IDIBELL
Institut d'Investigació Biomèdica de Bellvitge

CELLULAR MEDICINE

Consumo de huevo y diabetes ¿Alguna novedad?

Raul Zamora-Ros

Unit of Nutrition and Cancer
Bellvitge Biomedical Research Institute (IDIBELL)
Barcelona, Spain.

XXV Jornadas Internacionales Nutrición Práctica, 20-22 Abril 2021

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge
CELLULAR MEDICINE

Outline

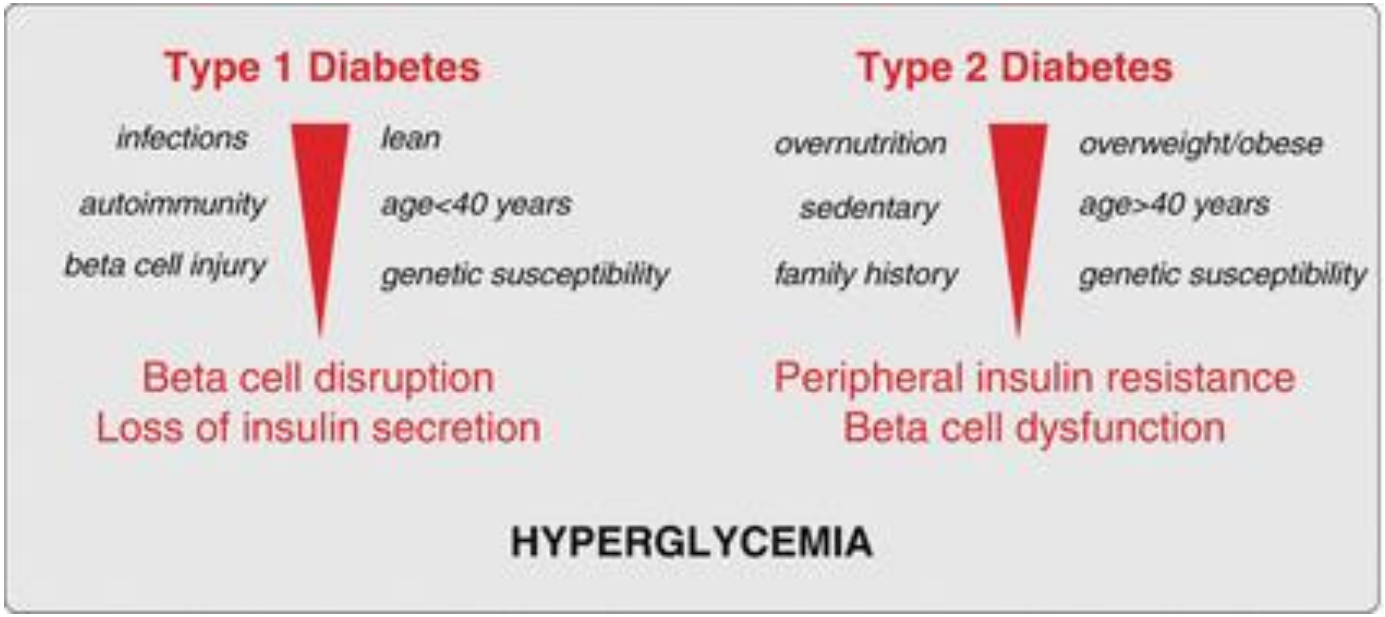
- Introduction:
  - Diabetes
  - Egg properties
- New studies on egg intake & diabetes risk
- Mechanism of action
- Dietary guidelines on egg intake
- Conclusions

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge
CELLULAR MEDICINE

Diabetes

Diabetes is a chronic disease characterized by hyperglycemia due to an absolute or relative lack of insulin or to a cellular resistance to insulin

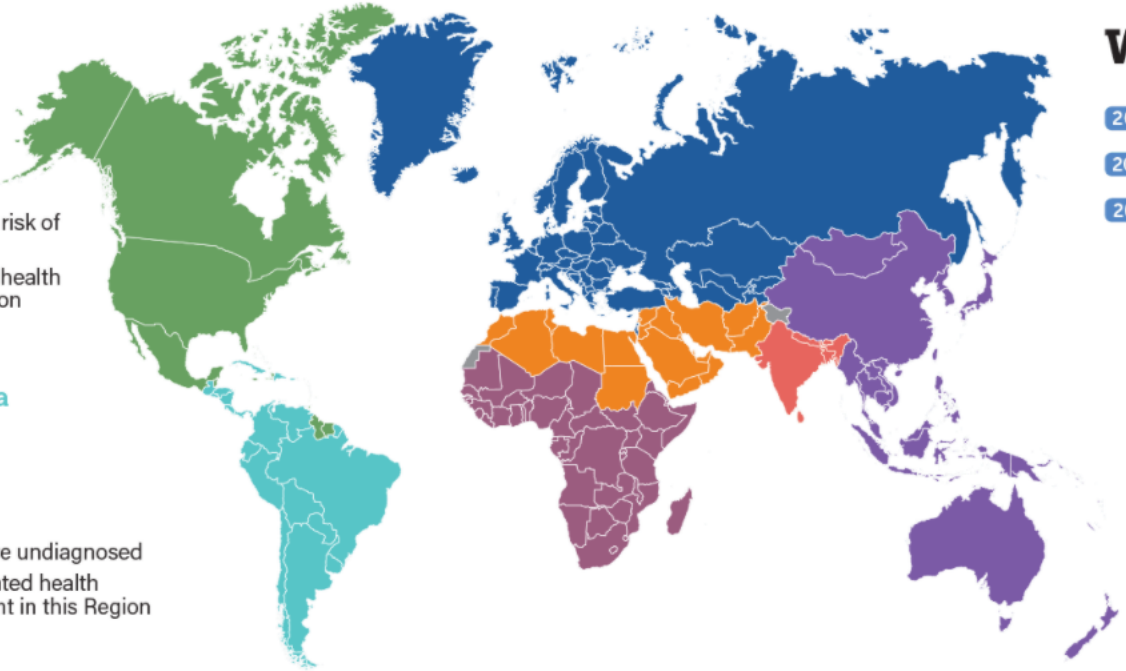
Autoimmune disease (10%) **Metabolic disorder (90%)**



IDIBELL
Institut d'Investigació Biomèdica de Bellvitge
CELLULAR MEDICINE

Diabetes

Number of adults (20–79 years) with diabetes worldwide



North America & Caribbean

2045 63 million
2030 56 million
2019 48 million
↑ 33% increase

- 1 in 6 adults in this Region is at risk of type 2 diabetes
- 43% of global diabetes-related health expenditure occurs in this Region

South & Central America

2045 49 million
2030 40 million
2019 32 million
↑ 55% increase

- 2 in 5 people with diabetes were undiagnosed
- Only 9% of global diabetes-related health expenditure for diabetes is spent in this Region

WORLD

2045 700 million
2030 578 million
2019 463 million
↑ 51% increase

Europe

2045 68 million
2030 66 million
2019 59 million
↑ 15% increase

- 1 in 6 live births are affected by hyperglycaemia in pregnancy
- The Region has the highest number of children and adolescents (0–19 years) with type 1 diabetes – 297,000 in total

Africa

2045 47 million
2030 29 million
2019 19 million
↑ 143% increase

- 3 in 5 people with diabetes are undiagnosed
- 3 in 4 deaths due to diabetes were in people under the age of 60

Middle East & North Africa

2045 108 million
2030 76 million
2019 55 million
↑ 96% increase

- 1 in 8 people have diabetes
- 1 in 2 deaths due to diabetes were in people under the age of 60

South-East Asia

2045 153 million
2030 115 million
2019 88 million
↑ 74% increase

- 1 in 5 adults with diabetes lives in this Region
- 1 in 4 live births are affected by hyperglycaemia in pregnancy

Western Pacific

2045 212 million
2030 197 million
2019 163 million
↑ 31% increase

- 1 in 3 adults with diabetes lives in this Region
- 1 in 3 deaths due to diabetes occur in this Region

IDF Diabetes Atlas, 9th edition 2019

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge
CELLULAR MEDICINE

Diabetes

- Diabetes is a major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation.
- In 2019, **1.5 million deaths** were directly caused by diabetes.
- In 2012, 2.2 million deaths were indirectly caused by diabetes.
- **Prevention**: healthy BMI and diet, physically active, no tobacco.
- **Treatment**: blood glucose and blood pressure control, foot care, screening for retinopathy and diabetes-related kidney disease, **blood lipid control (to regulate cholesterol levels)**

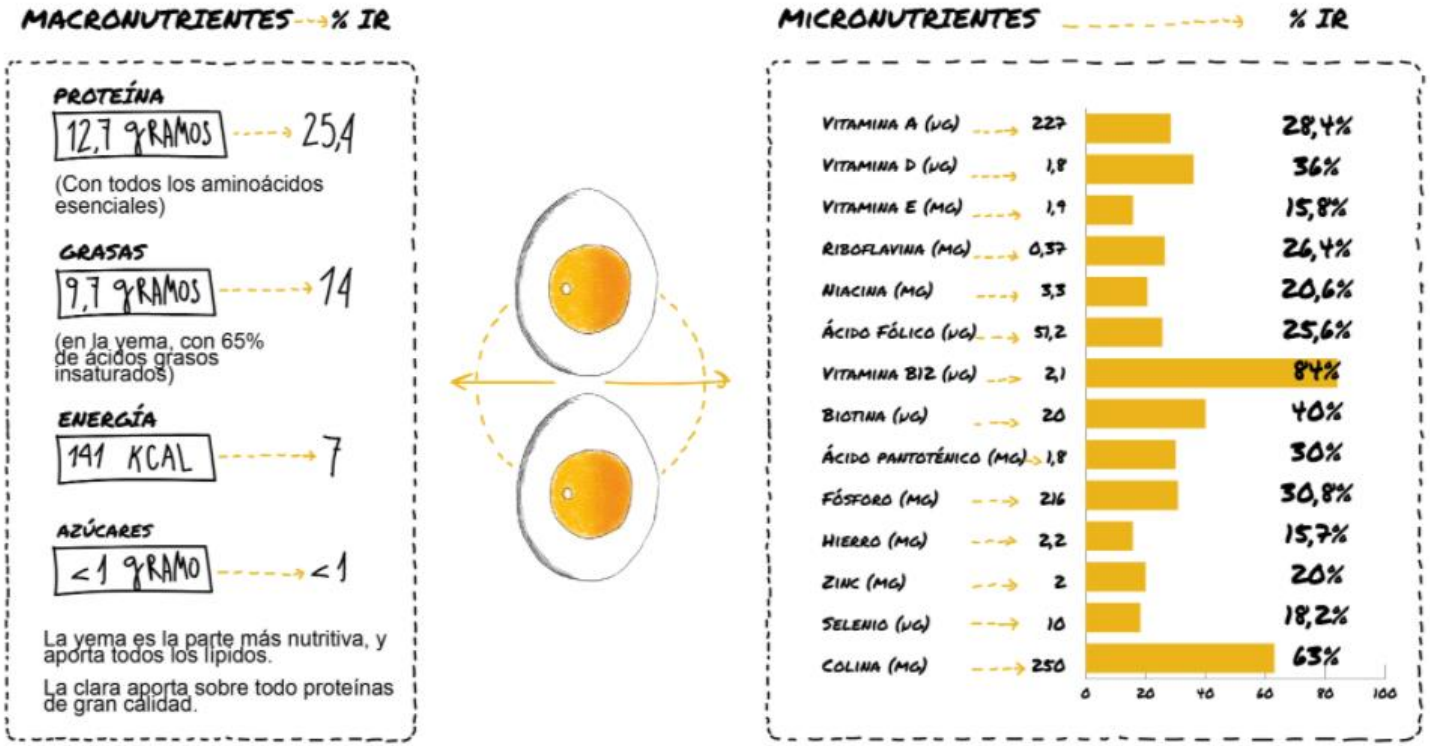
WHO-Diabetes

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge
CELLULAR MEDICINE

Egg

NUTRITIONAL COMPOSITION

Valor nutricional por ración (2 huevos, unos 100 g)



AG Saturados = 2.8g (35%)
AG Monoinsaturados = 3.6g
AG Poliinsaturados = 1.6g

Colesterol = 350mg

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge
CELLULAR MEDICINE

Egg intake & Diabetes

- Is the egg intake playing a role in the risk of type 2 diabetes?
- What is the new evidence on the field?

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge
CELLULAR MEDICINE

Egg intake & Diabetes

META-ANALYSIS 2016 (n=9)

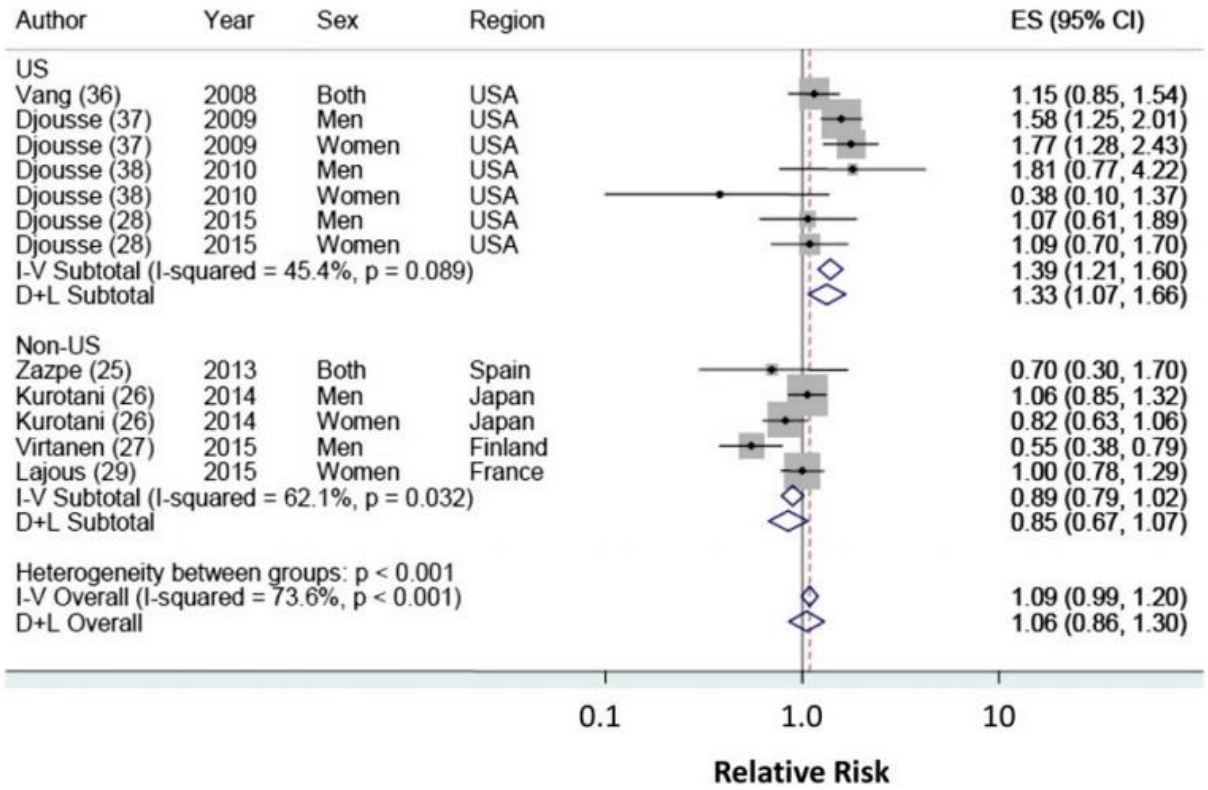


FIGURE 2 Meta-analysis of the association of egg consumption with diabetes mellitus risk (overall and stratified by geographic location: US compared with non-US studies). D+L: DerSimonian-Laird method; ES, effect size; I-V, inverse-weighted variance method.

Djoussé L et al, Am J Clin Nutr 2016; 103: 474-80

Egg intake & Diabetes

META-ANALYSIS 2016 (n=12)

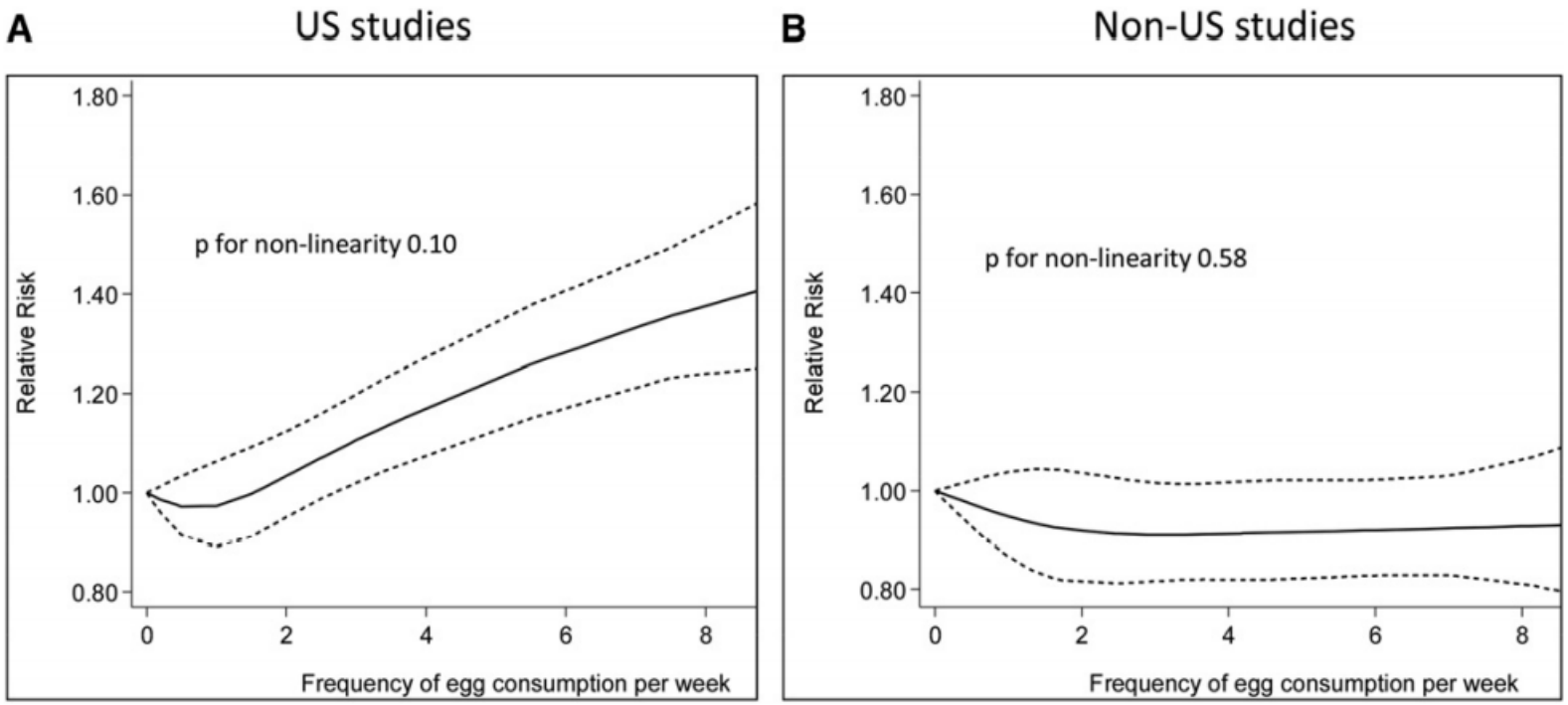


FIGURE 4 Dose-response relation between egg consumption and incident diabetes mellitus stratified by geographic location [US (A) compared with non-US (B) studies] using fixed-effect restricted cubic spline models with 4 kn (5th, 35th, 65th, and 95th percentiles) and generalized least squares regression.

Djoussé L et al, Am J Clin Nutr 2016; 103: 474-80

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge

CELLULAR MEDICINE

Egg intake & Diabetes

META-ANALYSIS 2016 (n=12)

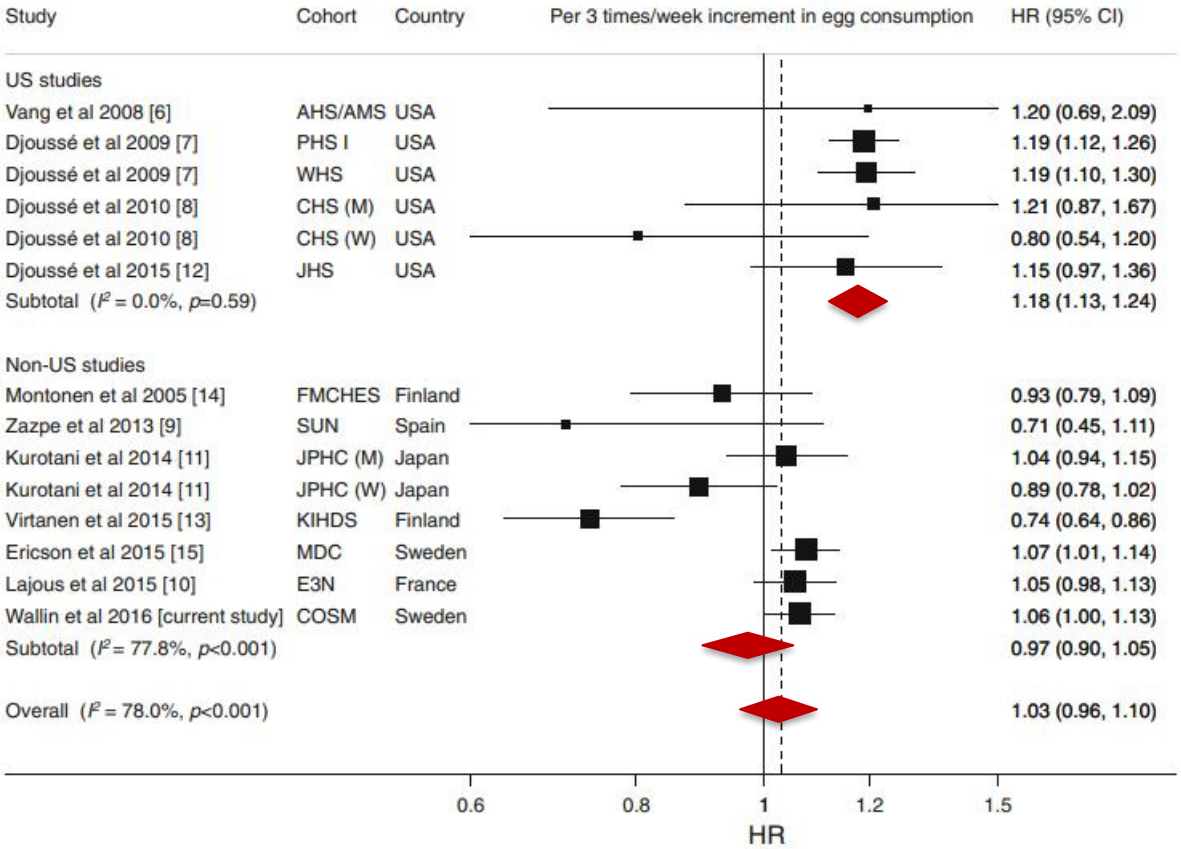


Fig. 1 HRs for type 2 diabetes for each 3 times/week increment in egg consumption. HRs were combined using a random-effects model. Squares represent study-specific HR estimates (size of the square reflects the study-specific statistical weight); horizontal lines represent 95% CIs; diamonds represent the combined HRs with their 95% CIs. AHS, Adventist Health Study; AMS, Adventist Mortality Study; CHS, Cardiovascular Health Study; E3N, The E3N study; FMCHES, Finnish Mobile Clinic Health Examination Survey; JHS, Jackson Heart Study; JPHC, Japan Public Health Center-based Prospective Study; KIHDS, Kuopio Ischaemic Heart Disease Risk Factor Study; MDC, Malmö Diet and Cancer; PHS I, Physicians' Health Study I; SUN, Sun Project; WHS, Women's Health Study; M, men; W, women

Wallin A et al, Diabetologia 2016; 59: 1204-13

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge
CELLULAR MEDICINE

Egg intake & Diabetes

China Health and Nutrition Survey (n=8545)

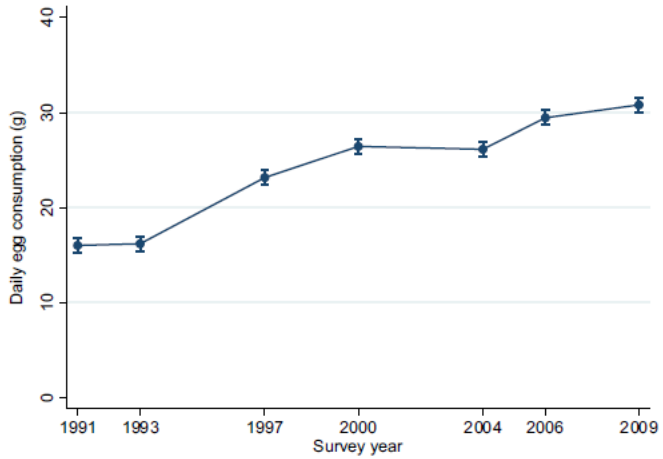


Fig. 1. Age- and sex-adjusted daily egg consumption (g) and 95 % confidence intervals during 1991–2009. Numbers of participants: 9229 in 1991, 8838 in 1993, 9487 in 1997, 10 392 in 2000, 9718 in 2004, 9594 in 2006 and 9942 in

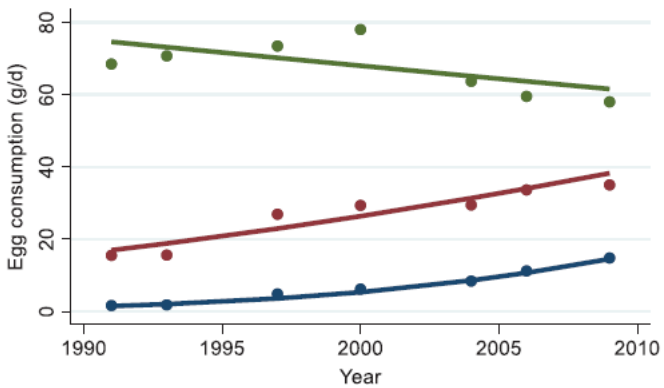


Fig. 2. Trajectory groups of egg consumption among adults attending China Health and Nutrition Survey between 1991 and 2009. Dots represent the mean intake at each time point in each trajectory group. Lines represent predicted values of intake in different trajectory groups of egg consumption. ——, Group 1 (30·7 %); ——, group 2 (62·2 %); ——, group 3 (7·1 %).

Table 3. Quartiles of mean egg consumption during 1991–2009 stratified by sex among participants in the China Health and Nutrition Survey (*n* 8545) (Number of diabetes cases; adjusted odds ratios and 95 % confidence intervals)

	Male (*n* 4000)			Female (*n* 4545)		
	Cases	Adjusted OR*	95 % CI	Cases	Adjusted OR*	95 % CI
First quartile (0–9·0 g/d)	94	Ref.		79	Ref.	
Second quartile (9·1–20·6 g/d)	109	0·94	0·67, 1·33	131	1·73	1·24, 2·43
Third quartile (20·7–37·5 g/d)	114	0·90	0·64, 1·27	149	2·09	1·49, 2·94
Fourth quartile (≥37·6 g/d)	159	1·03	0·73, 1·46	112	1·46	1·01, 2·12

Ref., reference.
* OR adjusted for age, urbanisation, income, education, smoking, drinking, physical activity, dietary pattern, overweight/obesity, high blood pressure, serum cholesterol and energy intake.

Wang Y et al, Br J Nutr 2020; In press

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge

CELLULAR MEDICINE

Egg intake & Diabetes

META-ANALYSIS 2016 (n=19)

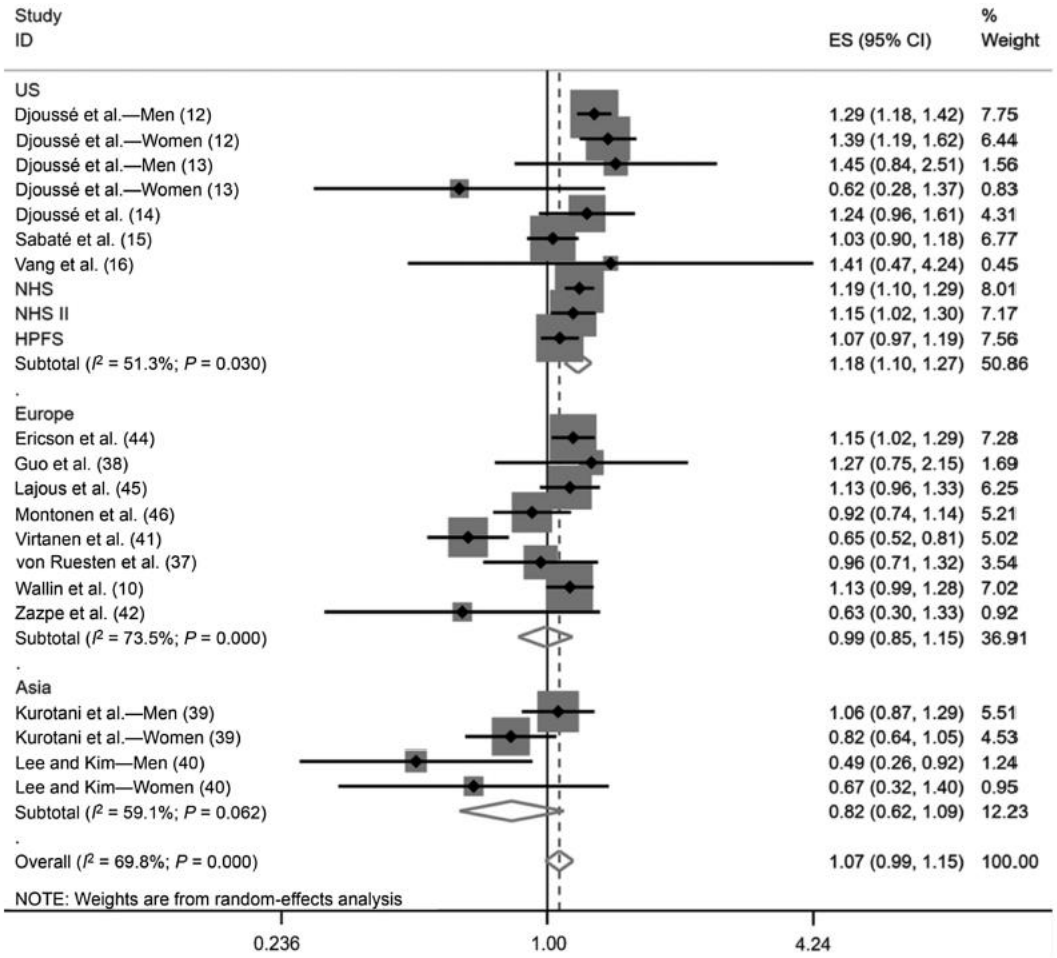


FIGURE 2 Association of egg consumption with T2D risk, for a 1-egg/d increase, stratified by geographic region and using random-effects meta-analysis (589,559 participants; 41,248 incident T2D cases). Weights of each of the studies are represented by the size of the square. Black diamonds represent the individual study effects and black lines represent the 95% CIs. The overall effect estimate and 95% CI are represented by the dotted line and white diamonds respectively. P value for interaction between geographic regions, tested using meta-regression = 0.01. ES, effect size; HPFS, Health Professionals' Follow-up Study; NHS, Nurses' Health Study; T2D, type 2 diabetes.

Drouin-Chartier JP et al, Am J Clin Nutr 2020; 112: 619-30

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge
CELLULAR MEDICINE

Egg intake & Diabetes

MECHANISMS OF ACTION

- **Cholesterol intake & diabetes**
  - **Cardiovascular Health Study (n=5888)** (Am J Clin Nutr 2010;92:422–7) **= RR**
  - **Japan Public Health Center–based Prospective Study (n=63466)** (Br J Nutr 2014;112:1636-43).

    = RR ♂ & ↓23% ♀
- **Egg intake & Hemoglobin A1c, HOMA-IR, ß-cell function**
  - **Jackson Heart Study (n=4568)** (Clin Nutr 2016;35:679-84) **NO association**
- **Egg & TMAO (trimethylamine-N-oxide)**
  - **Egg -> ↑ TMAO** (Am J Clin Nutr 2014;100:778–86)
  - **TMAO -> ↑LDL oxidation & ↑inflammation** (Nature 2011;472:57–63) **-> ↑Diabetes** (Diabetes Res Clin Pract 2014;105:231–8)

NO CLEAR POTENTIAL MECHANISM OF ACTION

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge

CELLULAR MEDICINE

Egg intake & Diabetes

META-ANALYSIS 2016 (n=19)

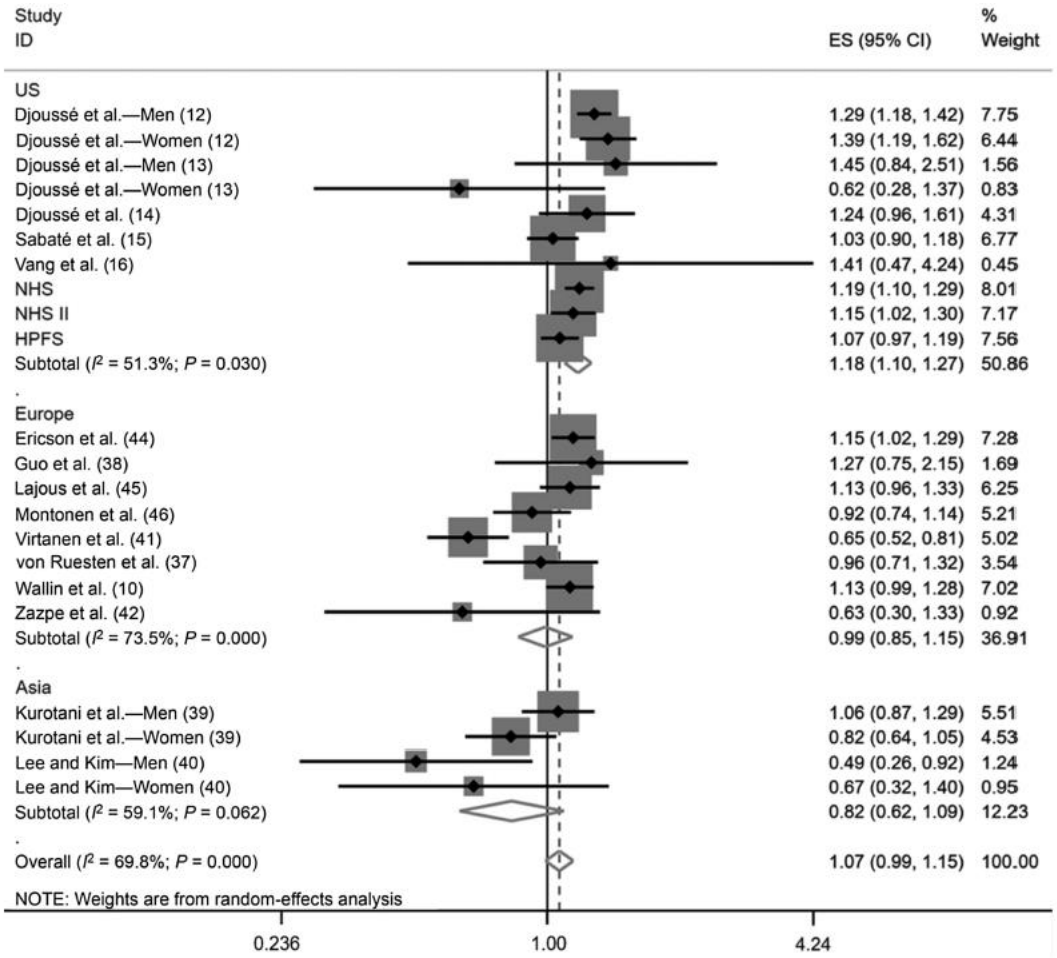


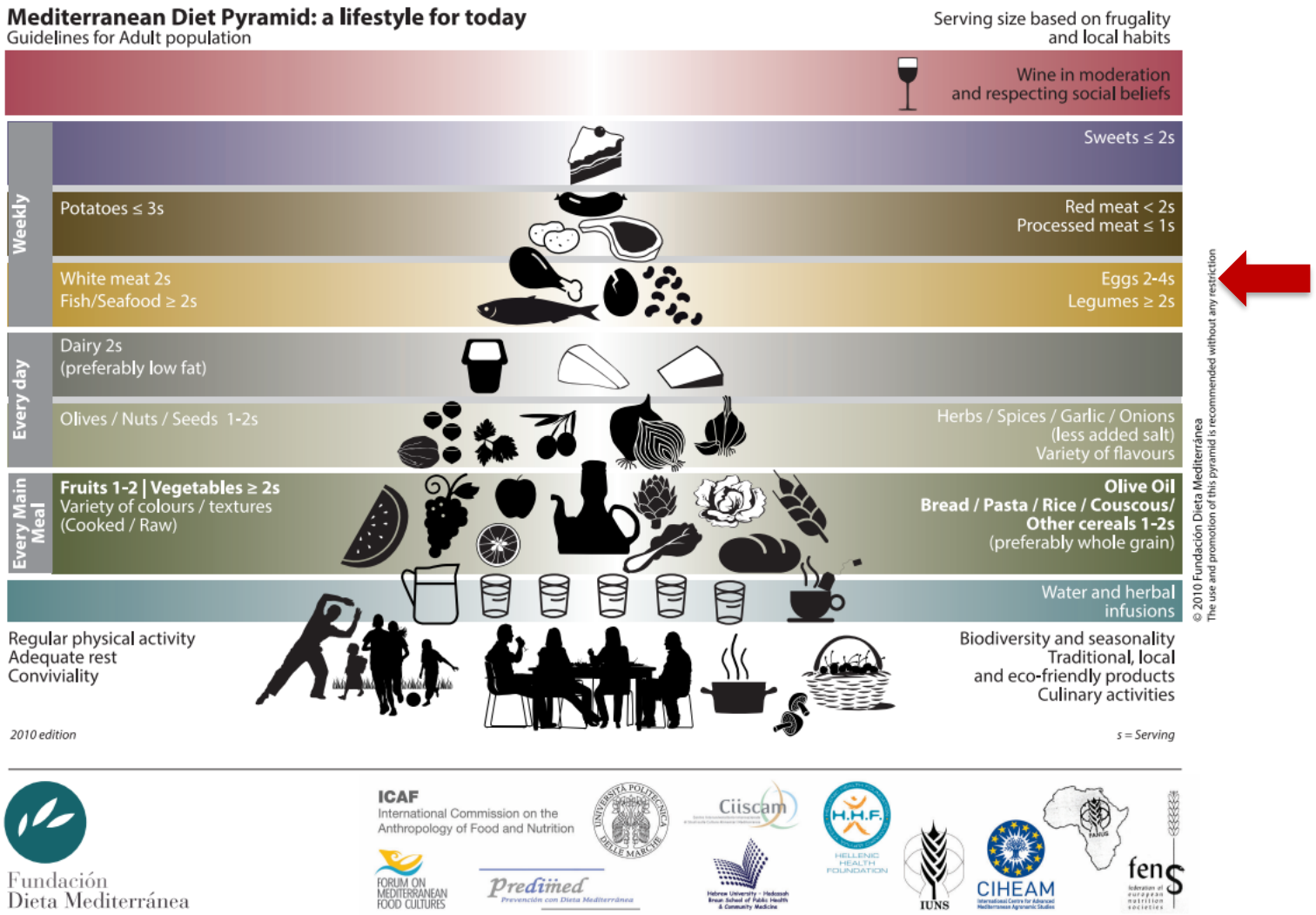
FIGURE 2 Association of egg consumption with T2D risk, for a 1-egg/d increase, stratified by geographic region and using random-effects meta-analysis (589,559 participants; 41,248 incident T2D cases). Weights of each of the studies are represented by the size of the square. Black diamonds represent the individual study effects and black lines represent the 95% CIs. The overall effect estimate and 95% CI are represented by the dotted line and white diamonds respectively. P value for interaction between geographic regions, tested using meta-regression = 0.01. ES, effect size; HPFS, Health Professionals' Follow-up Study; NHS, Nurses' Health Study; T2D, type 2 diabetes.

Drouin-Chartier JP et al, Am J Clin Nutr 2020; 112: 619-30

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge

CELLULAR MEDICINE

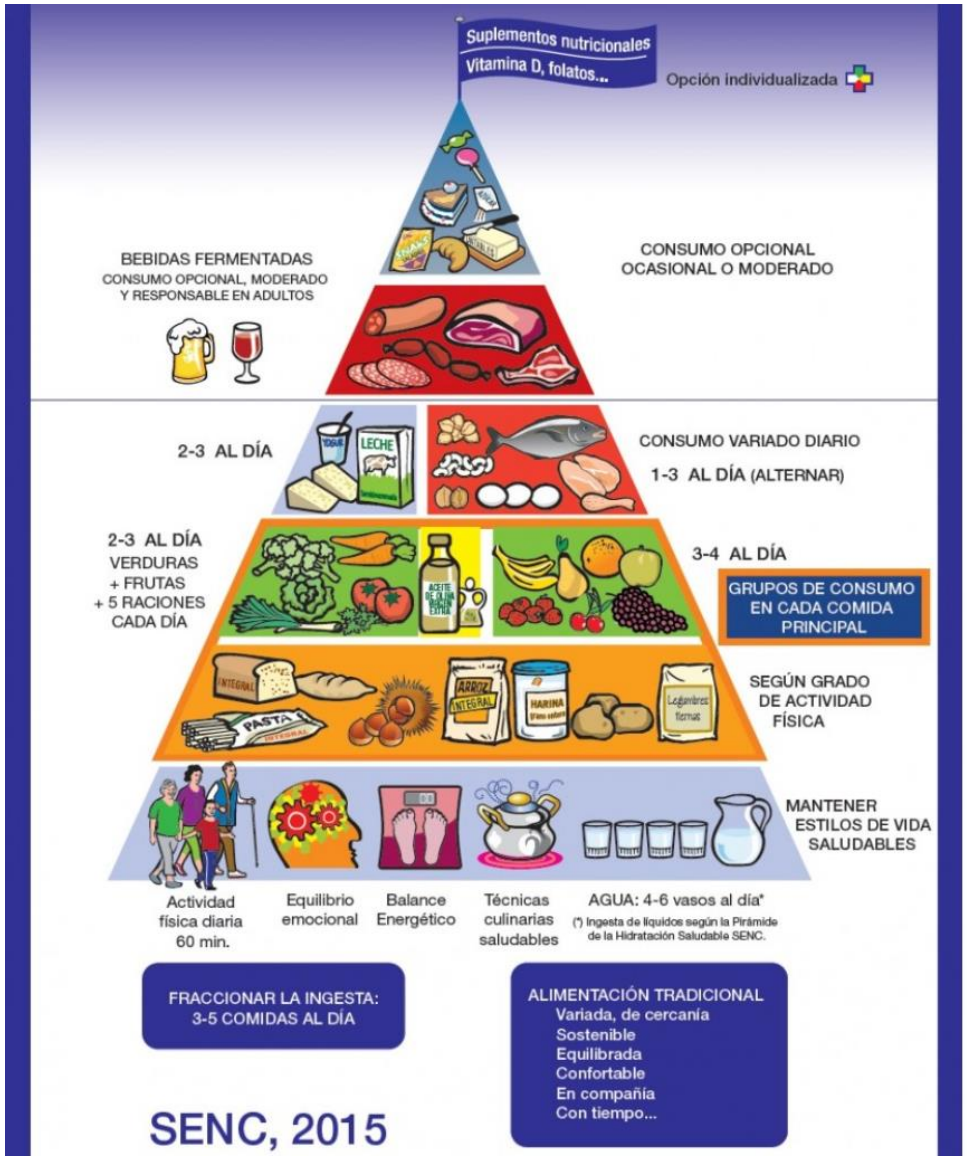
Dietary guidelines



IDIBELL
Institut d'Investigació Biomèdica de Bellvitge

CELLULAR MEDICINE

Dietary guidelines

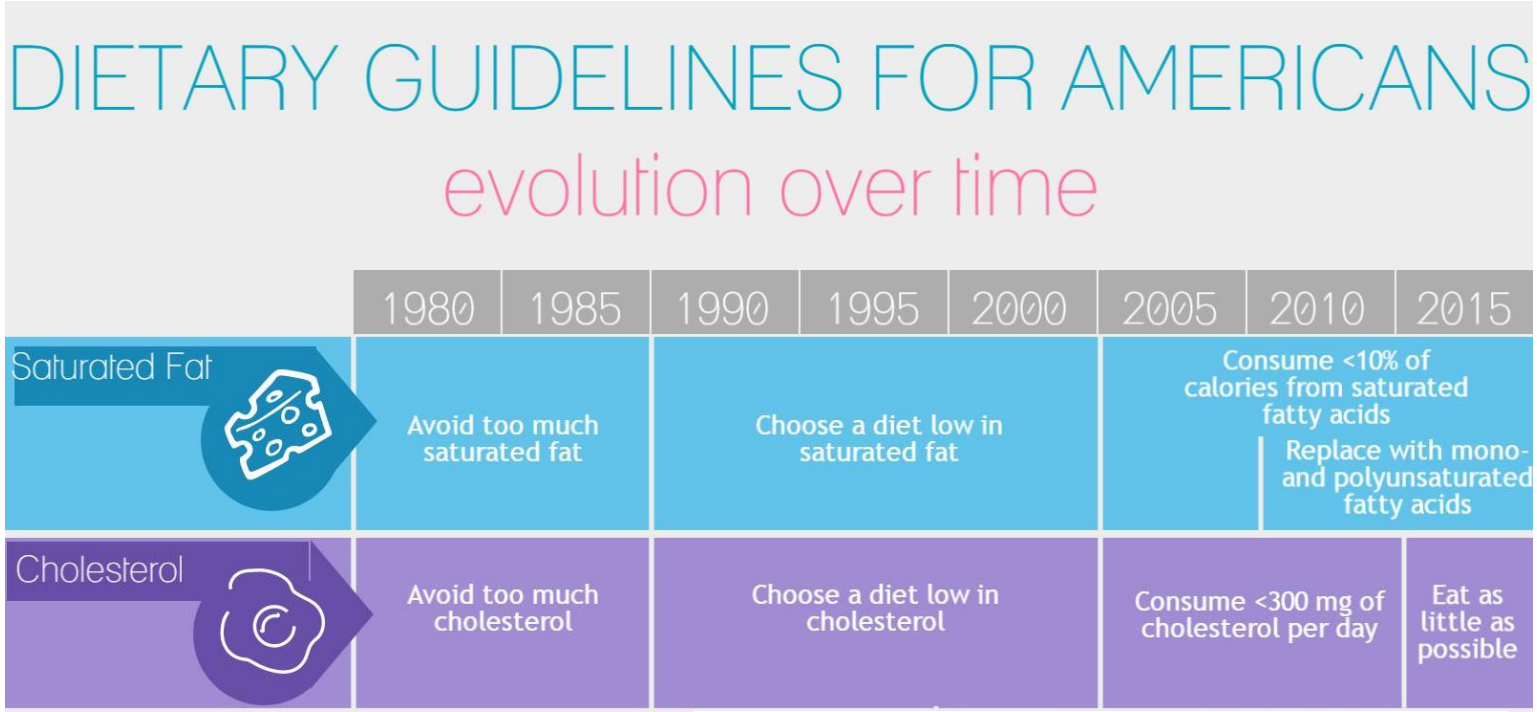


IDIBELL
Institut d'Investigació Biomèdica de Bellvitge
CELLULAR MEDICINE

Dietary guidelines

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge
CELLULAR MEDICINE

Dietary guidelines



Federal dietary guidelines for 2015-2020

The guideline recommendation to limit cholesterol consumption to 300 mg per day — an egg has roughly 200 mg — has been dropped. The government's expert panel said that dietary cholesterol is no longer a "nutrient of concern."

US Department of Health and Human Servicies (health.gov)

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge
CELLULAR MEDICINE

Conclusions

Editorial

ASN EST. 1928

See corresponding article on page 619.

Eggs and diabetes: 1 daily egg a safe bet?

Mahshid Dehghan, Andrew Mente, and Salim Yusuf

Population Health Research Institute, Hamilton, Ontario, Canada

In conclusion, moderate egg consumption (i.e., 1 egg/d) is a safe and an affordable source of high-quality protein and can be included as part of a healthy diet which emphasizes moderate intakes of a variety of foods.

Dehghan M et al, Am J Clin Nutr 2020; 112: 503-4

IDIBELL
Institut d'Investigació Biomèdica de Bellvitge

CELLULAR MEDICINE

Many thanks
for your attention!