VEGETARIAN AND VEGAN DIETS

T. Tong (UK)
The evidence behind diets: Vegetarian and vegan diets

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Why study vegetarians and vegans?

- Number of vegetarians/vegans increasing
  - 2-5% of population in UK, US
  - 20-30% of population in India (National Family Health Survey)
  - Many others are reducing meat consumption
Why become vegetarian or vegan?

- Animals
- Environment
- Health
- Other
Data available – current studies

Large prospective studies targeted at **vegetarians**

**US: Adventist Health Study-2**: recruitment in 2002-2007
- 96,469 participants, 21,177 vegetarians and 5,548 vegans

**UK: EPIC-Oxford**: recruitment in 1993-1999
- 65,429 participants, 18,840 vegetarians and 2,596 vegans

**UK Biobank**: recruitment in 2006-2010
- 0.5 million participants, 7910 vegetarians and 398 vegans
Terminology

- Meat eaters – eat some meat
  - Regular, low, poultry
- Fish eaters – eat some fish but not meat
- Vegetarians – no meat or fish, but eat dairy and/or eggs
- Vegans – no meat, fish, dairy or eggs
Outline

- Nutritional adequacy
- Biomarker levels
- Anthropometry and physiology
- Major diseases (cardiovascular disease, cancer, diabetes, fracture)
Nutritional adequacy and biomarkers
EPIC-Oxford: Mean nutrient intakes by diet group

Data from 3\textsuperscript{rd} follow up, 14 years after recruitment, in 2010

Mean intake

- Protein (g/10kg)
- Saturated fat (% E)
- Fibre (g/d)

- Goal = 23 g/d
- EAR = 6 g/10 kg bodyweight
- Goal <10%

EPIC-Oxford. Mean calcium and vitamin B12 intakes

Calcium* (mg/d)

- Meat-eaters
- Fish-eaters
- Vegetarians
- Vegans

EAR=525mg/d

Vitamin B12* (µg/d)

*intake from food

50% of vegans used supplements containing B12

52% of vegans categorized as deficient by vitamin B12 <118 pmol/l

Means (95% CI)

n=689 men

Gilsing et al. EJCN 2010;64:933
Circulating vitamin D

Adjusted for age, season, year of blood collection

n=2107

n=229

UK Biobank: Iron intake from foods

Age adjusted means (95% CI)

mg/d

Regular meat-eaters
Low meat-eaters
Poultry eaters
Fish-eaters
Vegetarians
Vegans

Adjusted for age
UK Biobank white British participants

P<0.001

Tong et al. AJCN 2019, 110:461
UK Biobank: Haemoglobin concentrations

White British premenopausal women (76 vegans)

Adjusted for age and smoking

Tong et al. AJCN 2019, 110:461
Anthropometry and physiology
UK Biobank: BMI and waist

**BMI (kg/m²)**

**Waist circumference (cm)**

*Age adjusted means (95% CI) in white British women*

Tong et al. AJCN 2018;107:909
UK Biobank: Body fat %

Age adjusted means (95% CI) in white British women

Tong et al. AJCN 2018;107:909
UK Biobank: Heel bone mineral density

Age adjusted means (95% CI) in white British women

Tong et al. AJCN 2018;107:909
UK Biobank: Blood pressure

Age adjusted means (95% CI) in white British men

Tong et al. AJCN 2018;107:909
EPIC-Oxford: Serum cholesterol

Total cholesterol (mmol/L)

Difference in non-HDL-C
0.85 mmol/l

N=670 men  \( p<0.0001 \)

Adjusted for age, alcohol, physical activity

Bradbury et al. EJCN 2015;69:1180
Major diseases
Cardiovascular diseases

<table>
<thead>
<tr>
<th></th>
<th>Cases</th>
<th>Hazard ratios (95% CI)</th>
<th>P-het</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ischaemic heart disease</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat eaters</td>
<td>2026</td>
<td>1.00 (Reference)</td>
<td></td>
</tr>
<tr>
<td>Fish eaters</td>
<td>298</td>
<td>0.87 (0.77 to 0.99)</td>
<td></td>
</tr>
<tr>
<td>Vegetarians</td>
<td>496</td>
<td>0.78 (0.70 to 0.87)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Ischaemic stroke</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat eaters</td>
<td>340</td>
<td>1.00 (Reference)</td>
<td></td>
</tr>
<tr>
<td>Fish eaters</td>
<td>62</td>
<td>1.05 (0.80 to 1.39)</td>
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</tr>
<tr>
<td>Vegetarians</td>
<td>117</td>
<td>1.12 (0.90 to 1.41)</td>
<td>0.59</td>
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<tr>
<td><strong>Haemorrhagic stroke</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat eaters</td>
<td>173</td>
<td>1.00 (Reference)</td>
<td></td>
</tr>
<tr>
<td>Fish eaters</td>
<td>38</td>
<td>1.12 (0.78 to 1.61)</td>
<td>0.04</td>
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<tr>
<td>Vegetarians</td>
<td>89</td>
<td>1.43 (1.08 to 1.90)</td>
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</tr>
<tr>
<td><strong>Total stroke</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat eaters</td>
<td>678</td>
<td>1.00 (Reference)</td>
<td></td>
</tr>
<tr>
<td>Fish eaters</td>
<td>136</td>
<td>1.14 (0.94 to 1.38)</td>
<td>0.06</td>
</tr>
<tr>
<td>Vegetarians</td>
<td>258</td>
<td>1.20 (1.02 to 1.40)</td>
<td></td>
</tr>
</tbody>
</table>

**Adjusted for age, sex, method of recruitment, lifestyle, SES EPIC-Oxford men and women**
Breast, prostate, colorectal cancer

<table>
<thead>
<tr>
<th>Cancer Type</th>
<th>Cases</th>
<th>Hazard ratios (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breast Cancer</strong></td>
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<td></td>
</tr>
<tr>
<td>Meat eaters</td>
<td>900</td>
<td>1</td>
</tr>
<tr>
<td>Vegetarians</td>
<td>352</td>
<td>0.96 (0.83, 1.10)</td>
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<tr>
<td><strong>Prostate Cancer</strong></td>
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<td></td>
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<tr>
<td>Meat eaters</td>
<td>327</td>
<td>1</td>
</tr>
<tr>
<td>Vegetarians</td>
<td>100</td>
<td>0.83 (0.64, 1.06)</td>
</tr>
<tr>
<td><strong>Colorectal Cancer</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat eaters</td>
<td>382</td>
<td>1</td>
</tr>
<tr>
<td>Vegetarians</td>
<td>154</td>
<td>1.04 (0.84, 1.28)</td>
</tr>
</tbody>
</table>

Adjusted for age, sex, method of recruitment, smoking, alcohol, PA, parity, OCA

Key et al. AJCN 2014; 100:378S
**Diabetes**

<table>
<thead>
<tr>
<th>Type</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular meat eaters</td>
<td>691</td>
</tr>
<tr>
<td>Low meat eaters</td>
<td>184</td>
</tr>
<tr>
<td>Fish eaters</td>
<td>93</td>
</tr>
<tr>
<td>Vegetarians</td>
<td>256</td>
</tr>
</tbody>
</table>

**Hazard ratios (95% CI) P-het**

- Regular meat eaters: 1.00
- Low meat eaters: 0.63 (0.54, 0.75)
- Fish eaters: 0.47 (0.38, 0.59)
- Vegetarians: 0.63 (0.54, 0.74) *<0.001*

*Adjusted for age, sex, method of recruitment, lifestyle, SES*  
*EPIC-Oxford men and women*  
*Papier et al. Nutr Diabetes 2019;9:7*
Fracture

Adjusted for age, sex, method of recruitment, lifestyle, SES, parity
EPIC-Oxford men and women

Appleby et al. EJCN 2007;61:1400

<table>
<thead>
<tr>
<th>Diet</th>
<th>Cases</th>
<th>Hazard Ratios (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat eaters</td>
<td>1092</td>
<td>1</td>
</tr>
<tr>
<td>Fish eaters</td>
<td>261</td>
<td>1.01 (0.88, 1.17)</td>
</tr>
<tr>
<td>Vegetarians</td>
<td>471</td>
<td>1.00 (0.89, 1.13)</td>
</tr>
<tr>
<td>Vegans</td>
<td>74</td>
<td>1.30 (1.02, 1.66)</td>
</tr>
</tbody>
</table>
Summary (1)

- Nutritional adequacy and biomarker level
  - Lower protein, saturated fat, higher fibre
  - Lower calcium (vegans), vitamin B12, vitamin D (EPIC-Oxford)
  - Similar iron intake but lower haemoglobin
Summary (2)

- Anthropometry and physiology
  - Lower BMI, WC, body fat, bone mineral density, blood pressure and cholesterol

- Major diseases
  - CVD: Lower IHD and higher stroke
  - Cancer: No difference for breast, prostate, colorectal
  - Diabetes: Lower
  - Fracture: Higher
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