UCD Institute of Food & Health

Cheese and health: an update of the evidence

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Atlantica-db

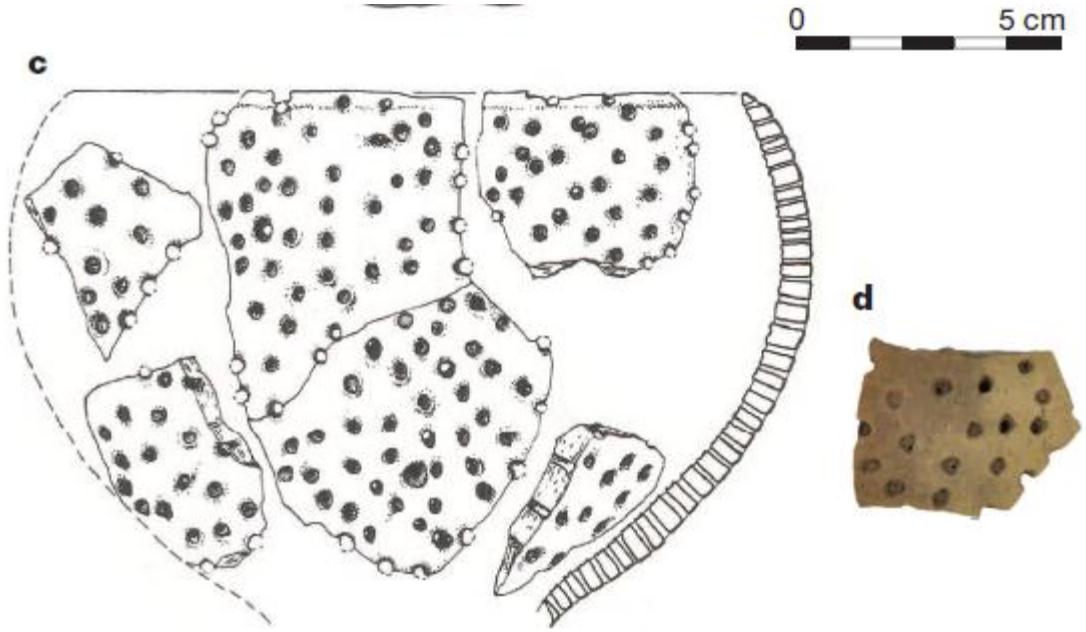
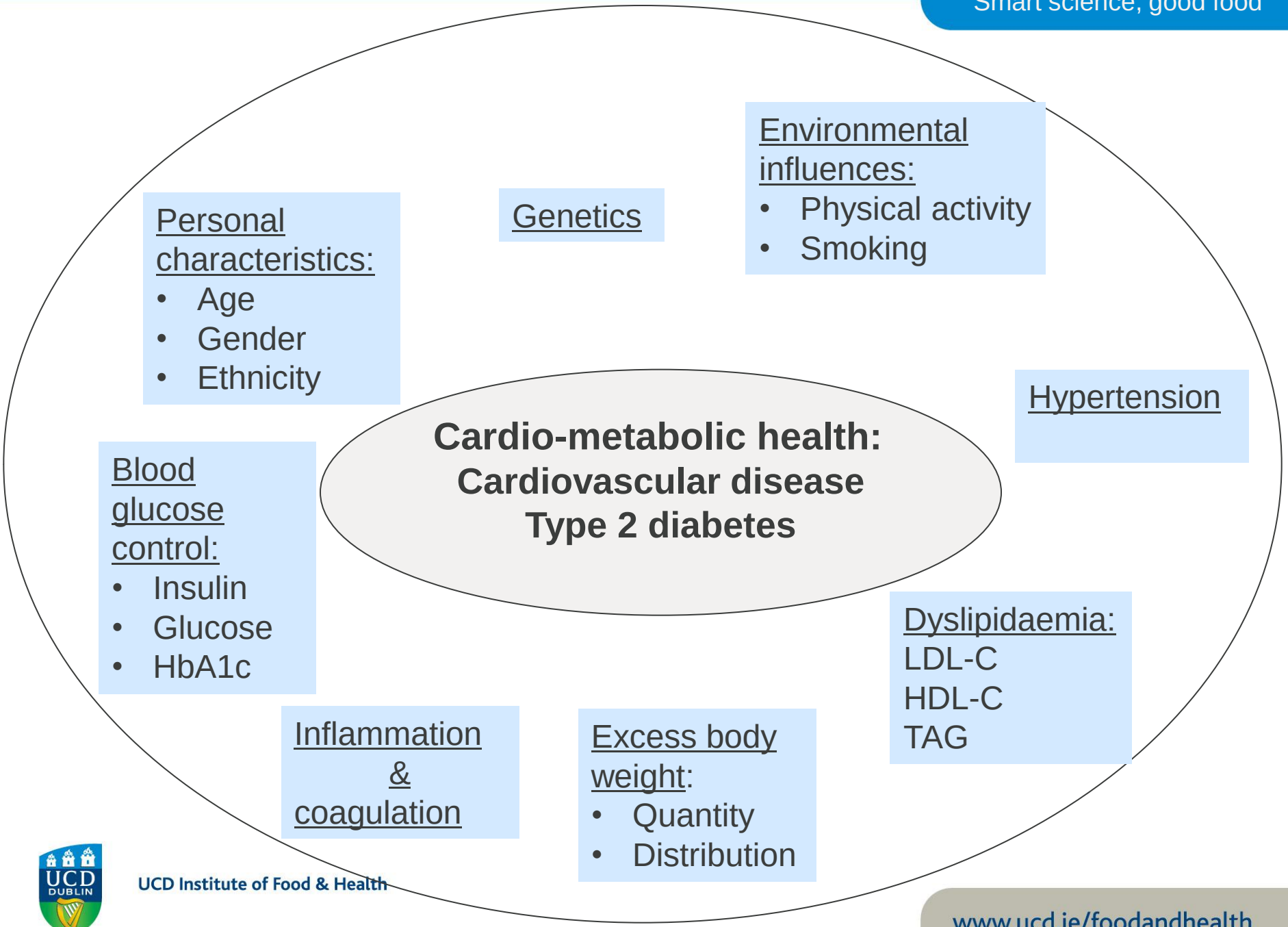


Figure 1 | Drawings of representative reconstructed sieve vessels and photographs of specific sieve fragments from the region of Kuyavia submitted to lipid residue analyses. a, b, KUY0750, from Brześć Kujawski site 3. c, d, KUY0757 from Smólsk site 4. The typology of the sieve vessels is comparable to those used by modern-day cheese producers (Supplementary Fig. 1). Drawings used with permission from ref. 20.

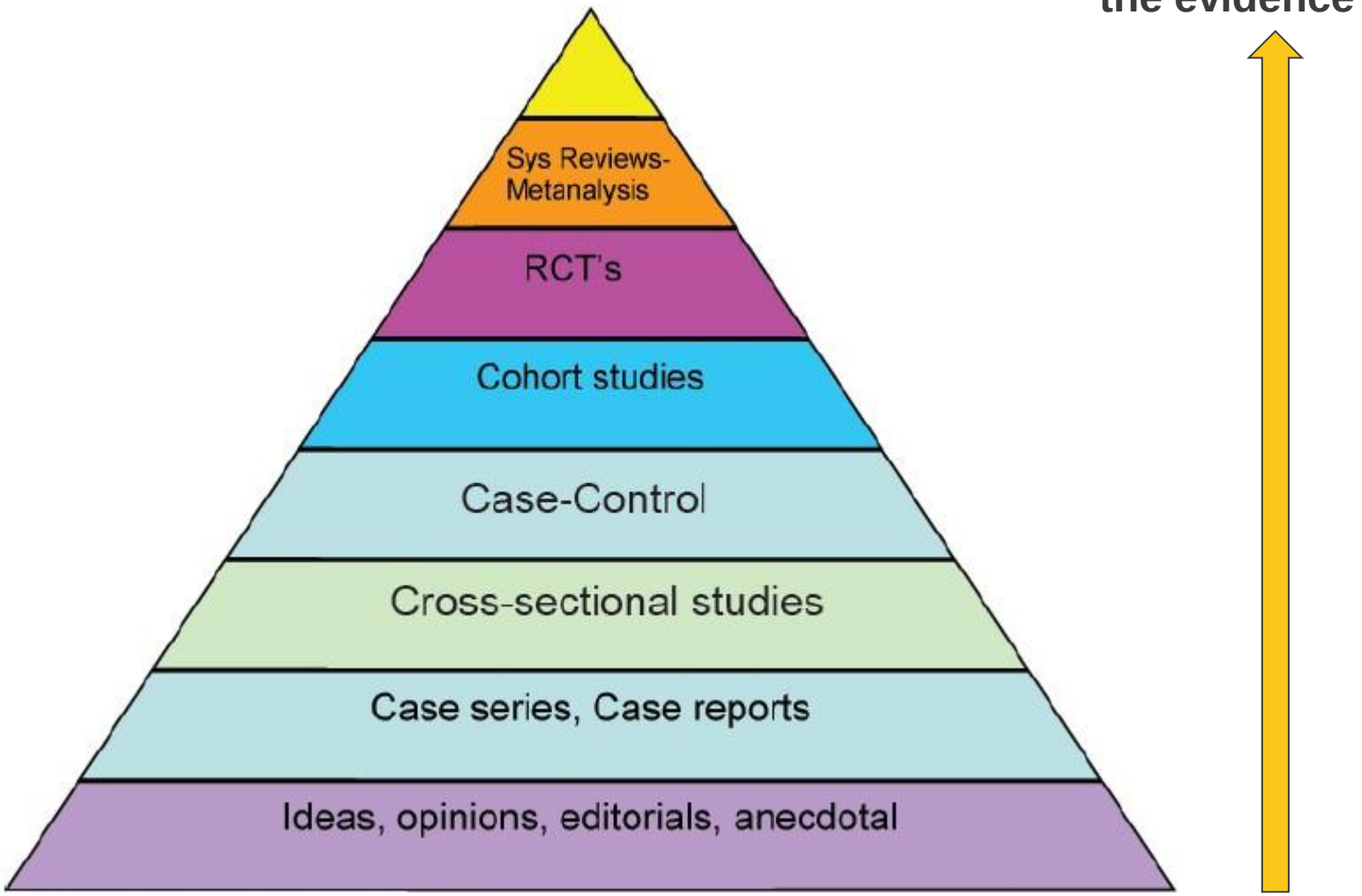
5,200-4,800BC, Salque et al. 2013. , 522-25 Nature 493.

Cheese & health

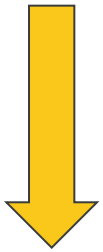
Will eating cheese affect my health?

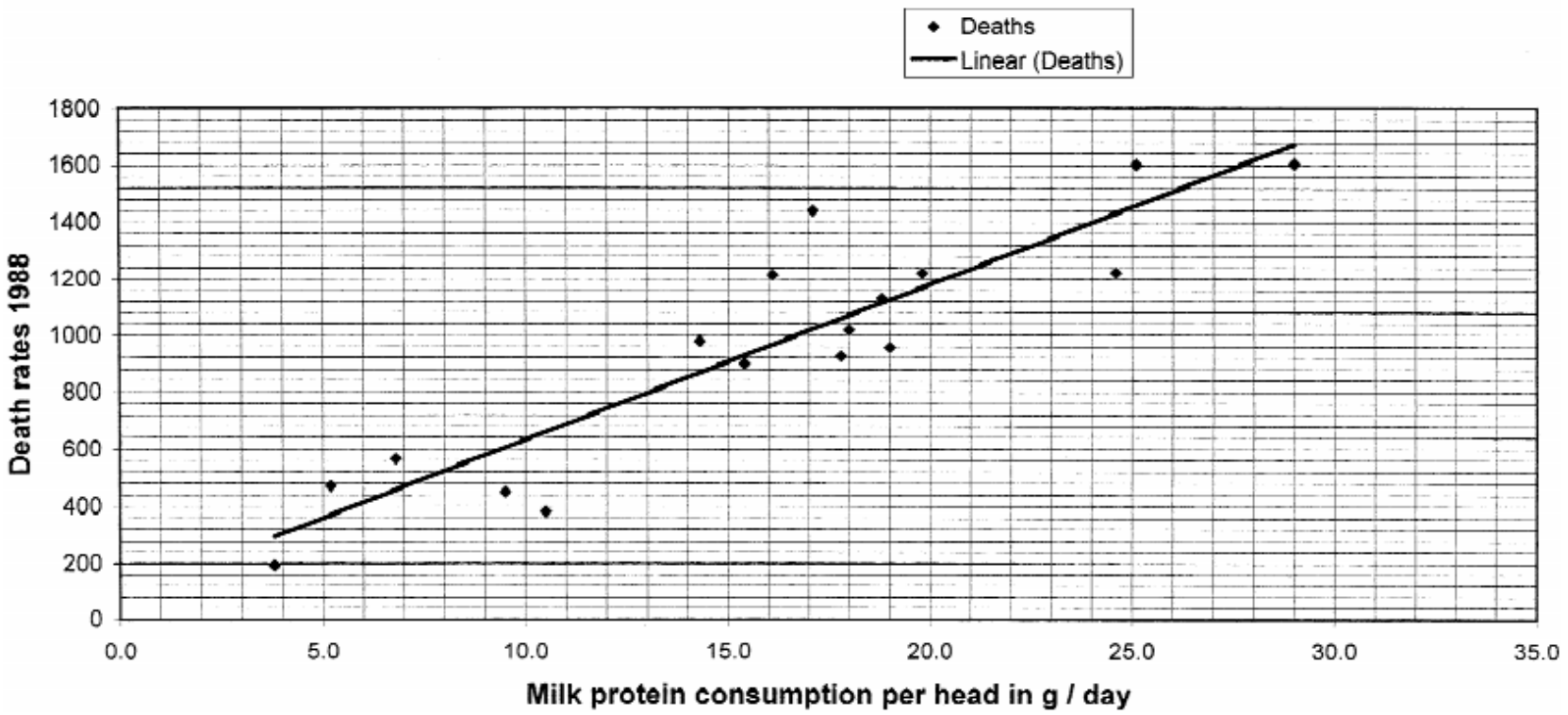

Personal characteristics:
• Age
• Gender
• Ethnicity
Genetics
Environmental influences:
• Physical activity
• Smoking
Hypertension
Cardio-metabolic health:
Cardiovascular disease
Type 2 diabetes
Blood glucose control:
• Insulin
• Glucose
• HbA1c
Dyslipidaemia:
LDL-C
HDL-C
TAG
Inflammation & coagulation
Excess body weight:
• Quantity
• Distribution

What is the evidence?



Ecological/ Correlation studies




Deaths
Linear (Deaths)
Death rates 1988
1800
1600
1400
1200
1000
800
600
400
200
0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
Milk protein consumption per head in g / day

Ecological/ Correlation studies

Author	Number of countries studied	Methods of assessment	Relationship with Cheese (Y/N)	Comment
Artaud-Wild et al. 1993	40	WHO death statistics; FAO food data	N	Subgroup analysis: negative correlation for countries with high SFA & cholesterol intakes
Seely et al. 1998	8	WHO death statistics; national food consumption data	N	
Moss & Freed, 2003	17	WHO statistics; OECD & euromonitor food intake data	N	

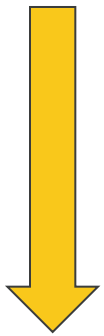
Ecological/ Correlation studies

- What is cheese intake?
  - Typically assessed using food balance sheets
  - No account of wastage

- What are death rates?
  - Have you captured all deaths?
  - Have they been correctly classed?

- Is there a relationship between them?
  - How good is your statistics?
  - Have you taken the ‘right’ approach?

Cross-sectional studies



Cross-sectional studies

- *n*≥8 studies, adults only (2007-2014)
- Sample sizes: 168-18,770 (*n*4 >10K participants)
- Mostly food frequency questionnaires
- Outcomes assessed:
  - Anthropometry (BMI, Waist circumference, weight)
  - Blood lipids (Total C, LDL-C, HDL-C, TAG, apoA, apoB)
  - Fasting glucose and insulin
  - Blood pressure (systolic & diastolic)

Was there a relationship between cheese intake & the primary outcomes measured?

Outcome	Relationship
Anthropometrics	↑ BMI (n2, 1 in males only) ↑ obesity, central obesity (n=1, stronger in males) NSD: n5
Blood lipids	↑ HDL (n3), ↓ TAG (n1), ↑ total & LDL-cholesterol (n1) NSD: n5
Insulin & glucose	NSD (n8)
Blood pressure	↓ SBP (n1), ↑ SBP (n1), ↑ DBP (n1), NSD:n1
Metabolic Syndrome	↓ presence (n2), ↑ (n1)

*NSD: no statistically significant difference. BMI: body mass index, HDL: High density cholesterol, TAG: tryglycerides, LDL: low density lipoprotein cholesterol, SBP: systolic blood pressure, DBP: diastolic blood pressure

How big is the degree of change??

- BMI:
  - Difference between male non-consumers & those eating >30 servings/month: 0.66kg/m^2 (Houston et al. 2008)
  - Relationship between cheese intake & increasing BMI. β=0.15±0.8 per 20g serving (Snijder et al. 2007)

- HDL-C:
  - Difference between High and Low/No consumers: 0.02-0.20mmol/l

(Houston et al, 2008, Hostmark et al. 2009, Sadeghi et al. 2014)

- Presence of the Metabolic Syndrome:
  - Increase risk: OR 1.16 (95% CI: 1.04-1.19) (Beydoun et al. 2008)
  - Decreased risk: OR 0.81 ((5% CI: 0.71-0.94) (Sadeghi et al. 2014)

Cross-sectional studies

- What is cheese intake?
  - Most FFQ, not primarily designed to capture cheese intakes
  - Mostly retained at frequency level

- How were the primary end points assessed?
  - Mostly measured anthropometrics & biochemistry

- Is there a relationship between intakes & endpoints?
  - Variable statistical analyses & details provided

Case Control studies

Case control studies on cheese & health

- 5 studies in adults (1990-2008)
- Myocardial infarction (n4), acute coronary syndrome (n1)
- Number of cases: n111-848 (Controls: n107-1078)
- 3 studies: no relationship between cheese intake & MI, one study showed a decreased risk while one study showed an increased risk

Considerations of case control studies

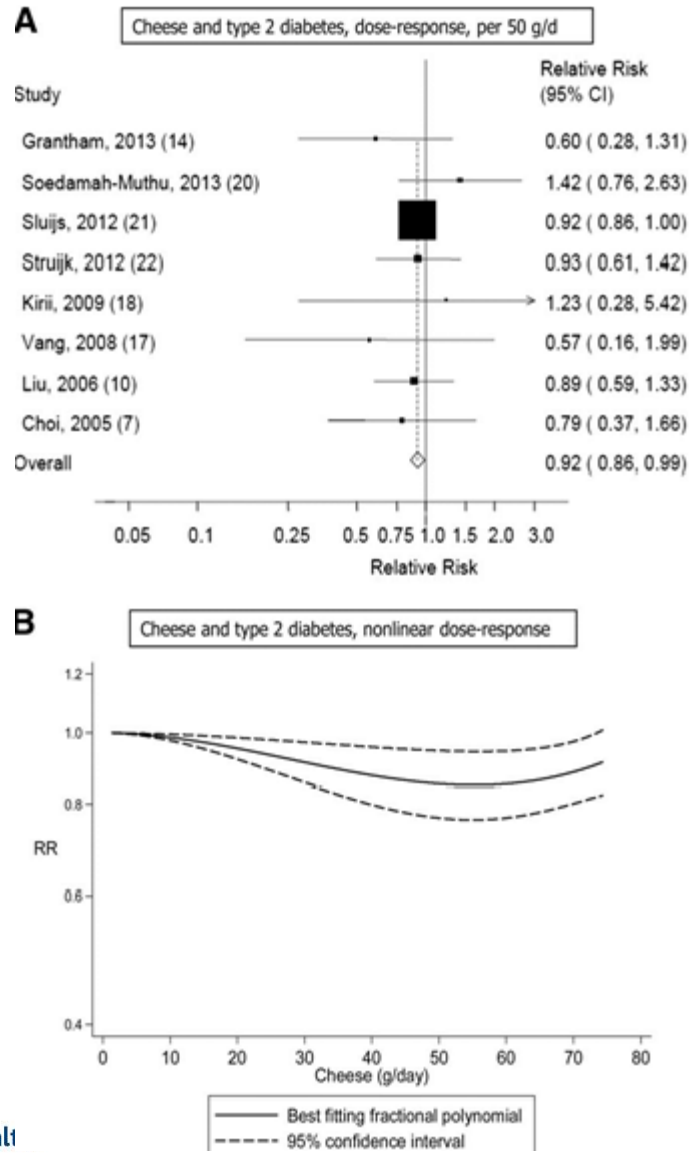
- Select cases (verified)
- Select age and sex matched controls (verified?)
- Enquire about previous dietary habits
  - What is the accuracy of such recall?
  - Does the existence of a diagnosis cause bias?
  - Are “surrogates” reliable?

Prospective studies

Prospective studies on cheese & health

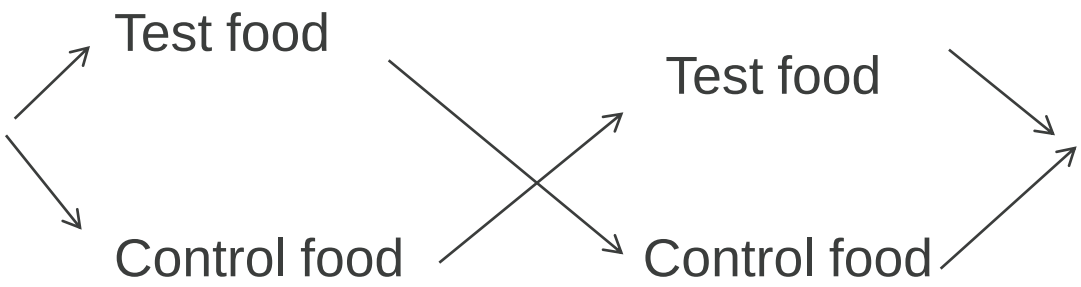
- ≥25 studies in adults (1984-2015)
- CVD/Heart Disease/Stroke (n15), type 2 diabetes (n10)
- Number of participants: 1,526 – 41,254
- 'CVD': 6 studies identified an inverse relationship (2 in women only), 8 studies showed no statistically significant relationship.1 study showed an increased risk (n64):
  - Total cheese & MI, HR: 0.74 (95% CI, 0.60, 0.91) (Patterson et al. 2013)

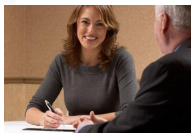
Prospective studies on cheese & T2D



Anue et al. 2013 AJCN 98, 1066-83

Randomised Controlled Trials





- Wash-out between phases
- Keep other lifestyle factors constant

Author	Foods Used	Description	Outcomes
Tholstrup et al. 2004	Whole milk, Samso hard cheese, Butter (balanced for lactose & protein)	3 wk intervention, 14 young healthy adults	Cheese reduced LDL-C *vs* butter.
Biong et al. 2004	Jarlsberg cheese, butter & casein	3 wk intervention, 22 healthy college students	Cheese reduced Total-C *vs* butter.
Nestel et al. 2005	Cheddar cheese, low fat dairy, butter	4 wk intervention period, 19 middle age with slightly raised cholesterol	Cheese group had lower Total-C & LDL-C *vs* butter
Hjerpsted et al. 2011	Butter, Samso hard cheese. Balanced for FA type	6 wk intervention, 49 middle age healthy adults	Cheese lowered Total-C, LDL-C & HDL-C *vs* butter.

What does this mean?

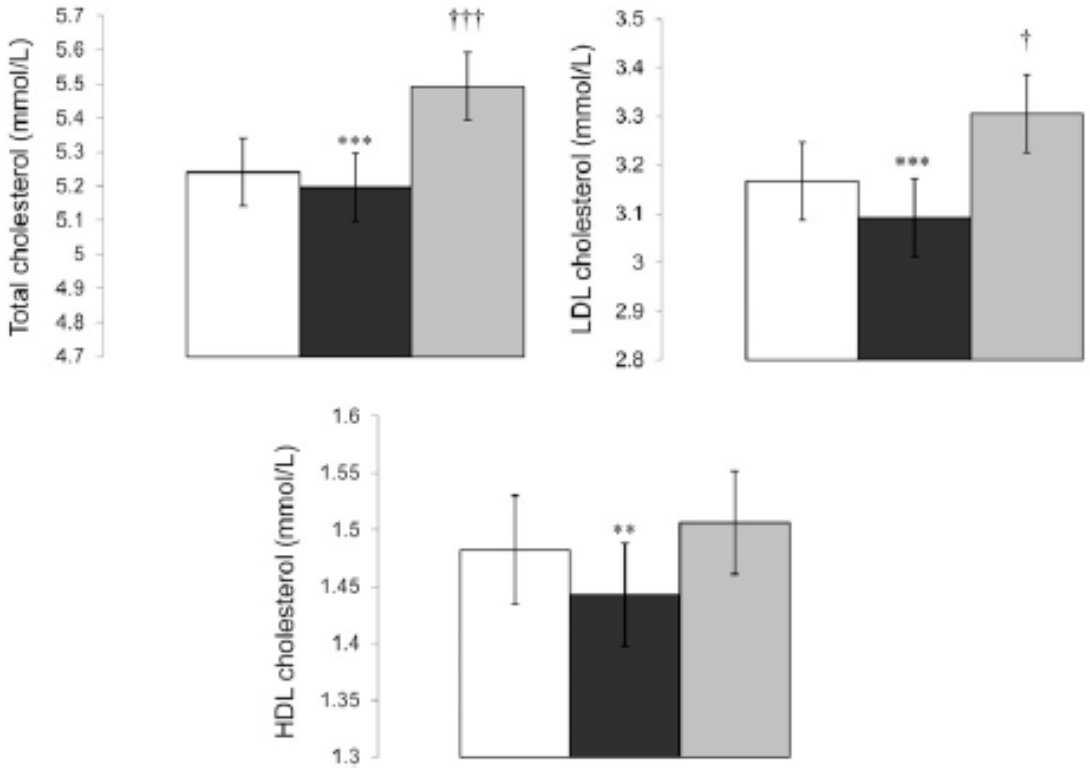


FIGURE 1. Least-squares mean (±SEM) serum concentrations of total, LDL, and HDL cholesterol in subjects after the run-in (white bars), cheese (dark-gray bars), and butter (light-gray bars) periods. Statistical differences are based on a linear mixed model with Bonferroni correction. **,***Significantly different from butter period: $^{**}P < 0.005$, $^{***}P < 0.0001$. †,†††Significantly different from run-in period: $^{\dagger}P < 0.05$, $^{\dagger\dagger\dagger}P < 0.0005$.

How does this compare with the other interventions?

- LDL reduced by 0.2 & 0.5mmol/l
- Total-C: 0.27 & 0.3mmol/l

What does this mean?

- Approx. 3% reduction in CVD risk based on a 0.2 mmol/l reduction in LDL

(Baigent et al. 2008, Lancet 366, 267-78)

Other outcomes assessed

- Where measured, intervention trials reported no difference in:
  - other markers of lipid metabolism: HDL, or HDL subfractions, TAG concentrations, apo A1, B, lipoprotein (a)
  - Markers of immune function/coagulation: Factor V11, fibrinogen, prothrombin fragments, CRP
  - Glucose & insulin function
    - 2 reports of higher blood glucose levels, one in a postprandial situation. NSD otherwise.

Considerations

- Did the volunteers ‘stick’ to the regimes?
- Most were young and healthy
- Choice of comparative diets
- Study design
- How much cheese were they asked to eat?
  - 13% - 29% energy intakes from fat *vs* 9-10% intakes typically in UK/Ireland (24g/day)
  - Intakes requested: 305g/day (Tholstrup et al.2004) *vs* mean daily intakes Irish adults (24g/d)

How may cheese mediate any effects?

Calcium content

Fermentation

Enzyme activity

Fatty acid composition

Bioactive peptides

? other

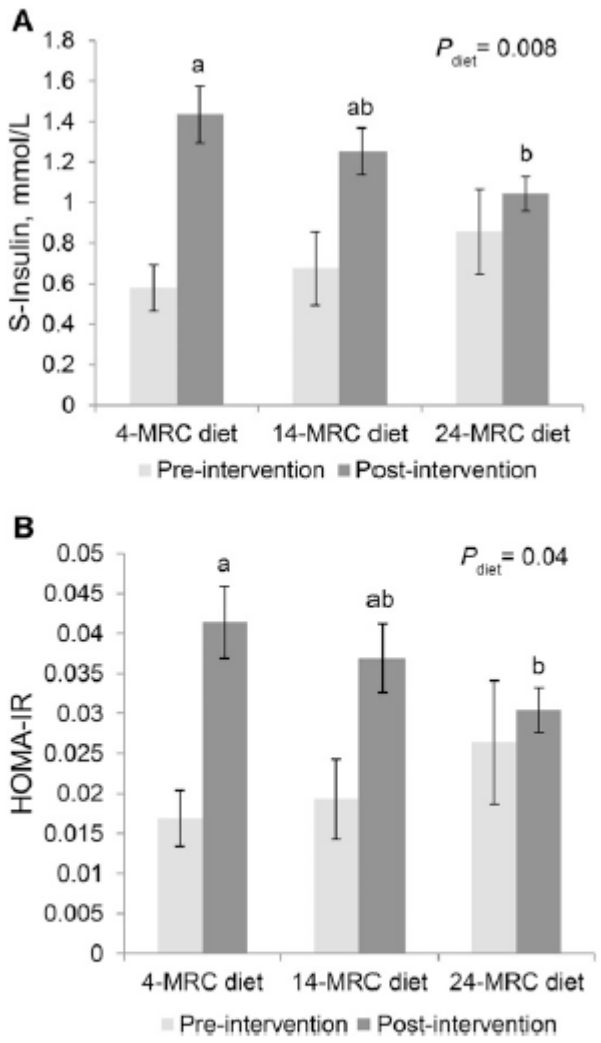


FIGURE 3 Serum insulin concentrations (A) and HOMA-IR (B) in 3-mo-old female pigs before and after being fed the 4-MRC, 14-MRC, and 24-MRC diets for 14 d. Values are means ± SEMs, n = 12. Labeled means without a common letter differ, $P < 0.05$. S, serum; 4-MRC, 4-mo ripened cheddar; 14-MRC, 14-mo ripened cheddar; 24-MRC, 24-mo ripened cheddar.

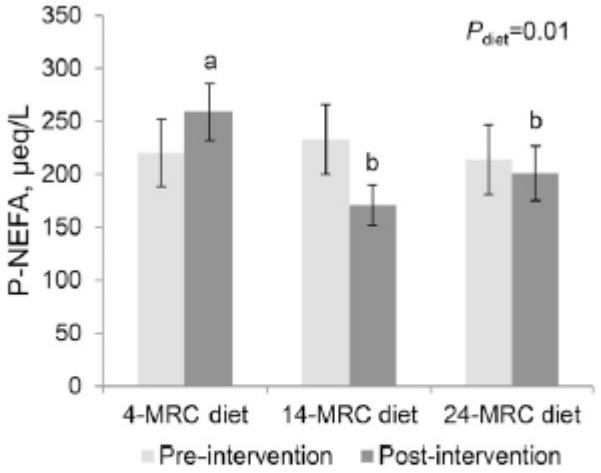


FIGURE 4 Plasma NEFA concentrations in 3-mo-old female pigs before and after being fed the 4-MRC, 14-MRC, and 24-MRC diets for 14 d. Values are means ± SEMs, n = 12. Labeled means without a common letter differ, $P < 0.05$. NEFA, nonesterified FAs; P, plasma; 4-MRC, 4-mo ripened cheddar; 14-MRC, 14-mo ripened cheddar; 24-MRC, 24-mo ripened cheddar.

Thorning et al. J Nutr 2015

doi: 10.3945/jn.115.210716.

Cheese and cardio-metabolic health: what is the evidence?

Cheese & Health: What is the evidence?

- Most studies do not show an adverse effect of cheese on health
- The primary outcomes are typically tightly focused and on fasting samples
- Quality of the analysis (studies) has vastly improved with time

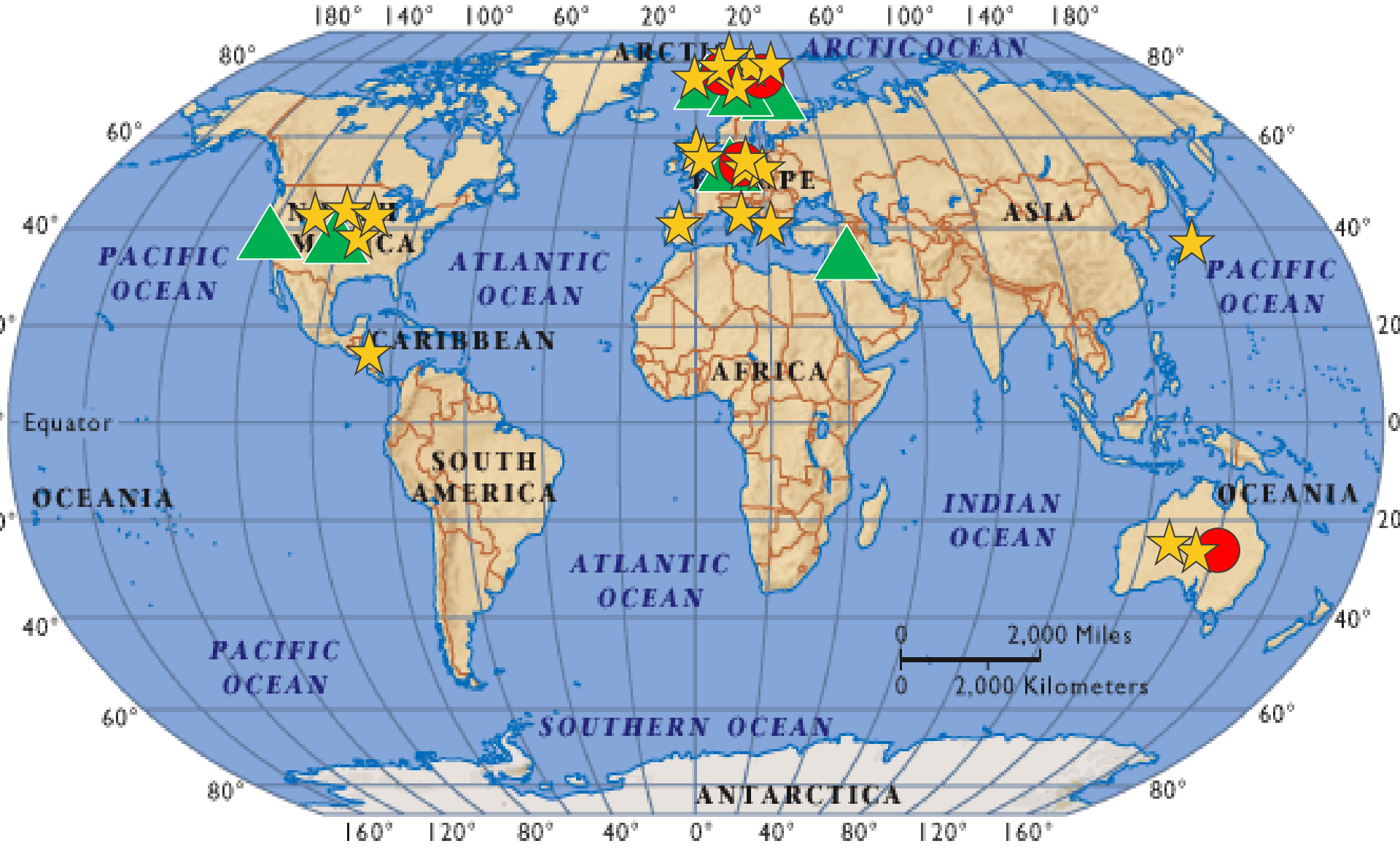
Cheese & Health: What is the evidence?

- Few studies looked at how the body responds to a challenge (post prandial studies)
- Most studies have used cholesterol as the primary outcome
- Is butter the ‘right’ control food for interventions?
- Limited population groups
- Is it ‘just’ cheese?

Cheese & Health: What is the evidence?

- What is cheese?
- Most of the dietary evidence relies on food frequency questionnaires
- Are people telling the truth? (Biomarkers)
- Little descriptive detail on intakes
- Very few have related levels of intake/benefit to those in the general population

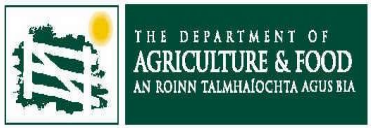
The World



Will eating cheese affect my (cardio-metabolic) health?

Thank you!

Kaifeng Li, Dr. Emma Feeney, Dr. Breige McNulty, Dr. Lorraine Brennan, Dr. Janette Walton, Dr. Eileen Gibney, Dr. Nessa Norohna, Prof. Albert Flynn, Prof. Mike Gibney.



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Other health effects