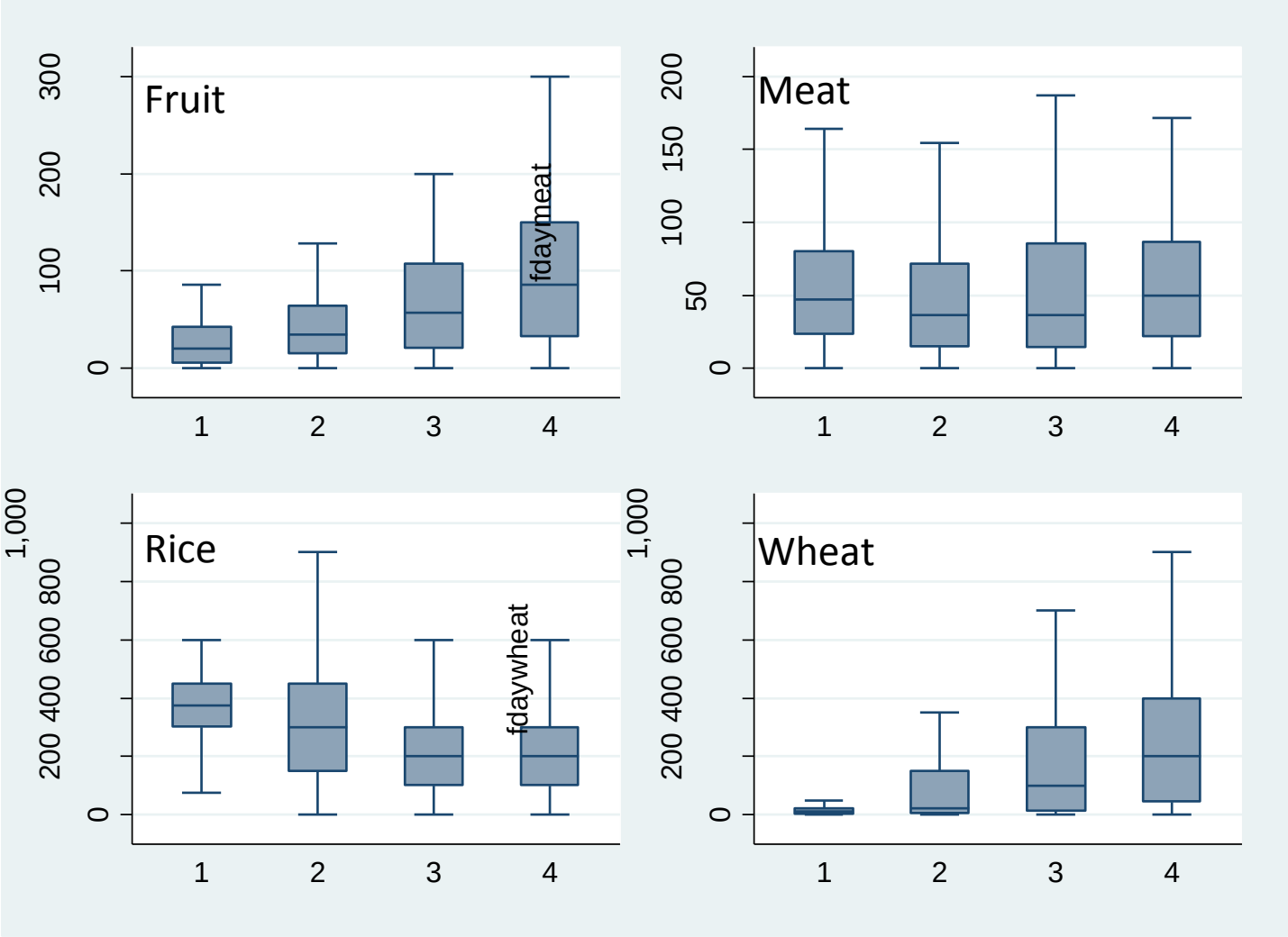
Shi Z, et al. Br J Nutr. 2011;105: 1047-54

Vegetable oil intake in association to vegetable intake





Food intake by quartiles of vegetable rich pattern



Rice intake and 5-year weight change

	Rice intake groups (g/d)			p	PRS*
	0-200	201-400	>=401		
Age, sex adjusted	Ref	-0.82 (-1.46, -0.17)	-2.00 (-2.65, -1.36)	<0.001	-0.27 (-0.35, -0.19)
Multivariable adjusted	Ref	-0.81 (-1.47, -0.15)	-2.08 (-2.75, -1.41)	<0.001	-0.28 (-0.37, -0.19)

** This column represents the amount of weight loss (kg) for every 10% increase in PRS (percentage of rice in staple foods)*

Shi Z, et al. Asia Pac J Clin Nutr. 2012;21:35-43

Fat intake and short sleep (cross-sectional)

Nutrient intake, blood profiles and sleep duration

	Sleep duration			
	<7 h	*7–9 h*	*9 or more hours*	*P-value*[a]
Total energy intake (kJ)				
Mean	9483.5	9811.5	10130.3	0.002
s.e.	149.8	60.7	114.6	
Fat intake (g day^{-1})				
Mean	84.39	80.96	77.73	<0.001
s.e.	2.02	0.82	1.54	
Fat energy (% of total energy intake)				
Mean	33.84	31.23	28.86	
s.e.	0.53	0.21	0.40	<0.001

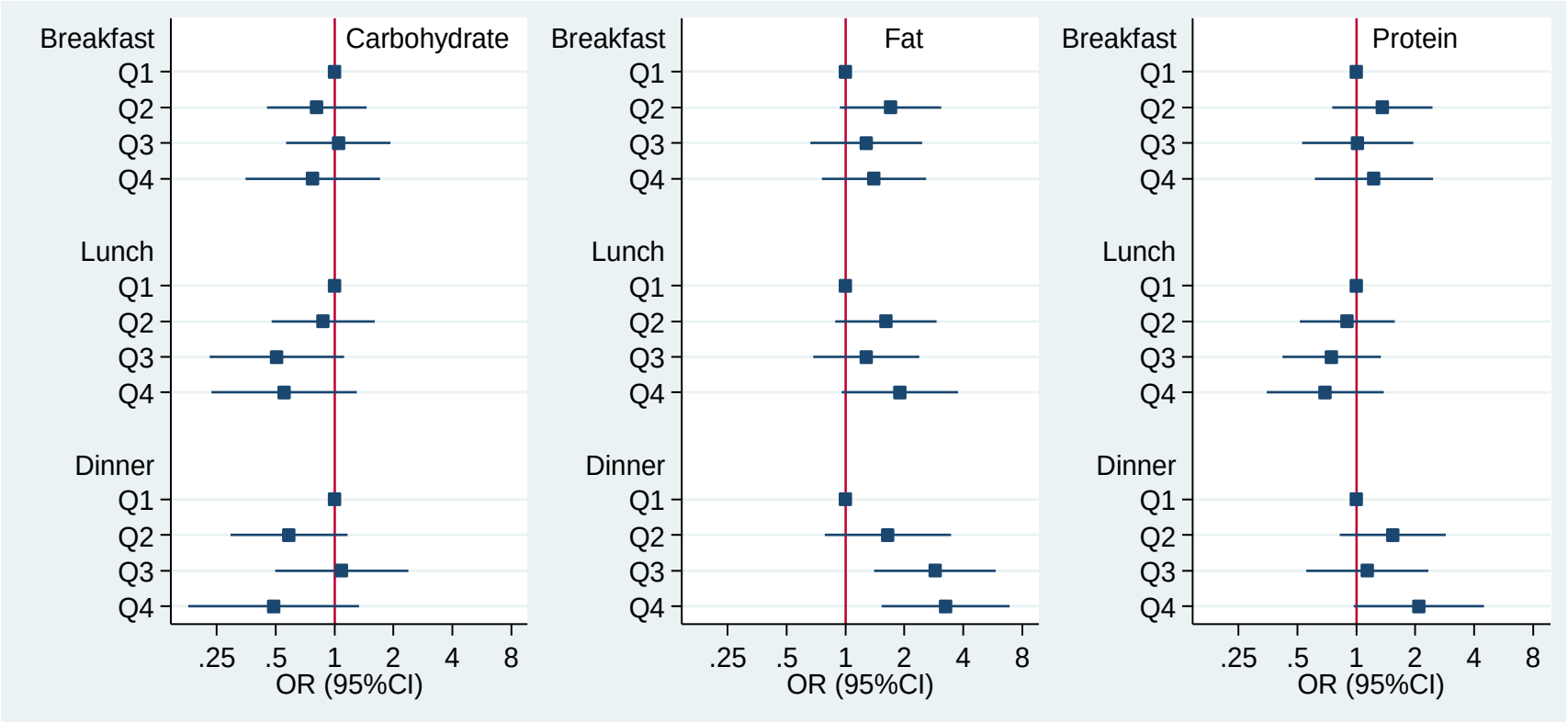
Shi Z, et al . *Int J Obes (Lond).* 2008; **32**(12)**:**1835-40

Fat intake and sleep duration

	Coefficient	P-value	95% CI	
Fat intake quartiles				
Quartile 1	Reference			
Quartile 2	−0.053	0.379	−0.170	0.065
Quartile 3	−0.077	0.229	−0.203	0.049
Quartile 4	−0.143	**0.062**	−0.293	0.007
Age (per year increase)	−0.014	**0.000**	−0.017	−0.010
Female	0.029	0.617	−0.085	0.143
Smoking per day (ref = none)				
1–19 cigarettes	−0.040	0.572	−0.177	0.098
20 or more cigarettes	−0.236	**0.001**	−0.377	−0.094
Alcohol consumption per week (ref = none)				
1–2 times	0.118	0.149	−0.042	0.277
3–4 times	0.049	0.634	−0.152	0.250
More than 4 times	−0.027	0.696	−0.163	0.109

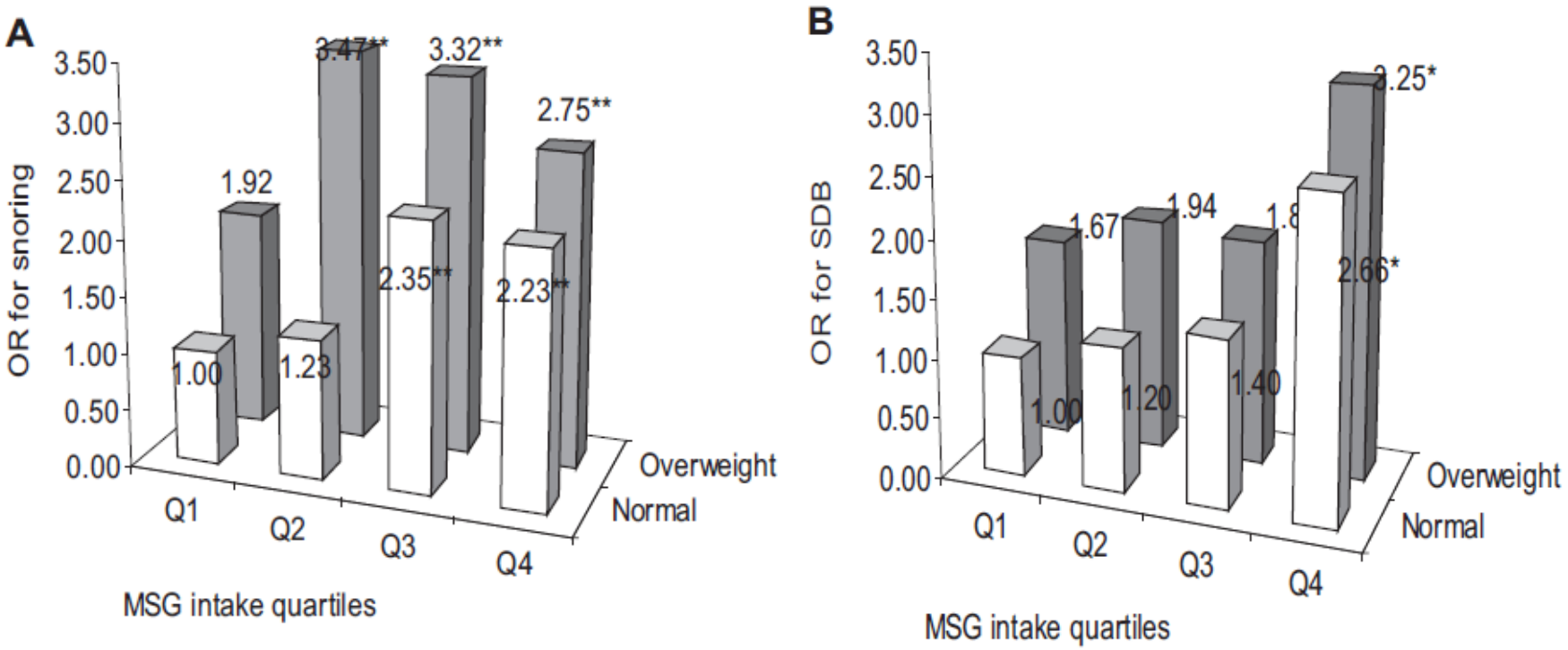
Shi Z, et al . *Int J Obes (Lond).* 2008; **32**(12)**:**1835-40

Macronutrients intake by eating occasions and persistent short sleep (baseline + follow-up)



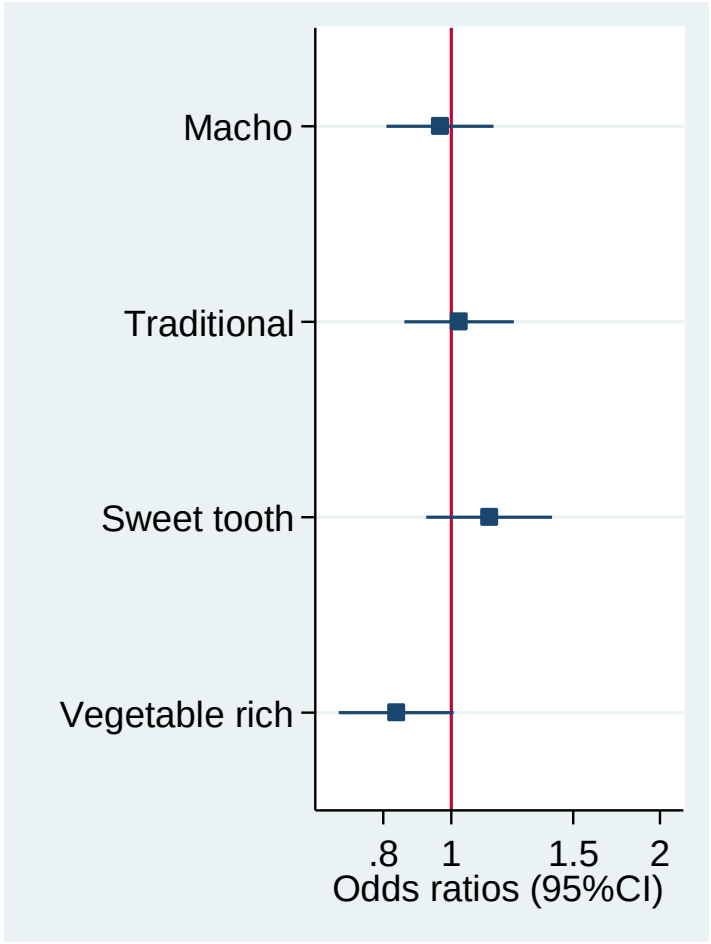
Unpublished data

MSG intake and sleep disordered breathing (SDB)



Shi Z, et al. Nutrition. 2013;29:508-13

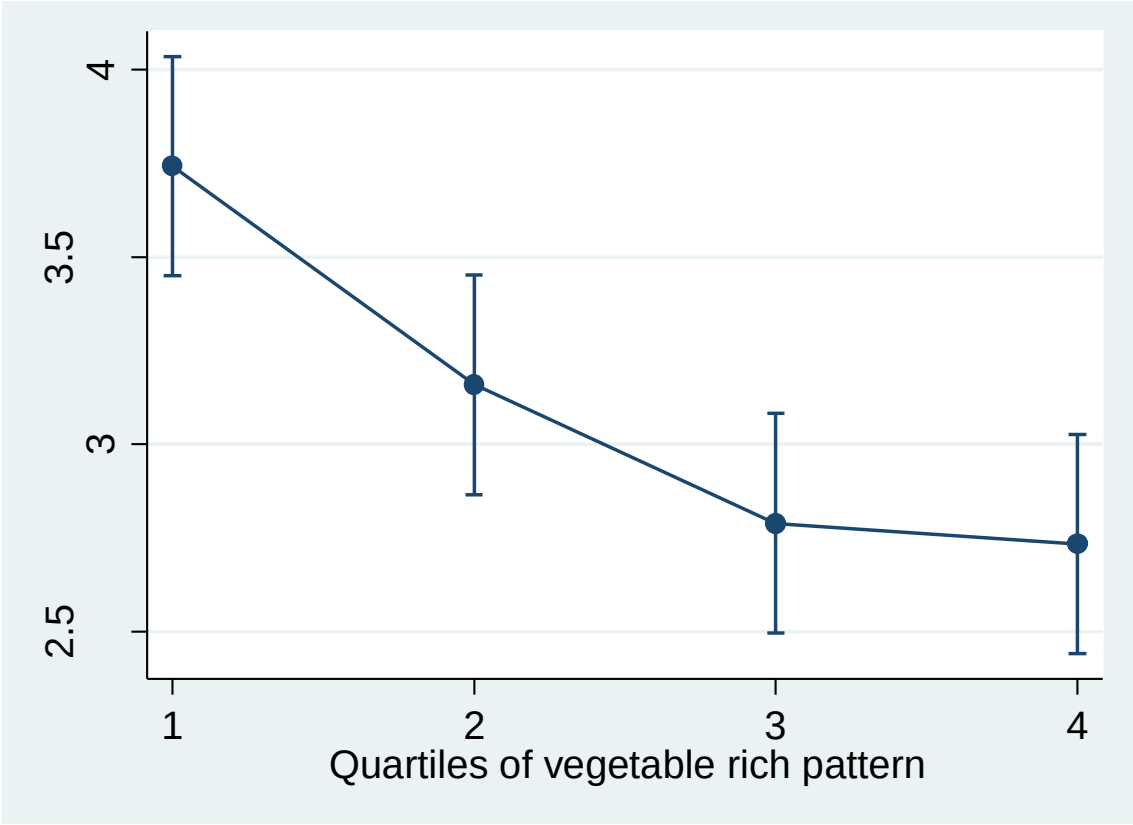
Dietary patterns and sleep disordered breathing (follow-up)



- Vegetable rich pattern inversely related to SDB
- Association was attenuated after adjustment for MSG intake.

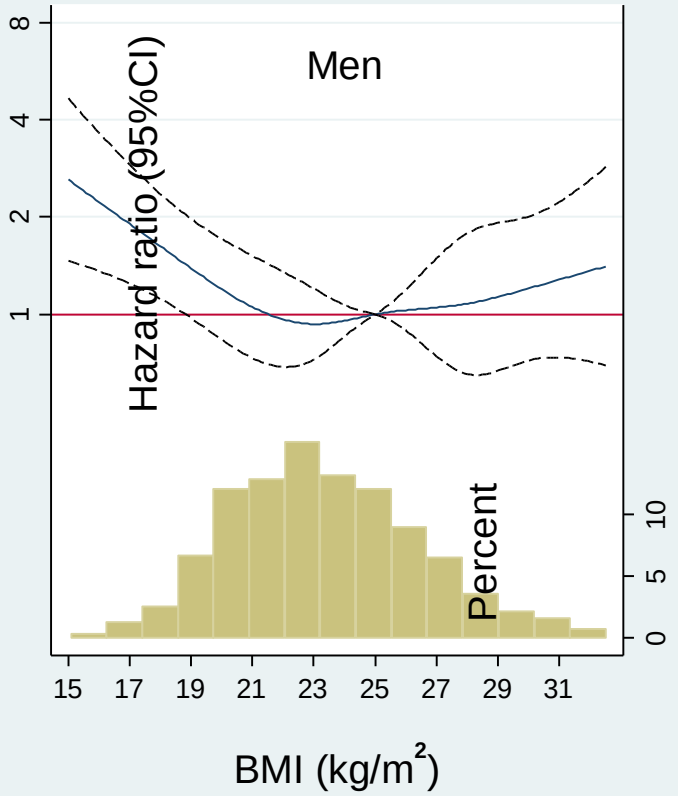
Unpublished data

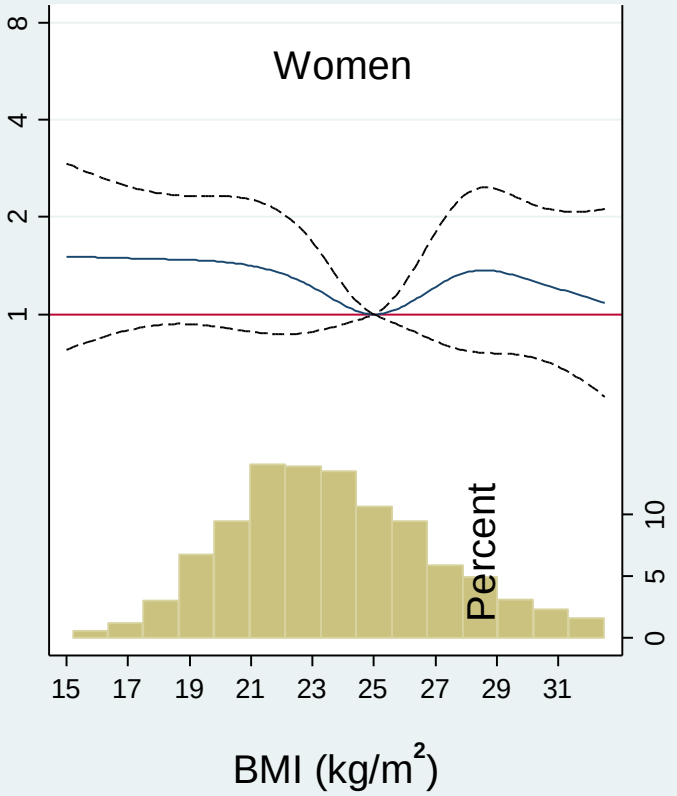
MSG intake by vegetable rich pattern



No association between other dietary patterns and MSG intake

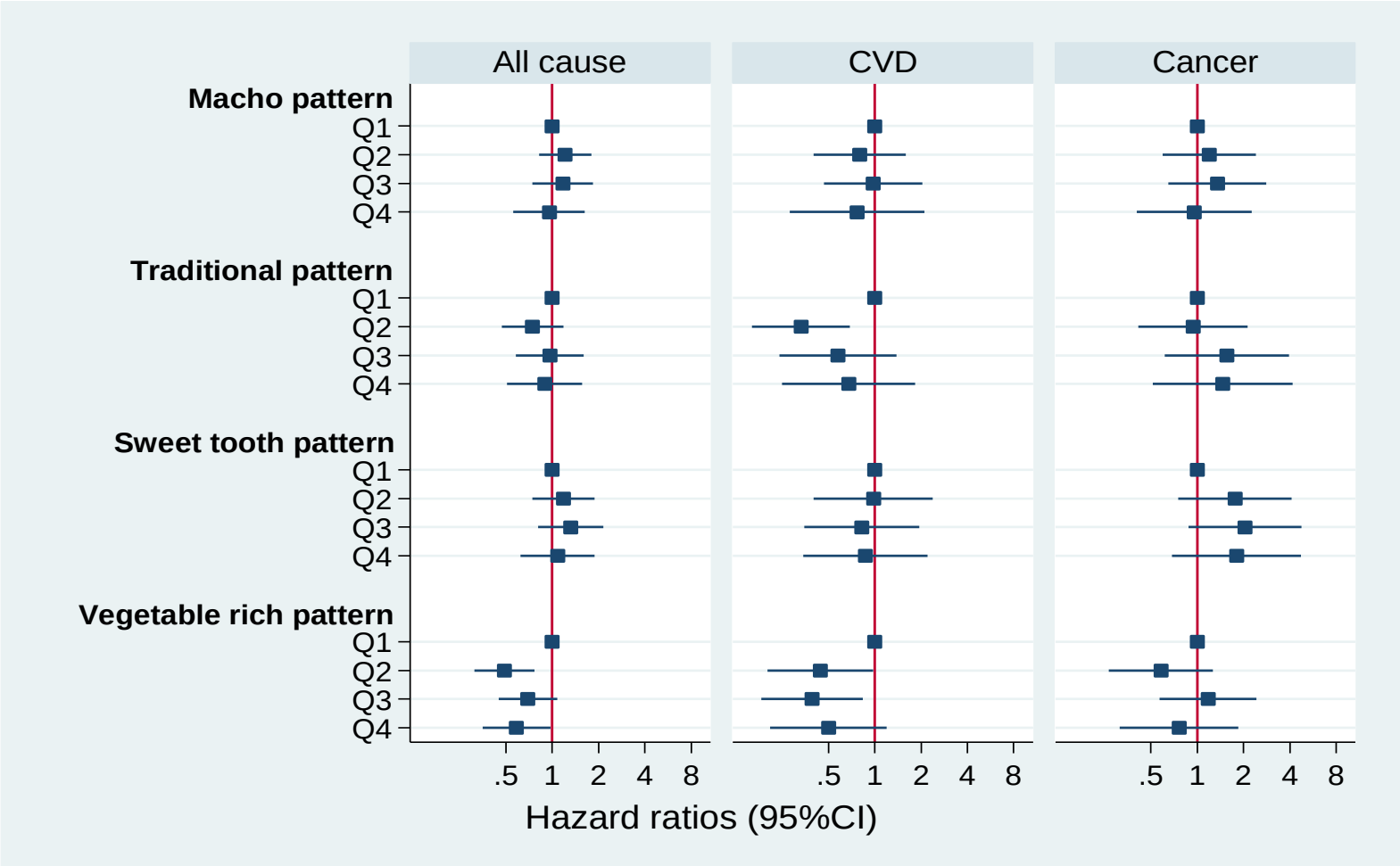
BMI and mortality





Unpublished data

Dietary patterns and mortality



Unpublished data

Conclusion

- Vegetable rich food pattern
  - Positively associated with obesity and weight gain
  - Could be due to high vegetable oil intake, or high wheat/low rice
  - Inversely related to sleep distorted breathing
  - Inversely related to mortality
- Overall dietary pattern is important
  - Gives direction for diet-disease association: single food level
- Promoting vegetable intake should take culture into account: cooking method is important
  - In China, vegetable is often stir-fried with oil
- Eating occasion is important but less studied

Acknowledgement - collaborators

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