**SHORT REPORT**

Height, body mass index, and survival in men with coronary disease: follow up of the diet and reinfarction trial (DART)

A R Ness, D Gunnell, J Hughes, P C Elwood, G Davey Smith, M L Burr

All men in the study were flagged with the NHS central register. By the end of February 2000, 1083 (53%) men enrolled in the study had died after a total of 21,147 person years of observation. Of these deaths 738 (68%) were attributed to coronary heart disease. Cox’s proportional hazards regression was used to examine survival in relation to height and BMI and to adjust for confounding factors.

The associations between quartiles of height and BMI and all cause mortality are shown in table 1. There was no association between height and survival or height and coronary mortality. The age adjusted hazards for height were essentially unaltered after adjustment for the baseline variables used in the original report, smoking, BMI, and randomisation group. There was a reverse J shaped association between BMI and CHD and all cause mortality. Those with the lowest BMI were at highest risk of coronary and all cause mortality. Those in the middle quartiles (BMI 24 to 28 kg/m²) were at lowest risk.

To eliminate confounding by smoking we repeated these analyses in non-smokers (n=1242). Compared with those with the lowest BMI the adjusted hazard for all cause mortality in non-smokers was 0.64 (95% CI 0.48 to 0.86) in quartile 2, 0.65 (95% CI 0.49 to 0.87) in quartile 3 and 0.65 (95% CI 0.49 to 0.86) in quartile 4.

The adjusted hazard in obese men (BMI > 30 kg/m²) was 0.72 (95% CI 0.48 to 1.08) compared with those who were underweight (BMI < 20 kg/m²). To formally test for non-linearity a quadratic term for BMI was fitted to the fully

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Deaths attributed to coronary disease all causes following myocardial infarction by height and body mass index in men enrolled in the Diet and Reinfarction Trial (DART) 1983–2000</th>
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</thead>
<tbody>
<tr>
<td><strong>Hazard for quartiles of height (cm)</strong></td>
<td>First Mean (range) 164 (150–168) Hazard (CI)</td>
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<tr>
<td>All cause mortality</td>
<td>Age adjusted 1.00 1.03 (0.86 to 1.22) 0.99 (0.85 to 1.16) 0.97 (0.82 to 1.14)</td>
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<tr>
<td></td>
<td>Multiply adjusted 1.00 1.07 (0.90 to 1.28) 1.00 (0.85 to 1.17) 0.99 (0.84 to 1.17)</td>
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<tr>
<td>Body mass index (BMI)</td>
<td>First Mean (range) 22 (15–24) Hazard (CI)</td>
</tr>
<tr>
<td>All cause mortality</td>
<td>Age adjusted 1.00 0.75 (0.64 to 0.89) 0.73 (0.61 to 0.86) 0.85 (0.72 to 1.00)</td>
</tr>
<tr>
<td></td>
<td>Multiply adjusted 1.00 0.76 (0.64 to 0.90) 0.69 (0.58 to 0.82) 0.79 (0.66 to 0.93)</td>
</tr>
</tbody>
</table>

*Adjusted for the following baseline variables: history of MI, angina, hypertension at baseline; radiographic evidence of cardiomegaly, pulmonary congestion or pulmonary oedema at baseline; treatment (β blockers, other antihypertensives, digoxin/antiarrhythmics, or anticoagulants), smoking, diet randomisation, height or BMI.
associated with a lower weight at recruitment. Alternatively, it is based on body weight, which includes both fat mass and physical fitness, which are cardioprotective. These explanations would be consistent with the observation that the protective effect of being overweight was strongest in those with a past history of myocardial infarction.

The observed excess mortality in those with a low BMI was more pronounced than in other studies.7 The excess mortality observed in men with low BMI may represent reverse causality with pre-existing illness (including cardiac cachexia) being associated with a lower weight at recruitment. Alternatively the adverse effect of low BMI may either reflect the fact that lean men cannot reduce their mortality by weight reduction or that low BMI in older people is a marker of biological aging.

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