

## IQ in childhood and vegetarianism in adulthood: 1970 British cohort study

Catharine R Gale, Ian J Deary, Ingrid Schoon, G David Batty

### Abstract

**Objective** To examine the relation between IQ in childhood and vegetarianism in adulthood.

**Design** Prospective cohort study in which IQ was assessed by tests of mental ability at age 10 years and vegetarianism by self-report at age 30 years.

**Setting** Great Britain.

**Participants** 8170 men and women aged 30 years participating in the 1970 British cohort study, a national birth cohort.

**Main outcome measures** Self-reported vegetarianism and type of diet followed.

**Results** 366 (4.5%) participants said they were vegetarian, although 123 (33.6%) admitted eating fish or chicken. Vegetarians were more likely to be female, to be of higher social class (both in childhood and currently), and to have attained higher academic or vocational qualifications, although these socioeconomic advantages were not reflected in their income. Higher IQ at age 10 years was associated with an increased likelihood of being vegetarian at age 30 (odds ratio for one standard deviation increase in childhood IQ score 1.38, 95% confidence interval 1.24 to 1.53). IQ remained a statistically significant predictor of being vegetarian as an adult after adjustment for social class (both in childhood and currently), academic or vocational qualifications, and sex (1.20, 1.06 to 1.36). Exclusion of those who said they were vegetarian but ate fish or chicken had little effect on the strength of this association.

**Conclusion** Higher scores for IQ in childhood are associated with an increased likelihood of being a vegetarian as an adult.

### Introduction

Children and adolescents who score higher on standard tests of intelligence have a lower risk of coronary heart disease in later life.<sup>1-3</sup> The underlying mechanisms are still unclear. Findings that higher intelligence is linked with a lower likelihood of starting to smoke<sup>4,5</sup> and a higher likelihood of giving up,<sup>6</sup> suggest that the ability to learn, reason, and solve problems may be important in determining how people respond to information on risk and the extent to which they adopt behaviours considered conducive to health.<sup>7</sup>

Vegetarianism, “the practice of living wholly on vegetable food, with or without dairy products, honey and eggs,”<sup>8</sup> is a behaviour that has for centuries been adopted primarily because of ethical objections to the use of animals for food. Some vegetarians have claimed that not consuming meat has beneficial effects on brain function. According to Benjamin Franklin, the 18th century statesman and scientist, a vegetarian diet results in

“greater clearness of head and quicker comprehension.”<sup>9</sup> But in the early part of the 20th century medical opinion on the potential health benefits of a vegetarian diet—at least in Britain—tended to be unenthusiastic: “Vegetarianism is harmless enough, though it is apt to fill a man with wind and self-righteousness,” declared Robert Hutchison in an address to the BMA in 1930. In the past few years, however, growing epidemiological evidence, some from prospective studies, has suggested that the health benefits associated with vegetarianism may be considerable: lower serum cholesterol concentrations, lower blood pressure, and a reduced risk of obesity and coronary heart disease.<sup>10-12</sup>

Might vegetarianism explain in part why children and adolescents who score higher on tests of intelligence have a lower risk of coronary heart disease in later life? In view of the evidence that vegetarians tend to have lower levels of cardiovascular risk, the decision to adopt a vegetarian diet might be viewed as a healthier option than the consumption of meat. Does a higher IQ make this decision more likely? This question could not be answered by a search of the biomedical and social science databases. We used the 1970 British cohort study to examine prospectively the effect of childhood IQ on the likelihood of being a vegetarian as an adult.

### Methods

The 1970 British cohort study comprises 17 198 live births occurring to parents living in Great Britain between 5 and 11 April 1970. Mental ability was assessed at the age of 10 years using a modified version of the British ability scales.<sup>13</sup> The four subscales were word definitions, word similarities, recall of digits, and matrices. We carried out a principal components analysis of the positively correlated scores from these four tests to establish the presence of a general cognitive ability factor (traditionally referred to as “g”).<sup>14</sup> The first unrotated principal component accounted for 57% of the total variance among the four tests. We used this component to derive a g score for each participant. For ease of interpretation we transformed the g score to the widely used IQ equivalent: mean (SD) 100 (15). At age 30 years participants were interviewed at home, when they were asked about whether they were vegetarian and, if so, what diet they followed. Information on socioeconomic status was reported by the parents when the participants were aged 10 years (parental occupational social class) and by the participants at age 30 (current occupational social class, academic or vocational qualifications, and income). Overall 11 204 participants provided information on vegetarian status at the 30 year follow-up, of whom 8170 (72.9%) had data on IQ score at age 10 years and were therefore included in our analyses.

We used analysis of covariance and the  $\chi^2$  test to examine the characteristics of the participants, and logistic regression to examine prospectively the relation between childhood IQ score and vegetarianism as an adult.

## Results

In total 366 (4.5%) of 8170 participants of the 1970 British cohort study with IQ scores at age 10 years said they were vegetarian: nine (2.5%) were vegan and 123 (33.6%) stated they were vegetarian but reported consuming fish or chicken. Vegetarians were more likely to be female, to be of a non-manual occupational social class (in childhood and currently), and to have higher academic or vocational qualifications (table 1[T1]): 8.5% of vegetarians (n=31) had a higher degree or equivalent vocational qualification compared with 3.5% of non-vegetarians (n=275). This evidence of higher socioeconomic status was not reflected in the vegetarians' annual income, which was similar to that of non-vegetarians. When strict vegetarians (no fish or meat) were compared with those who said they were vegetarian but consumed fish or chicken, no differences were found between them in any of these characteristics (data not shown).

IQ in childhood was associated with all indicators of socioeconomic status. Mean childhood IQ was higher in participants from non-manual occupational backgrounds, both in childhood and currently; in those with higher academic or vocational qualifications; and in those with higher annual gross earnings (data not shown).

**Table 1** Characteristics of study participants in relation to self-reported vegetarianism at age 30 years (n=8170)

Characteristics	Total	No (%) of non-vegetarians in each category	No (%) of vegetarians in each category
Women	4222	3951 (50.6)	271 (74.0)
Men	3948	3853 (49.4)	95 (26.0)***
Parental social class†:			
Professional or managerial	2244	2119 (27.2)	125 (34.2)
Skilled non-manual	752	719 (9.2)	33 (9.0)
Semiskilled	3081	2945 (37.7)	136 (37.2)
Unskilled	1205	1165 (14.9)	40 (10.9)
Unknown	888	856 (11.0)	32 (8.7)*
Current social class:			
Professional or managerial	2968	2798 (35.8)	170 (46.5)
Skilled non-manual	2102	1991 (25.5)	111 (30.3)
Semiskilled	1649	1611 (20.6)	38 (10.4)
Unskilled	1274	1235 (15.8)	39 (10.7)
Unknown	177	169 (2.2)	8 (2.2)***
Academic or vocational qualifications:			
No qualifications	695	685 (8.8)	10 (2.7)
CSE equivalent NVQ 1	647	629 (8.1)	18 (4.9)
O level or equivalent NVQ 2	2320	2246 (28.8)	74 (20.2)
A level or equivalent NVQ 3	1708	1638 (21.0)	70 (19.1)
Degree, diploma, or equivalent NVQ 4	2494	2331 (29.9)	163 (44.5)
Higher degree or NVQ 5	306	275 (3.5)	31 (8.5)***
Annual gross earnings‡:			
≤£11 440	1494	1424 (24.9)	70 (26.6)
£11 441–£16 600	1496	1432 (25.0)	64 (24.3)
£16 6001–£23 000	1518	1451 (25.3)	67 (25.5)
>£23 000	1484	1422 (24.8)	62 (23.6)

£1.00 (€1.48; \$1.89). NVQ=national vocational qualifications.

\*P<0.05; \*\*\*P<0.001.

†Derived from mother's occupation if no father present from whom to derive occupation.

‡Available for 5992 participants.

On average, vegetarians had a higher childhood IQ score than non-vegetarians. According to sex, the mean (SD) childhood IQ score of vegetarians compared with non-vegetarians was 106.1 (14.7) and 100.6 (15.2) for men and 104.0 (14.1) and 99.0 (14.7) for women, differences of 5.5 and 5.0 points (P<0.001).

When vegetarians were divided into those who were strictly vegetarian (no fish or meat) and those who consumed fish or chicken, no difference was found in IQ score. Among those who had taken vegetarianism to its logical conclusion ("gone the whole hog," as it were) and become vegan (no animal products), mean IQ scores were lower. On average, vegans had a childhood IQ score that was nearly 10 points lower than other vegetarians: mean (SD) IQ score 95.1 (14.8) in vegans compared with 104.8 (14.1) in other vegetarians (P=0.04), although this estimate must be viewed with caution as only nine participants were vegan.

The odds ratio for being vegetarian at age 30 years for one standard deviation increase in childhood IQ score was 1.38 (95% confidence interval 1.24 to 1.53; table 2[T2]). After controlling for sex, the odds ratio increased to 1.42 (1.28 to 1.59). Separate adjustment for social class, both in childhood and currently, and academic or vocational qualifications, attenuated these relations, particularly when academic or vocational qualifications were added to the model—but the associations remained statistically significant. In multivariate analysis the odds ratio for being vegetarian was 1.20 (1.06 to 1.36) for one standard deviation increase in childhood IQ score. When the analysis was repeated after removing those who said that they were vegetarian but consumed fish or chicken, this result was essentially unchanged (1.19, 1.03 to 1.39). Additional adjustment for annual earnings had no effect on the strength of the relation between childhood IQ and later vegetarianism (data not shown).

## Discussion

Participants of the 1970 British cohort study with higher intelligence test scores in childhood were more likely to report being a vegetarian at age 30 years. This relation was partly accounted for by educational attainment and by occupational social class in adult life but remained statistically significant after adjustment for these factors.

Several investigators have examined the link between education (a strong correlate of mental ability<sup>15</sup>) and vegetarianism. Findings are mixed. Pooled data from a meta-analysis of vegetarianism and mortality<sup>11</sup> showed that of four studies reporting data on educational attainment two showed higher levels in vegetarians than in non-vegetarians, whereas in two other studies the opposite association was seen. In previous analyses of the 1970 British cohort study, a greater consumption of non-meat products, such as bread or fresh fruit, was apparent in people with high educational attainment.<sup>16</sup>

Although the vegetarians in this cohort were, on average, more intelligent, better educated, and of higher occupational

**Table 2** Odds ratios (95% CI) for being vegetarian at age 30 years for a one standard deviation increase in childhood IQ score in 8170 participants of the 1970 British cohort study

Adjustments	Odds ratio (95% CI)
Unadjusted	1.38 (1.24 to 1.53)
Sex	1.42 (1.28 to 1.59)
Parental social class	1.35 (1.21 to 1.51)
Current social class	1.29 (1.15 to 1.45)
Academic or vocational qualifications	1.16 (1.03 to 1.30)
All	1.20 (1.06 to 1.36)

social class than the non-vegetarians, these socioeconomic advantages were not reflected in their income. It may be that ethical considerations determined not just their diet but also their choice of employment. Compared with non-vegetarians, vegetarians were less likely to be working in the private sector and more likely to be working in charitable organisations, local government, or education: 17% of the vegetarians worked in education compared with 9% of non-vegetarians. When asked, as part of the follow-up survey, what they thought of the statement “The government should redistribute income,” 50% of vegetarians said they agreed compared with 41% of non-vegetarians, and this proportion was even higher among male vegetarians (61% *v* 42%). Such views may not be compatible with a career in the more lucrative employment sectors.

Some of the participants who reported being vegetarian said they consumed fish or chicken. We found no difference in IQ scores, or any marker of socioeconomic status, between this group and the strict vegetarians. It may be that vegetarianism exists as a continuum, with those who describe themselves as vegetarian but who are prepared to eat white meat or fish (flesh that is paler and less obviously meaty than beef, pork, or lamb) having the same trait but less of it than those who avoid consuming any animal flesh.

The strengths of this study are its size, resulting in high statistical power; the representativeness of the sample, resulting in a high degree of generalisability for the British population born around the same time; and the breadth of data on socioeconomic status, allowing an examination of the role of potential confounding and mediating variables.

Our study also has some limitations. Firstly, some attrition has occurred in the cohort over time. The participants at the 30 year follow-up did gain significantly higher IQ scores at age 10 than those who did not take part, although the size of the differences was modest (0.3 of a standard deviation). Unless the relation between childhood mental ability and vegetarianism is in the opposite direction in non-participants, little bias will have been introduced in our study. Secondly, we had no information from the 30 year follow-up on how long our participants had been vegetarian. Evidence from a subset of 3795 participants (46.5%) who had taken part in a previous follow-up of the cohort when they were aged 16 years suggests that most of those who were vegetarian at age 30 had chosen that type of diet as adolescents or young adults, some years after their IQ was measured: among these 3795 participants, only 32% of those who were vegetarian at age 30 were already vegetarian at age 16, and of those already vegetarian at age 16 95% had become vegetarian between the ages of 11 and 16. The difference in childhood IQ scores between vegetarian and non-vegetarian participants at age 30 was also apparent at age 16; compared with non-vegetarians at this age, those who were vegetarian scored on average 4.1 points higher on the mental ability test at age 10.

Although our results suggest that children who are more intelligent may be more likely to become vegetarian as adolescents or as young adults, it does not rule out the possibility that such a diet might have some beneficial effect on subsequent cognitive performance. Might the nature of the vegetarians' diet in this cohort have enhanced their apparently superior brain power? Was this the mechanism that helped them to achieve the disproportionate number of higher degrees? Benjamin Franklin and George Bernard Shaw, both ardent vegetarians, would have us believe so. According to Shaw in an article published in *The Star* in 1890, “A mind of the calibre of mine cannot derive its nutriment from cows.” Even Shakespeare, not known for his vegetarian sensibilities, expressed through Sir Andrew Aguecheek

### What is already known on this topic

Vegetarianism may be viewed by those of higher intelligence as a healthier option than consuming meat

### What this study adds

Higher scores for IQ in childhood are associated with an increased likelihood of vegetarianism in adulthood

in *Twelfth Night* (Act 1, Scene 3) a belief in the deleterious effects of consuming meat; “I am a great eater of beef and I believe that does harm to my wit.” Further research may be needed to explore this hypothesis.

Our finding that children with greater intelligence are more likely to report being vegetarian as adults, coupled with the evidence on the potential benefits to cardiovascular health of a vegetarian diet, may help to explain why higher IQ in childhood or adolescence is linked with a reduced risk of coronary heart disease in adult life. Additional studies of older cohorts with data on cardiovascular risk factors will be needed to examine the extent to which vegetarianism mediates the association between childhood IQ and coronary heart disease.

Alternatively it is possible that the link between childhood IQ and vegetarianism in later life is not on a causal chain of mechanisms related to health. People with a higher IQ may well differ from those with less superior brain power in many of their lifestyle decisions: for instance, choice of newspaper, type of books read, preferred form of entertainment. The association between IQ and vegetarianism may be merely an example of many other lifestyle preferences that might be expected to vary with intelligence but which may or may not have implications for health.

The 10 year follow-up was carried out by the Department of Child Health, Bristol University. The 30 year follow-up was carried out under the auspices of the Joint Centre for Longitudinal Research (comprising the Centre for Longitudinal Studies, Institute of Education, University of London; the International Centre for Health and Society, University College Medical School, London; and the National Centre for Social Research). We thank the UK Data Archive, University of Essex, for providing the data. The original data creators, depositors, or copyright holders, the funding agencies, and the UK Data Archive bear no responsibility for the analyses and interpretation presented here. GDB is a Wellcome fellow. IJD is the recipient of a Royal Society-Wolfson Research merit award.

Contributors: CRG and GDB conceived the idea for the present analyses, which were developed by the coauthors. CRG carried out the data analyses and wrote the first draft of the manuscript to which the coauthors made substantial contributions. IJD advised on the psychometric analyses of the mental ability tests. CRG and GDB are guarantors.

Competing interests: CRG and GDB are lapsed vegetarians, IS is a committed vegetarian, and IJD is an omnivore. The IQs of three of the authors have never been tested; IJD opts not to disclose.

Ethical approval: Not required.

- Hart CL, Taylor MD, Davey Smith G, Whalley LJ, Starr JM, Hole DJ, et al. Childhood IQ, social class, deprivation, and their relationships with mortality and morbidity risk in later life: prospective observational study linking the Scottish mental survey 1932 and the midspan studies. *Psychosom Med* 2003;65:877-83.
- Batty GD, Mortensen EL, Nybo Andersen AM, Osler M. Childhood intelligence in relation to adult coronary heart disease and stroke risk: evidence from a Danish birth cohort study. *Paediatr Perinat Epidemiol* 2005;19:452-9.
- Hemmingsson T, Melin B, Allebeck P, Lundberg I. The association between cognitive ability measured at ages 18-20 and mortality during 30 years of follow-up—a prospective observational study among Swedish males born 1949-51. *Int J Epidemiol* 2006;35:665-70.
- Martin LT, Fitzmaurice GM, Kindlon DJ, Buka SL. Cognitive performance in childhood and early adult illness: a prospective cohort study. *J Epidemiol Community Health* 2004;58:674-9.
- Batty GD, Deary IJ, MacIntyre S. Childhood IQ in relation to physiological and behavioural risk factors for premature mortality in middle-aged persons. *J Epidemiol Community Health* 2006 (in press).

- 6 Taylor MD, Hart CL, Davey Smith G, Starr JM, Hole DJ, Whalley LJ, et al. Childhood mental ability and smoking cessation in adulthood: prospective observational study linking the Scottish mental survey 1932 and the midspan studies. *J Epidemiol Community Health* 2003;57:464-5.
- 7 Batty GD, Deary IJ. Early life intelligence and adult health. *BMJ* 2004;329:585-6.
- 8 *Chambers Dictionary*. Edinburgh: Chambers Harrap, 1994.
- 9 Franklin B. *The autobiography of Benjamin Franklin*. New York: Macmillan Publishing, 1962.
- 10 Fu CH, Yang CC, Lin CL, Kuo TB. Effects of long-term vegetarian diets on cardiovascular autonomic functions in healthy postmenopausal women. *Am J Cardiol* 2006;97:380-3.
- 11 Key TJ, Fraser GE, Thorogood M, Appleby PN, Beral V, Reeves G, et al. Mortality in vegetarians and nonvegetarians: detailed findings from a collaborative analysis of 5 prospective studies. *Am J Clin Nutr* 1999;70:S516-24.
- 12 Key TJ, Appleby PN, Rosell MS. Health effects of vegetarian and vegan diets. *Proc Nutr Soc* 2006;65:35-41.
- 13 Elliott C, Murray D, Pearson L. *British ability scales*. Windsor: National Foundation for Educational Research, 1978.
- 14 Carroll J. *Human cognitive abilities: a survey of factor-analytical studies*. New York: Cambridge University Press, 2006.
- 15 Deary IJ, Strand S, Smith P, Fernandes C. Intelligence and educational achievement. *Intelligence* 2006 (in press).
- 16 Schoon I, Parsons S. Lifestyles and health behaviour in three birth cohorts. In: Ferri E, Bynner J, Wadsworth M, eds. *Changing Britain, changing lives. Three generations at the turn of the century*. London: Institute of Education Press, 2003.  
(Accepted 28 October 2006)

doi 10.1136/bmj.39030.675069.55

---

Medical Research Council Epidemiology Resource Centre, University of Southampton, Southampton General Hospital, Southampton SO16 6YD  
Catharine R Gale *senior research fellow*

Department of Psychology, University of Edinburgh, Edinburgh  
Ian J Deary *professor of differential psychology*

Department of Psychology, University of Edinburgh, Edinburgh and Medical Research Council Social, and Public Health Sciences Unit, University of Glasgow, Glasgow

G David Batty *Wellcome fellow*

Department of Psychology, City University, London

Ingrid Schoon *professor*

Correspondence to: C Gale [crg@mrc.soton.ac.uk](mailto:crg@mrc.soton.ac.uk)