Dietary intake and the risk of type 2 diabetes in Korea

Major of Food Science & Nutrition

The Catholic University of Korea

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Contents

Increasing prevalence of type 2 diabetes in Asia

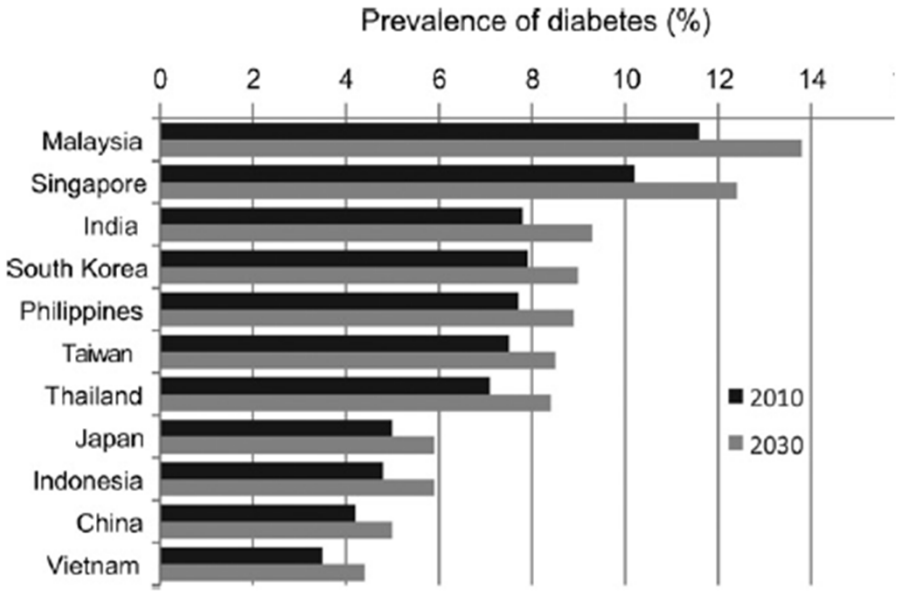


Fig. 1 – Estimated prevalence of diabetes among adults aged 20–79 years in 11 Asian countries (%). Age-adjusted to world population, except Taiwan (developed world population).

- Compared to other races, Asians develop T2DM younger and at a lower degree of obesity, suffer longer from its complications and die earlier

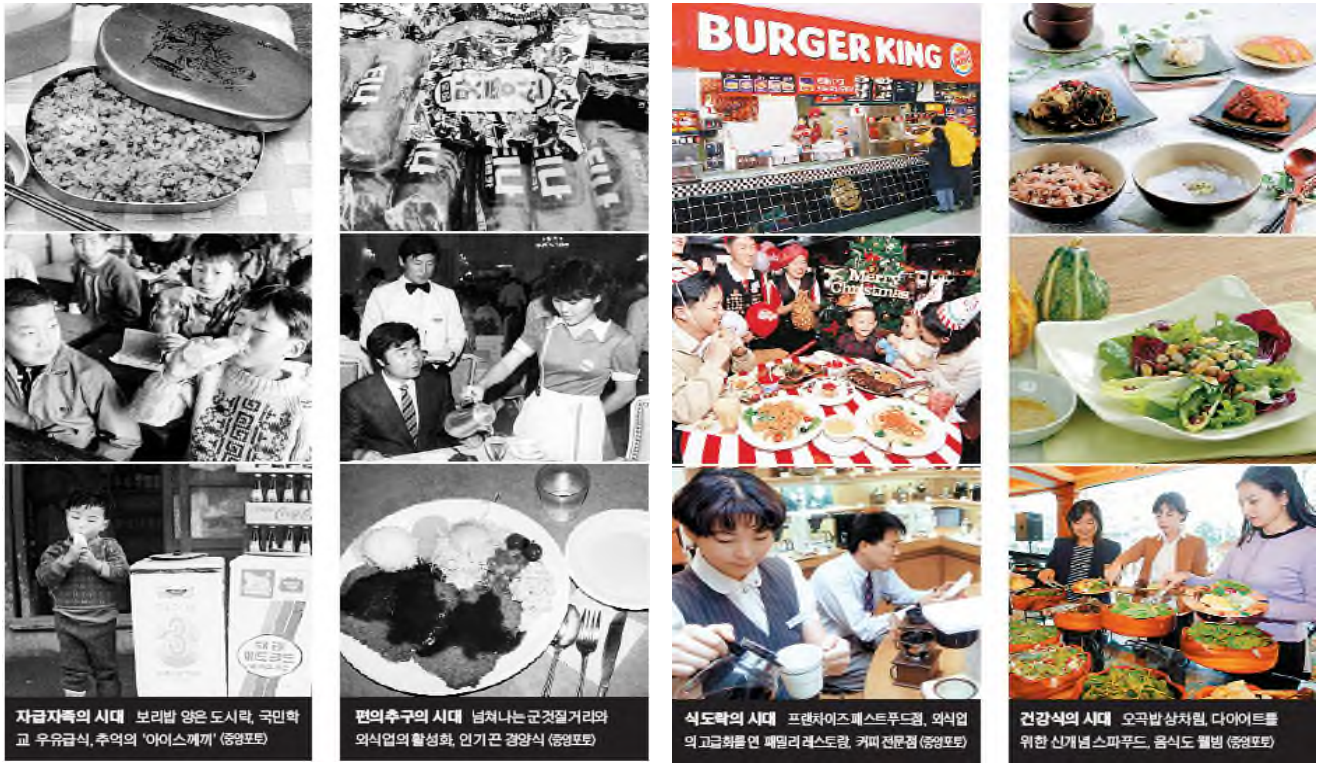
(Mu et al, Diabetes Res Clin Pract 2012)

Characteristics of Korean diet

- Rice as a main crop
  - ✓ Hot and humid climate with rainfall
- A variety of food ingredients
  - ✓ abundant seafood, fish, seaweed, sea salts by a peninsular
  - ✓ rice, vegetables, fruits, beans by rich plains and valley
  - ✓ mushrooms, wild ferns, roots by mountains
  - ✓ various seasonal foods by four distinct season
- Typical forms of Korean diets
  - ✓ serve the forms of rice, soup and side dishes.
  - ✓ The combination of dishes creates the blend of color, flavors, and nutrients.

Low-fat High-carb diet!

Dietary change in Korea

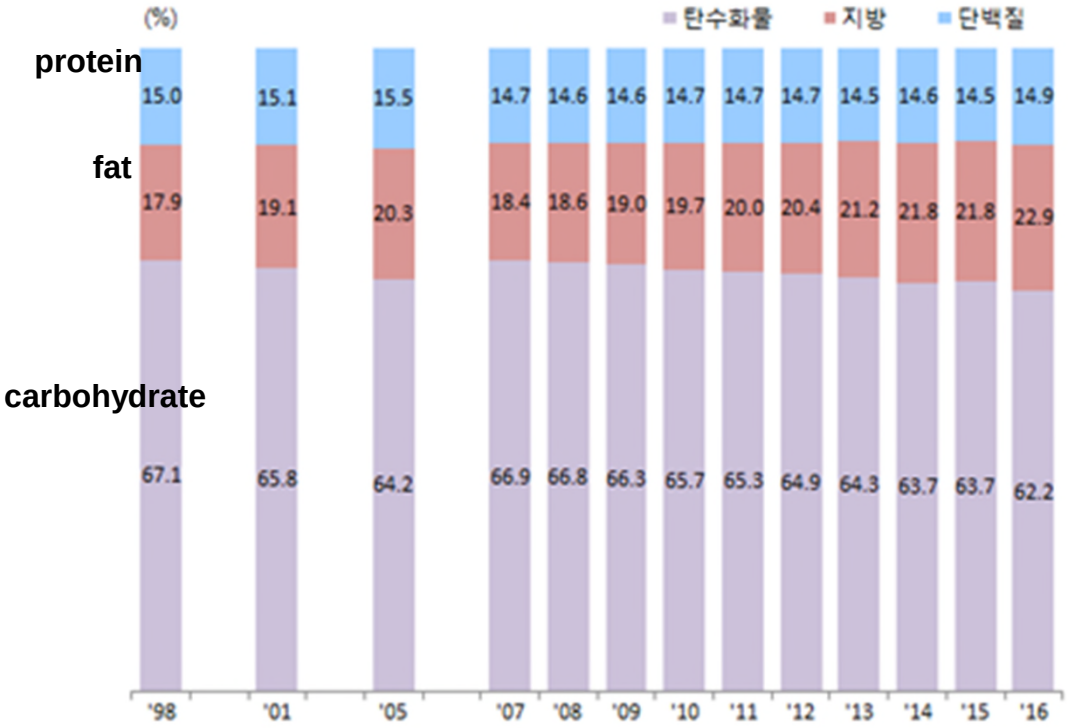


1965-1974 **1975-1984** **1985-1994** **1995-present**

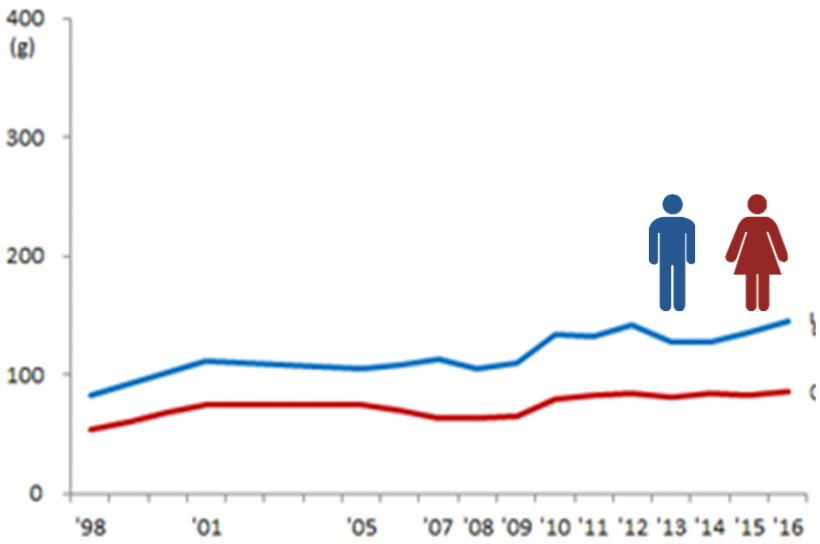
- ✓ Westernized dietary pattern?
- ✓ Higher consumption of animal foods?
- ✓ Increasing fat intake?

Fat and Meat consumption

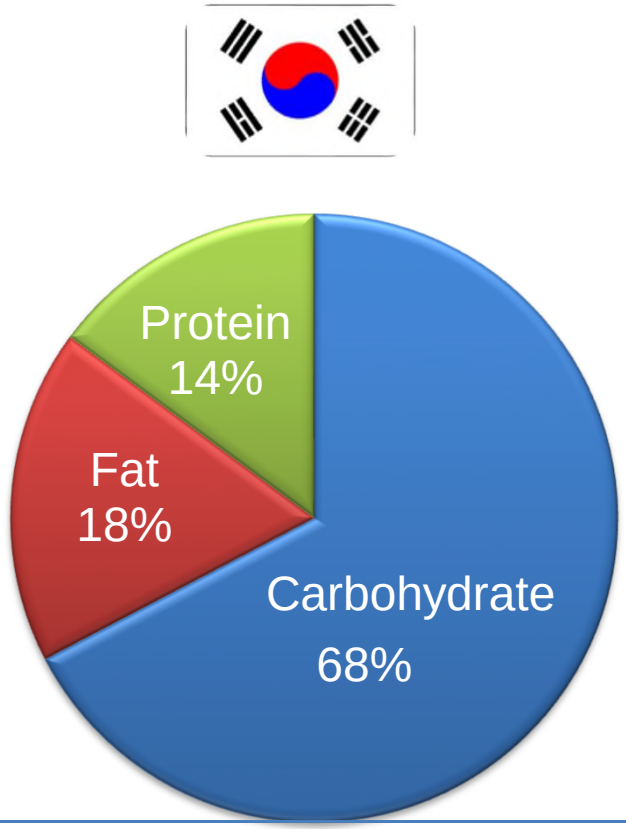
According to the data of the Korea National Health and Nutrition Survey (1998-2016),



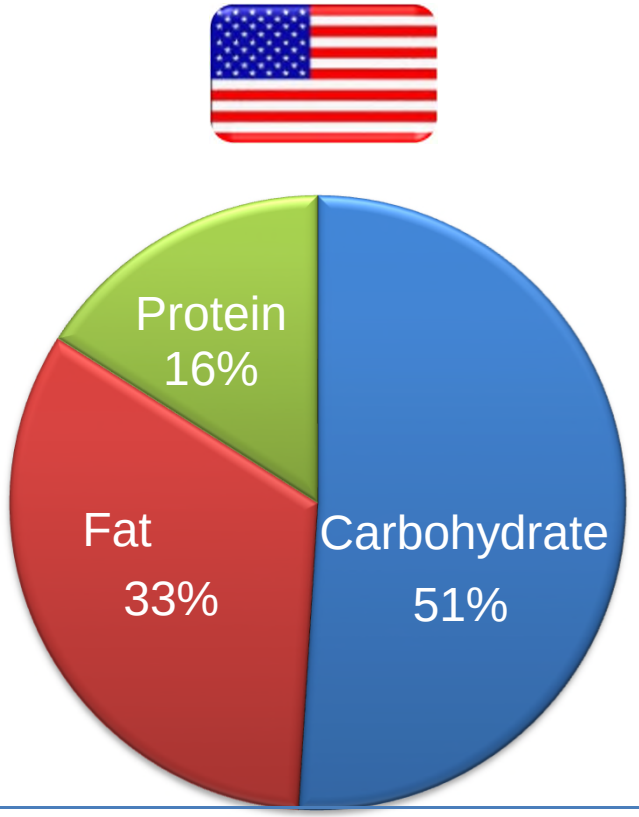
Meat consumption (g/day)



How different macronutrient composition?



KNHANES 2007-2012



NHANES 2007-2012

(Ha et al, Eur J Clin Nutr, 2018)

Distribution of carbohydrate intake

DRIs for Koreans
Recommended range
for carb **(55-65%)**

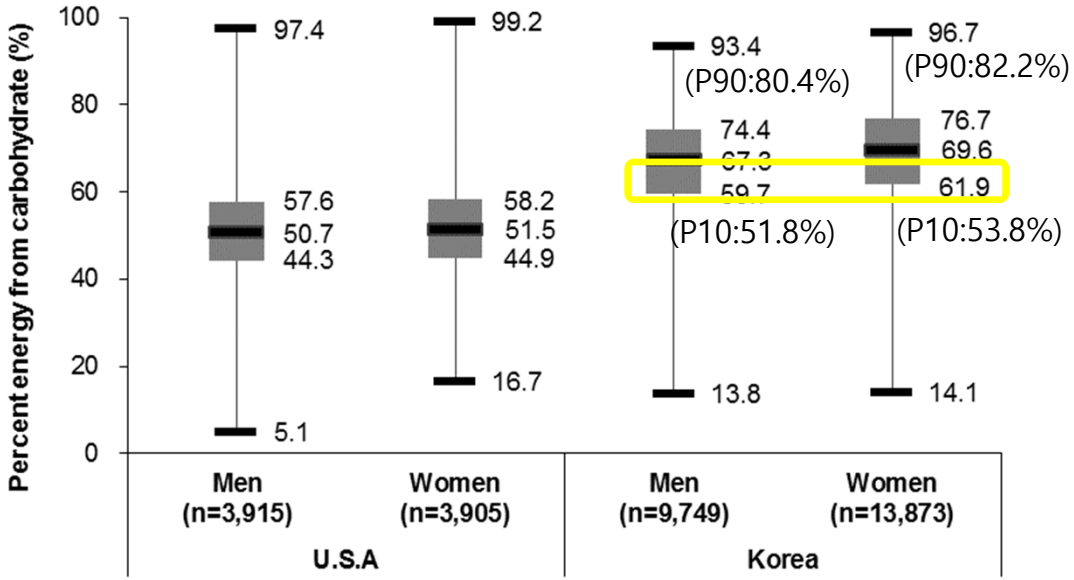


Figure 1. Distribution of carbohydrate intake among participants in the NHANES and KNHANES 2007-2012

(Ha et al, Eur J Clin Nutr 2018)

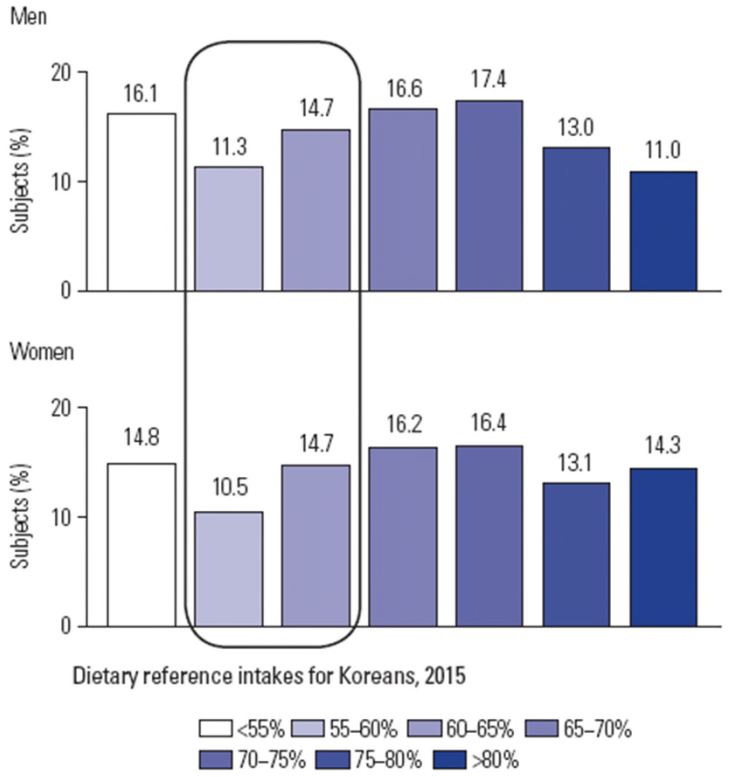
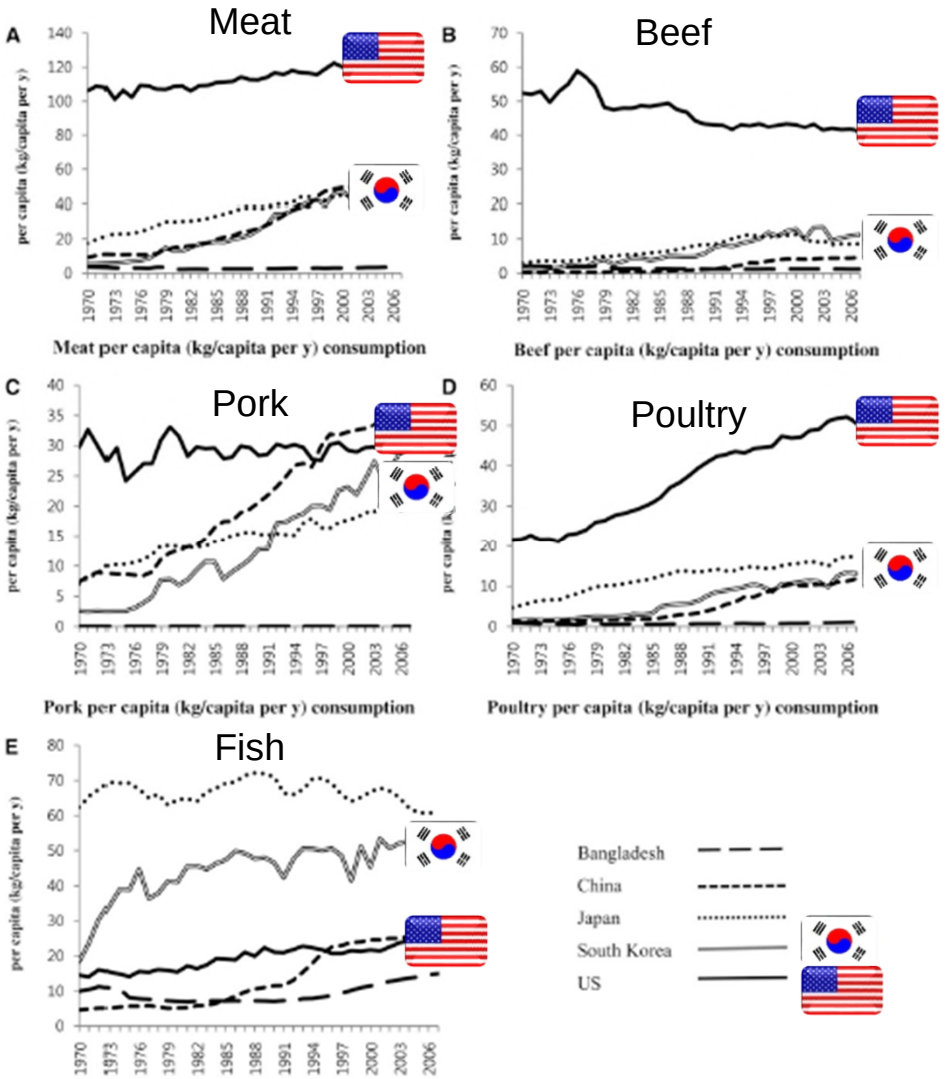


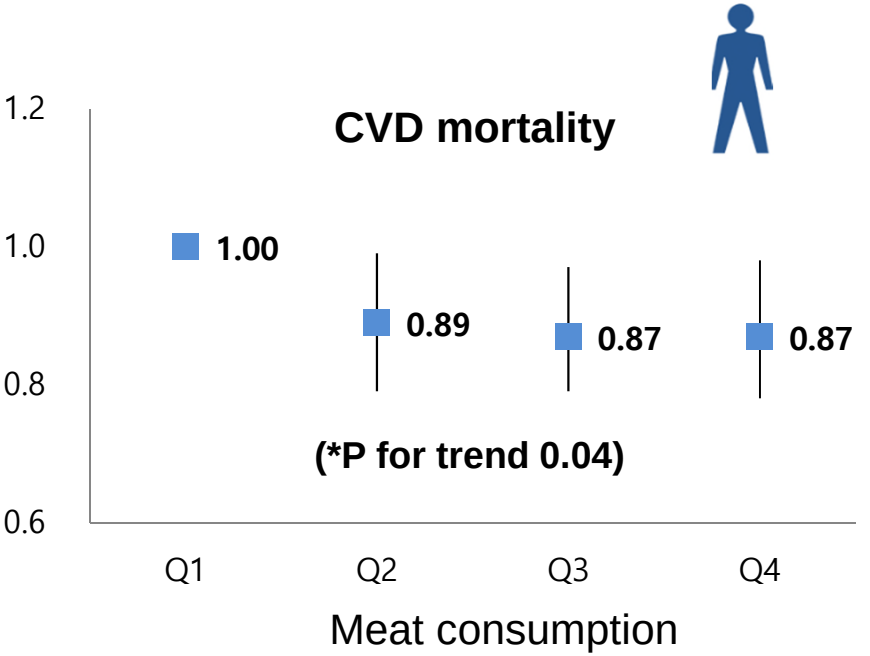
Fig. 1. Distribution of dietary carbohydrate intake according to sex.

(Lee et al, Yonsei Med J 2018)

Meat consumption



Meat intake and cause-specific mortality: a pooled analysis of Asian prospective cohort studies



(Lee JE, Am J Clin Nutr, 2013)

Fat intake in US & Korea

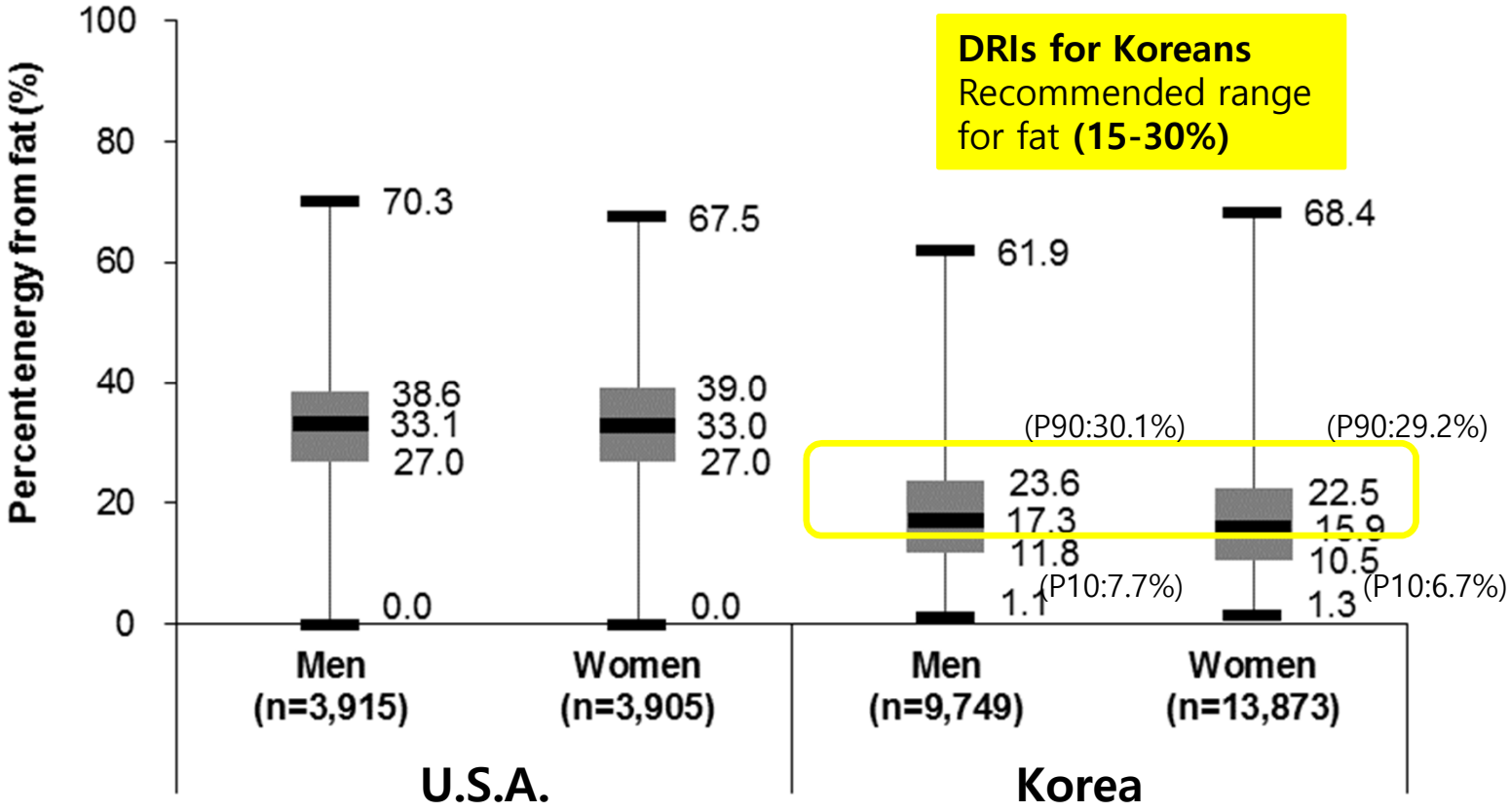
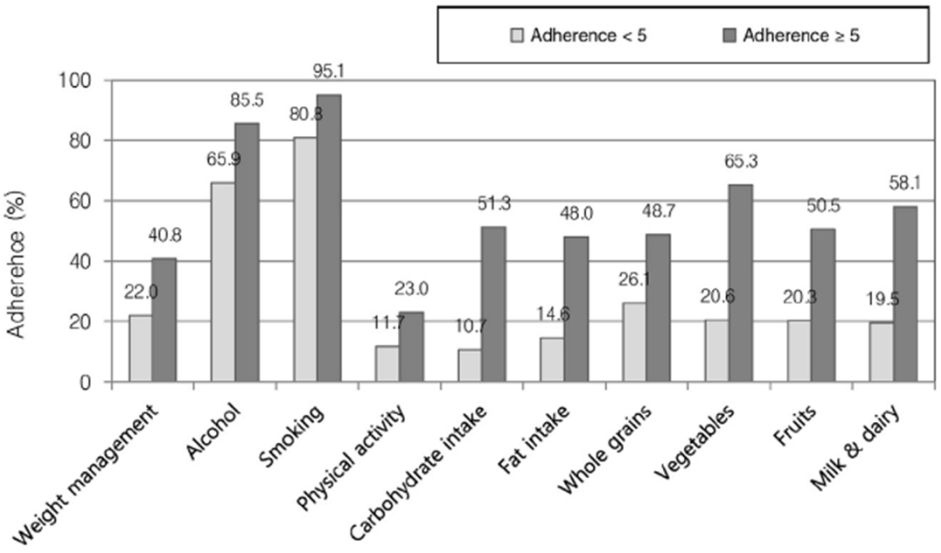


Figure 2. Distribution of fat intake among participants in the NHANES and KNHANES 2007-2012

(Ha et al, Eur J Clin Nutr, 2018)

DIET & TYPE 2 DIABETES IN KOREA

Diet and type 2 diabetes in Korea



All distributions were significantly different in both groups after adjusted for age, gender, education, income, diabetes duration, and diabetes treatment ($p<0.01$).

Fig. 1 – Percent adherence to each lifestyle recommendation* by degree of adherence.

*the Korean Diabetes Association

- Adherence to recommendation in Korean adults who had type 2 diabetes for an average of 8 years (n=728)
- High adherence group showed better glycemic control and improved blood lipid levels
- In low adherence group, **carbohydrate intake** was the least recommendation to adhere (only 10% met the recommendation for carbohydrate)

(Lim et al, Diabetes Res Clin Pract 2013)

Carbohydrate quantity & quality

- Total carbohydrate (g/day)
- Energy from carbohydrate (%E)
- Dietary glycemic index
- Dietary glycemic load
- Total grains
- Refined grains
- White rice

Carbohydrate & Metabolic syndrome

Using KNHANES (2007-2009) data of 6,845 adults aged 30 to 65 years,

Table 5. Metabolic syndrome components by quintiles of dietary carbohydrate intake in men and women in a study examining the relationship between metabolic syndrome prevalence and dietary carbohydrate intake among Korean adults[a]

	Quintiles of Energy from Carbohydrate[b] (%)					*P* for trend[c]
	Q1 (n=526)	Q2 (n=526)	Q3 (n=527)	Q4 (n=526)	Q5 (n=526)	
Men (n=2,631)	←*mean±standard error of mean*→					
Waist circumference (cm)	83.8±0.4	85.4±0.4	84.0±0.4	83.3±0.4	83.8±0.4	0.066
Triglyceride (mg/dL[d])	146.0±4.4	164.0±7.2	161.0±5.5	153.9±5.3	159.2±6.1	0.028
HDL[e]-cholesterol (mg/dL[f])	46.6±0.5	44.8±0.4	45.2±0.4	45.3±0.5	45.1±0.5	0.048
Fasting blood glucose (mg/dL[g])	94.5±0.7	94.2±0.6	94.8±0.8	97.5±1.1	97.2±0.9	0.004
Systolic blood pressure (mm Hg)	114.9±0.5	116.0±0.6	115.3±0.6	115.9±0.8	116.1±0.7	0.815
Diastolic blood pressure (mm Hg)	78.8±0.5	79.3±0.5	78.0±0.5	77.5±0.6	77.8±0.5	0.044
	Quintiles of White Rice Intake[b] (Servings/Day)					
	Q1 (n=842)	Q2 (n=843)	Q3 (n=843)	Q4 (n=843)	Q5 (n=843)	
Women (n=4,214)	←*mean±standard error of mean*→					
Waist circumference (cm)	76.5±0.4	77.2±0.4	76.7±0.3	77.2±0.4	79.0±0.4	0.432
Triglyceride (mg/dL[d])	96.9±2.3	102.9±2.4	102.0±2.9	108.6±3.2	109.1±2.6	0.053
HDL cholesterol (mg/dL[f])	52.4±0.5	50.8±0.4	51.1±0.4	50.1±0.4	49.2±0.4	0.002
Fasting blood glucose (mg/dL[g])	91.1±0.4	92.0±0.4	92.5±0.5	92.9±0.5	93.4±0.7	0.059
Systolic blood pressure (mm Hg)	107.6±0.5	108.3±0.5	109.3±0.6	109.4±0.5	112.2±0.6	0.009
Diastolic blood pressure (mm Hg)	71.8±0.4	71.9±0.4	71.9±0.4	72.3±0.4	73.5±0.4	0.105

(Song et al, J Acad Nutr Diet 2014)

White rice & type 2 diabetes

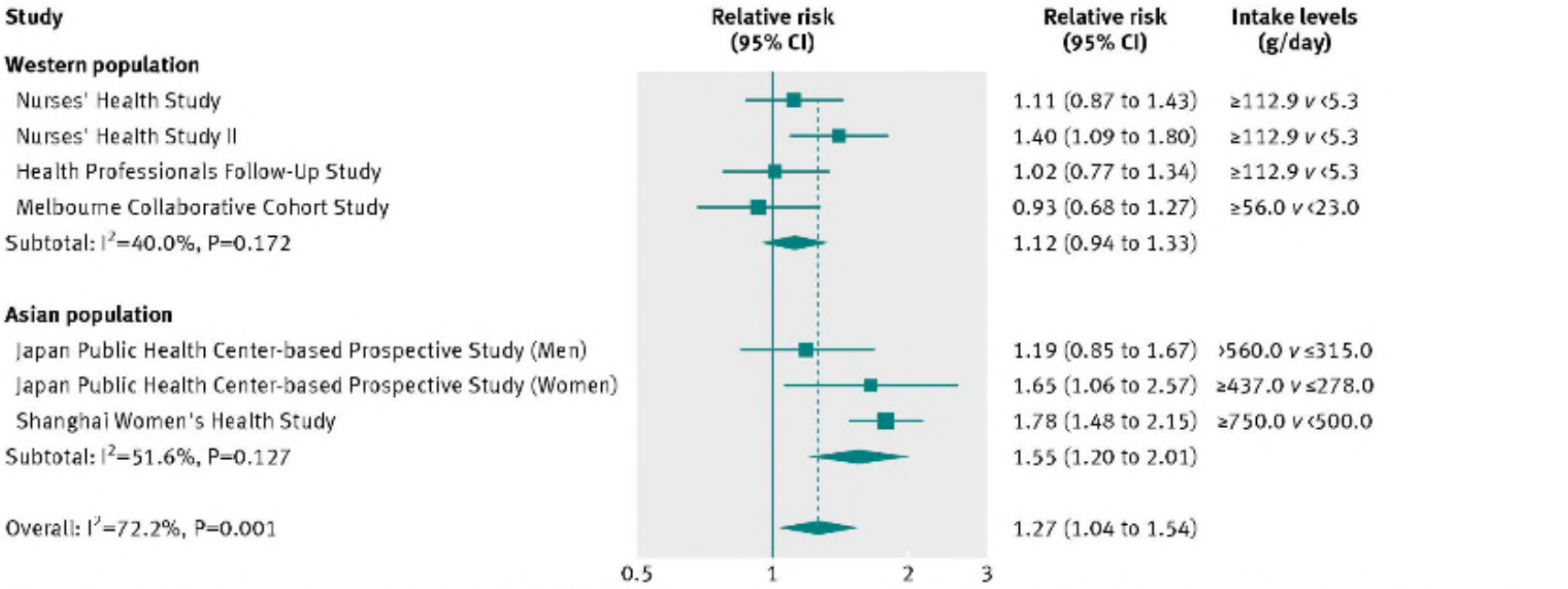


Fig 2 Pooled random effects relative risk (95% CI) of type 2 diabetes comparing high with low white rice consumption levels. P values are P for heterogeneity

(Hu EA et al, BMJ 2012;344:e1454)

Dietary carbohydrate & fat with metabolic syndrome

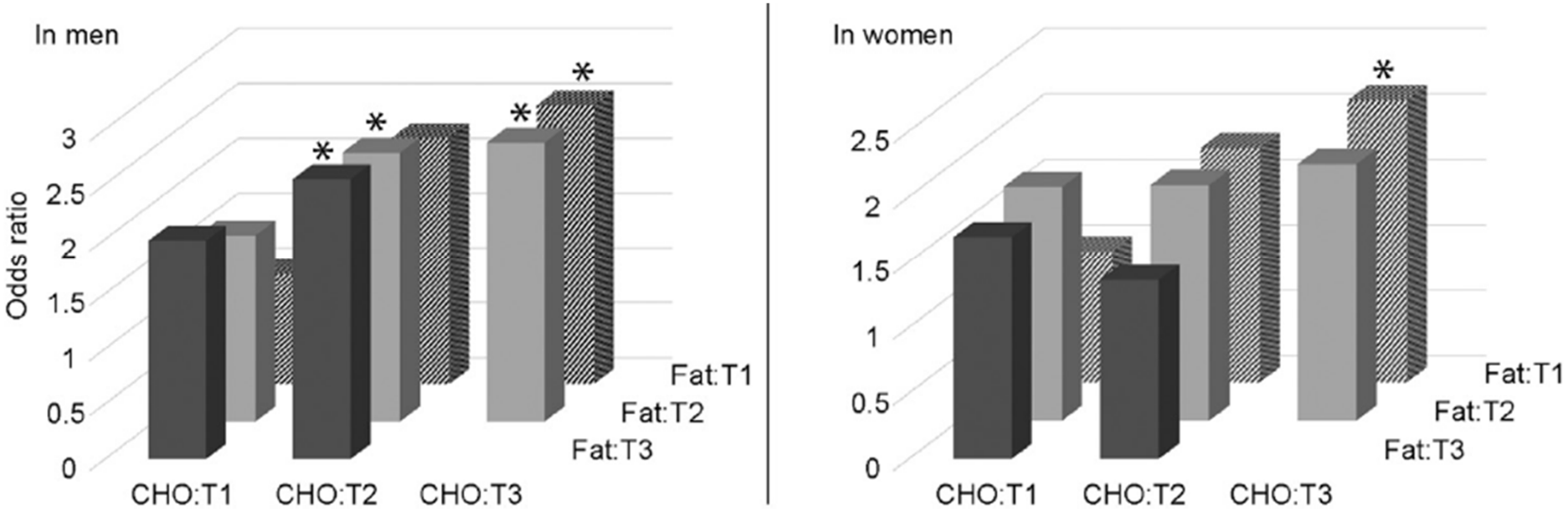


Fig 2. Adjusted odds ratios (OR) and confidence band for metabolic syndrome according to carbohydrate and fat intake.

CHO: T1 (≤61.0%), T2 (61.0–70.1%), and T3 (≥70.1%) for males and T1 (≤63.5%), T2 (63.5–72.8%), and T3 (≥72.8%) for females.
Fat: T1 (≤15.0%), T2 (15.0–22.4%), T3 (≥22.4%) for males and T1 (≤13.3%), T2 (13.3–20.8%), and T3 (≥20.8%) for females.

- ✓ This results indicate that reduction of excessive CHO and adequate intake of fat, considering the optimal type of fat, are useful for the prevention of MS.

(Kwon Y et al, Clin Nutr 2018)

Dietary fat & carbohydrate

- Based on the data from the Korean Genome and Epidemiology Study (community-based prospective cohort)
- A total of 5,595 adults aged 40-69 years without diabetes, cardiovascular diseases or any cancer at baseline
- During a median follow-up of 138-months (12 years), 1,010 cases of type 2 diabetes were newly determined.
  - ✓ Participants were enrolled during 2001–2002 and have been followed up biennially through 2013–2014
- Validated semi-quantitative food frequency questionnaire

Nutrient intake

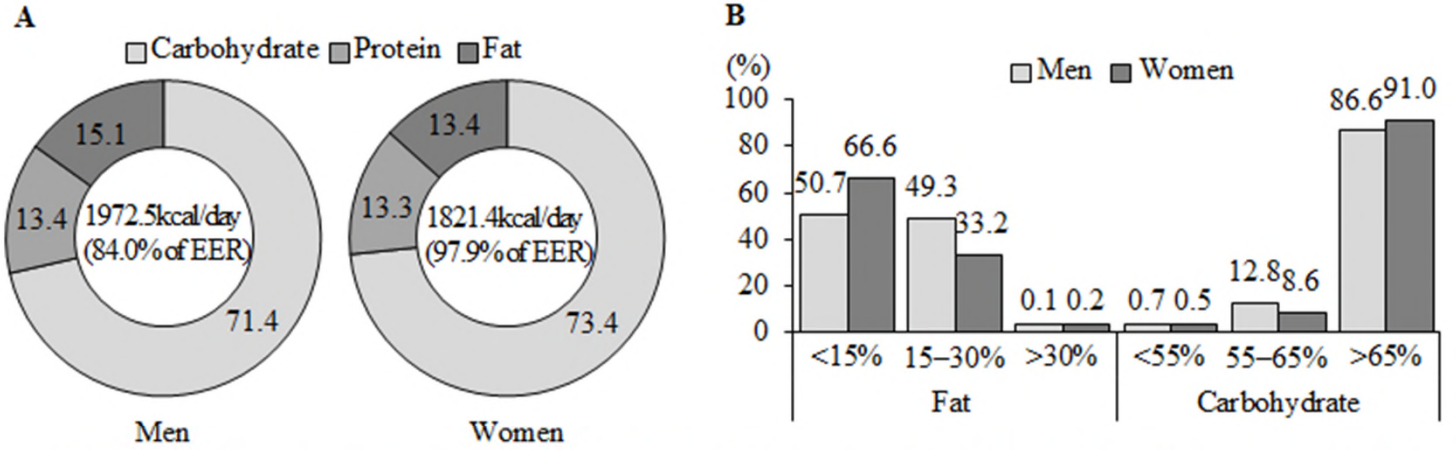


Figure 1. Energy and macronutrient intake (A) and distribution of study participants according to dietary fat and carbohydrate intake compared to Dietary Reference Intakes (B)

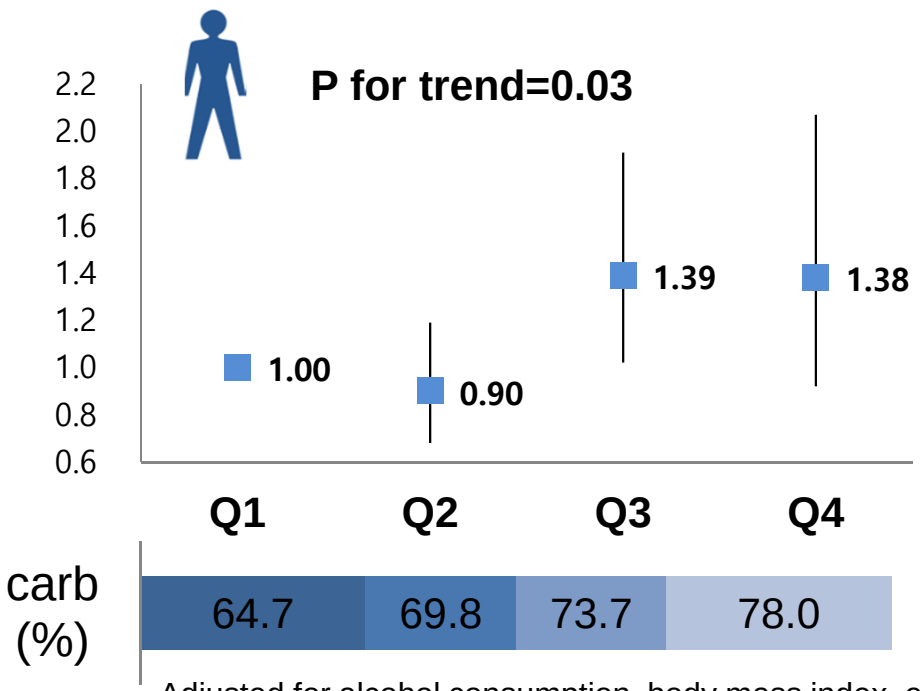
(A) EER, estimated energy requirement. Macronutrient intake is presented as percentage of total energy.

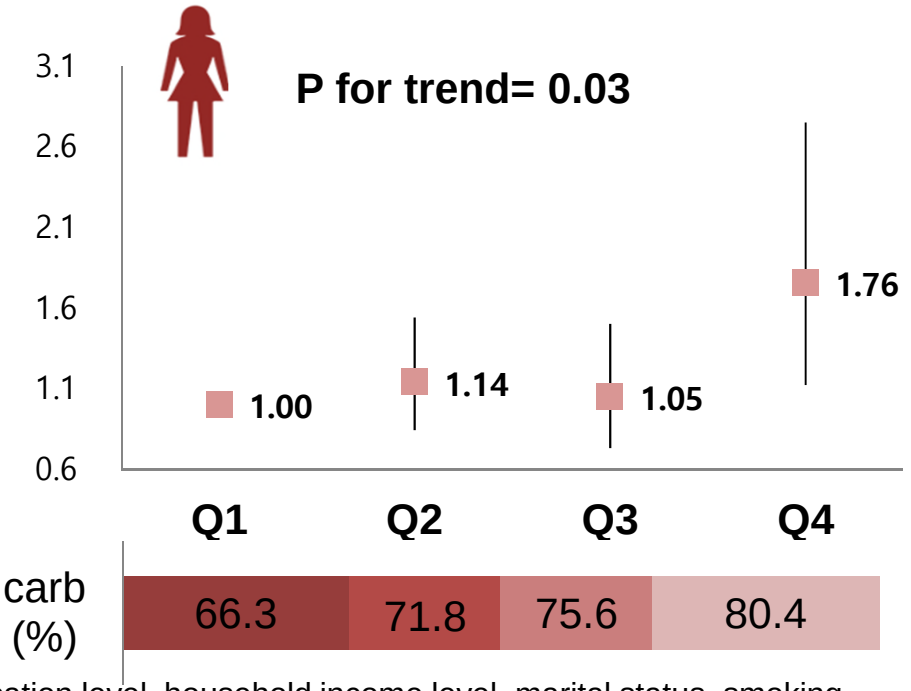
(B) According to Dietary Reference Intakes for Koreans, the acceptable macronutrient distribution range is 15–30% of total energy for fat and 55–65% of total energy for carbohydrates among adults. All values were statistically significantly different between men and women by a generalized linear model or chi-square test ($p<0.05$)

(Ha et al, under review)

Inadequate carbohydrate intake

Data from the Korean Genome and Epidemiology Study, 12y follow up, 40-69y





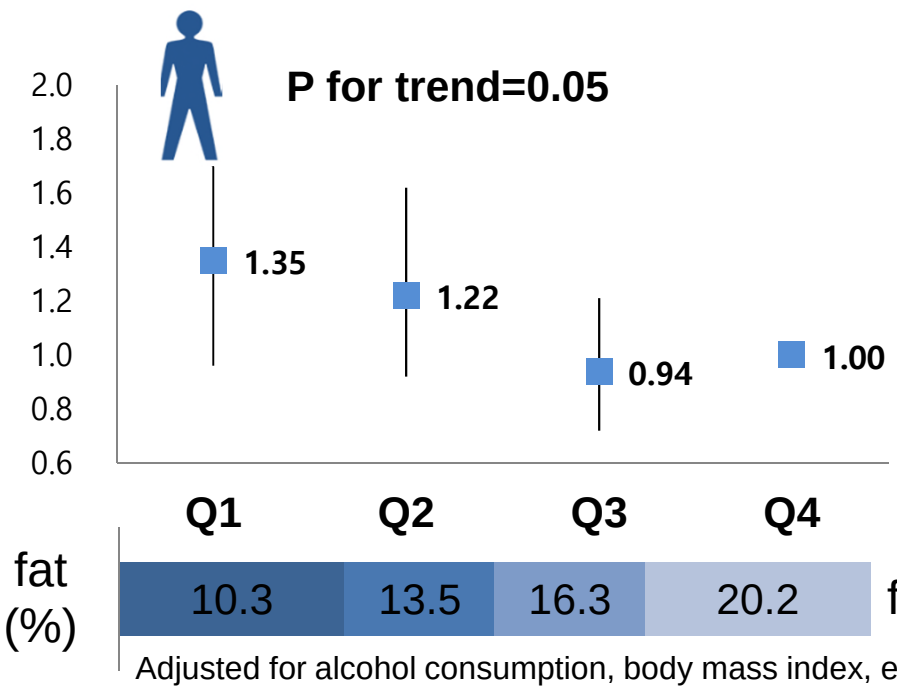
Adjusted for alcohol consumption, body mass index, education level, household income level, marital status, smoking status, parental history of diabetes, physical activity, residence, protein intake (% of total energy), and total energy intake (kcal/day).

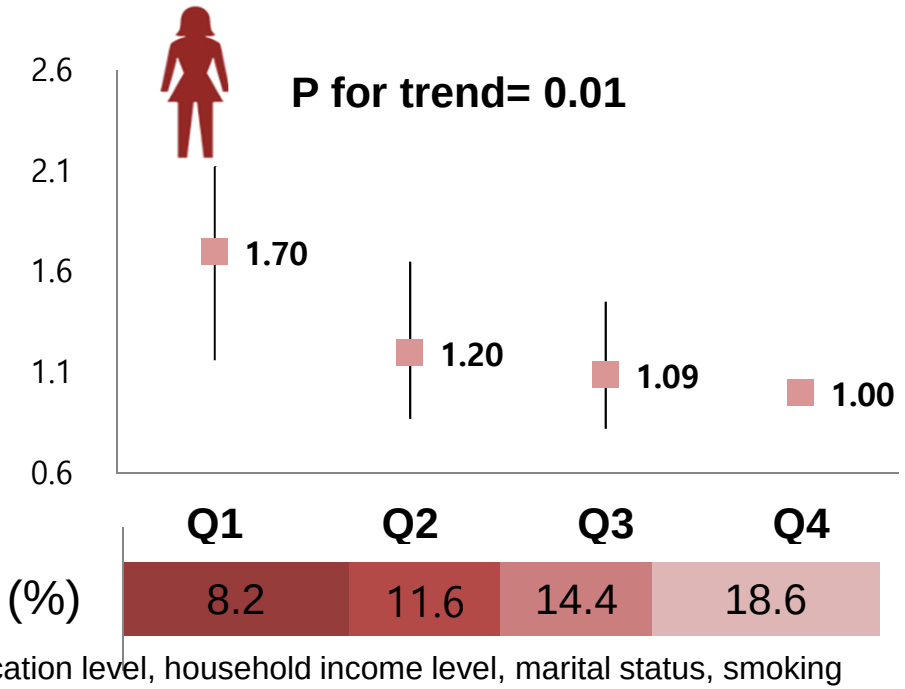
✓ **Excessive carbohydrate** intake was associated with increased risks of T2DM in Korean men and women

(Ha et al, under review)

Inadequate fat intake

Data from the Korean Genome and Epidemiology Study, 12y follow up, 40-69y





Adjusted for alcohol consumption, body mass index, education level, household income level, marital status, smoking status, parental history of diabetes, physical activity, residence, protein intake (% of total energy), and total energy intake (kcal/day).

✓ **Very low fat** intake was associated with increased risks of T2DM in Korean men and women

(Ha et al, under review)

Dietary carbohydrate & food pattern

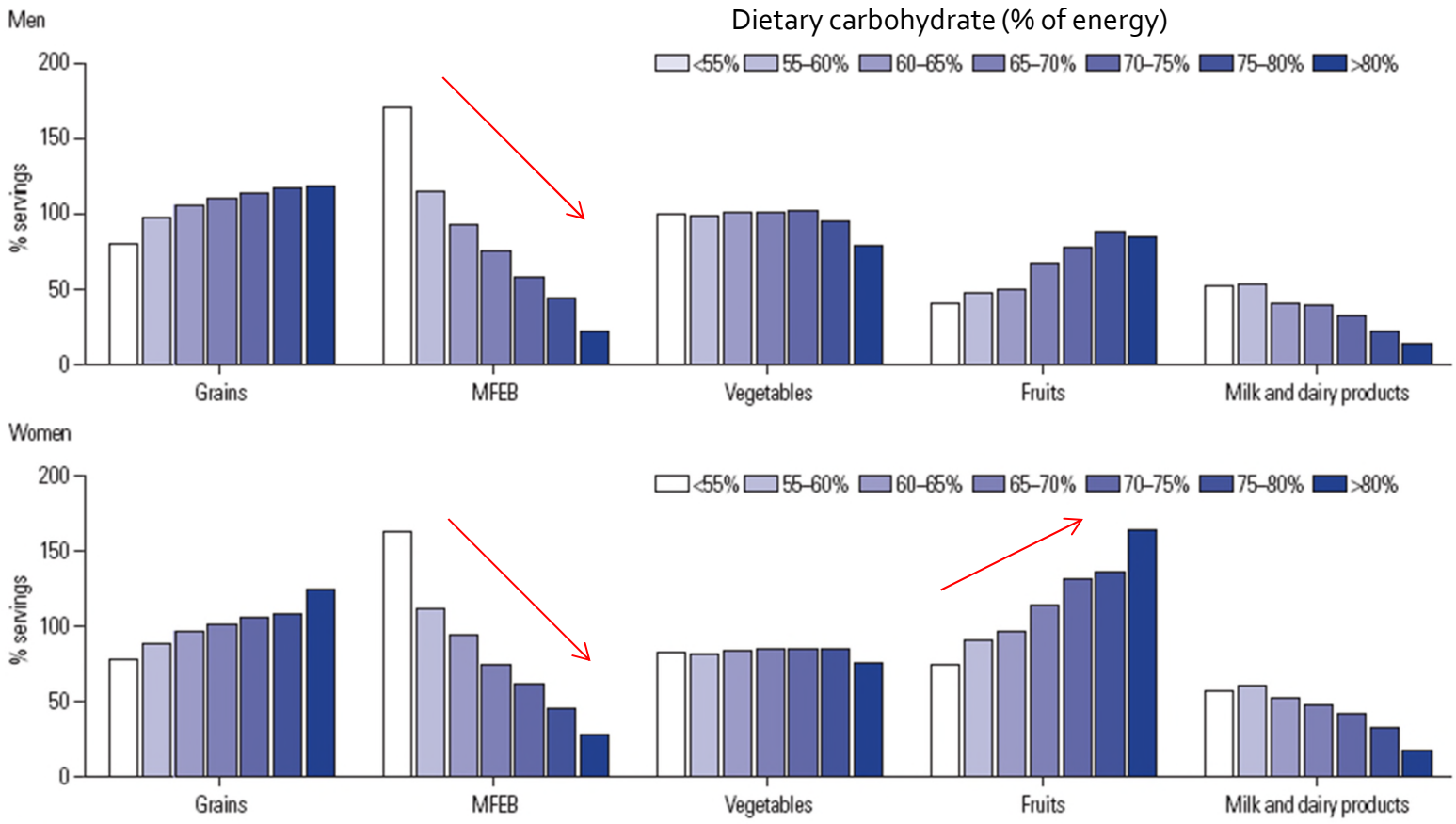


Fig. 2. Food group consumption (percentage of recommended servings) according to dietary carbohydrate intake based on the Korean Food Guidance System. % servings=the number of servings consumed/the recommended number of servings×100. MFEB, meat, fish, eggs, and beans.

Lee et al, Yonsei Med J 2018

Summary

- Although nutrition transition has been paid attention in public due to rapid economic growth and adoption of western dietary pattern in Korea, high fat intake is not yet a major contributor to metabolic syndrome and type 2 diabetes in Korea, whereas very high carbohydrate intake (quantity & quality) still be an important factor.
- More longitudinal studies are needed to clarity the optimal types and amounts of carbohydrate and fat intake in the prevention and management of type 2 diabetes in Korean populations.

Thank you for listening