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# The UK Women's Cohort Study: comparison of vegetarians, fish-eaters and meat-eaters

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## Abstract

*Background:* This paper describes the development of the UK Women's Cohort Study and presents cohort baseline characteristics.
*Methods:* In total, 35 372 women, aged 35–69 years at recruitment, were selected to ensure a wide range of dietary intakes. Diet was assessed by a 217-item food-frequency questionnaire (FFQ). Detailed lifestyle information was collected by postal questionnaire. Vegetarians, fish-eaters and meat-eaters were compared.
*Results:* The cohort women are mainly white, well-educated, middle-class and married with children. They are health-conscious with only 11% current smokers and 58% taking dietary supplements. Twenty-eight per cent of subjects self-report as being vegetarian and 1% as vegan. However, only 18% are defined as 'vegetarian' from the FFQ. Fat provides 32% of energy; vitamin and mineral intakes are high, with a broad range of intakes. Meat-eaters are older, with a higher body mass index (BMI) and the lowest intakes of carbohydrate, fibre, vitamin C, folate, iron and calcium. Other fish-eaters are similar to vegetarians. Vegetarians have the lowest intakes of protein, fat and saturated fat. Oily fish-eaters have the lowest BMI; are the least likely to smoke or use full-fat milk; and are the most likely to use dietary supplements and consume the most fruit and vegetables. Oily fish-eaters have the highest total energy intake and vegetarians the lowest. Semi-skimmed milk, bread, potatoes, wine, bananas and muesli are important contributors to energy for all groups.
*Conclusion:* A large cohort of middle-aged women has been created encompassing a wide range of different eating patterns, including diets currently of interest to research into protection against cancer and coronary heart disease. Participants will be followed up to study the effects of different food and nutrient intakes on long-term health outcomes.

**Keywords**
Cohort
Nutrition
Food intake
Vegetarian
Fish intake
Women
Diet

Over recent years, a number of cohort studies have been carried out to explore diet and disease relationships[1–8]. The UK Women's Cohort Study (UKWCS) is one of these, and was started in 1993 to investigate diet and cancer relationships in a group of women in the United Kingdom. Through the selection procedure used, the study was designed to optimise exposure to dietary factors of interest. While our current knowledge on diet and cancer is sufficient to make some broad recommendations[9], many important questions remain unanswered on the links between diet and cancer.

Nutritional epidemiology has often produced conflicting results when exploring diet and chronic disease[10,11]. This is due in part to the fact that diet is a complex exposure with measurement being subject to a range of errors and bias. There are many different methods of assessing diet, each with its own shortcomings[12]. Also, within any single population group, diet often appears too homogeneous to be able to detect subtle effects of dietary differences.

One of the key questions that needs to be addressed is 'Which dietary pattern makes us live the longest?'[13]. Cohort studies have often not addressed or have been unable to assess the risks associated with a particular dietary pattern. One recent collaborative analysis of five large prospective studies with a high proportion of people who defined themselves as 'vegetarian' showed no protective effect on cancer mortality of this type of dietary pattern[14]. However, there are many different definitions of the term 'vegetarian'[15,16], making interpretation of these results problematic.

The design of the UKWCS is described in this paper with an emphasis on characterisation of the subjects in the

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cohort. Vegetarians, fish-eaters and meat-eaters are compared.

## Methods

The UKWCS has been established to study the relationships between diet and cancer incidence and mortality (from selected causes) in a group of middle-aged women in the UK. Specifically: to establish a cohort with a wide range of exposure to nutrients of interest, including total energy, types of fat, fibre and antioxidant nutrients; to test the hypothesis that eating a vegetarian diet is protective against ill health; and to study specific diet–disease research questions in the cohort.

### *Cohort sample*

Subjects in the cohort were selected to ensure that there was a wide range of dietary patterns represented. The cohort was constructed to have similar, large numbers of subjects in three main groups: vegetarian, eating fish (not meat) and meat-eaters. This ensured higher power for important comparisons involving fruit, vegetables or fish intake as well as associated nutrients that may be the focus of research into potential relationships between diet and cancer.

The cohort was taken from responders to the World Cancer Research Fund's (WCRF) direct mail survey. This included people living in England, Wales and Scotland and used direct mail lists, targeted towards females, with an overall response rate of 17%. This identified about 16 000 self-reported vegetarians and a similar number of other non red-meat-eaters aged 35–69 years, out of a total of 500 000 responders. Eighty-five per cent of the responders were women. Seventy-five per cent of the responders to the original survey indicated that they would be willing to participate in a more detailed survey. These women formed the population to be contacted to become part of the UK Women's Cohort.

Women aged 35–69 years at completion of the original mail survey were eligible for inclusion. All of the vegetarians and the non red-meat-eaters were invited to take part in the study. A comparison group was selected from the remaining eligible women by selecting, for each vegetarian, the next non-vegetarian in the list aged within 10 years of the vegetarian. Further women were recruited from responders to the baseline data collection, who were asked to identify friends and relatives of a similar age group who were vegetarians and meat-eaters.

### *Sample size*

A sample from the WCRF initial mail survey was used to estimate numbers available for the main cohort. Original sample size estimates were based on data from 1989, the most recent cancer registration statistics available at the time[17,18]. Expected figures over a 1-year follow-up period showed that a total of around 30 000 subjects would be able to detect fairly small differences in total cancer registrations. For site-specific cancers, the difference in risk would obviously have to be more marked to be detectable with near certainty. Current projections, allowing for the substantial healthy participant effect, staggered entry and time lag, estimate that, by the end of 2006, we will have 1600 incident cancer cases identified of which 550 will be breast cancer and 1500 deaths from all causes within the cohort. This sample size should have approximately 80% power to detect a protective effect of a vegetarian diet with an odds ratio of 0.8 for either endpoint, dependent on definition of vegetarian.

### *Baseline data collection*

One hundred and seventy-four local research ethics committees were contacted and permission to carry out the baseline study was obtained[19]. Baseline data were collected between 1995 and 1998 via a postal questionnaire to each subject. The self-administered questionnaires consisted of a detailed assessment of diet using a food-frequency questionnaire (FFQ) developed from the one used in the Oxford arm of the European Prospective Investigation into Cancer and Nutrition (EPIC) study[20]. To ensure that foods frequently consumed by vegetarians were included, a pilot study was undertaken in June 1994 on the sample of 71 vegetarian women in the cohort living in Southampton. An FFQ and a 7-day weighed food diary were completed by these women. As a result, more vegetable-based composite dishes were added to the food list[21]. The resulting FFQ consists of a list of 217 foods with 10 pre-coded classifications of frequency of consumption ranging from never to 6 or more times per day[22]. The FFQ has recently been validated on a sub-sample of 303 cohort subjects. Nutrient values from the FFQ were compared with values from a 4-day food diary and also fasting blood measures of specific nutrients[23]. Results showed highly significant correlations between all diary and FFQ nutrients. In addition, there were significant correlations between plasma and FFQ measures for vitamin $B_{12}$, vitamin C and calcium.

Although 28% of subjects defined themselves as vegetarian, in this analysis we used a more accurate definition of 'vegetarian' from the FFQ data. Women who said that they ate meat or fish less than once a week were classified as being vegetarians. This pragmatic definition reflects a realistic vegetarian diet with very low meat or fish consumption. Other groups defined were: meat-eaters, who ate meat once a week or more; oily fish-eaters, who ate oily fish 2–4 times per week and meat less than once a week; and other fish-eaters, who ate fish once a week or more and meat less than once a week (oily fish less than 2–4 times per week).

Analysis of the FFQ generated nutrient intakes. This was done by applying standard values from *McCance & Widdowson's The Composition of Foods* (5th edition)[24] and associated supplements for nutrients for each food item on

the FFQ. This was then multiplied by the frequency of consumption of the item, expressed per day. The sum of these items produced the total nutrient intake. Type and amount of milk and amount of sugar consumed per day were generated from separate, more detailed questions, since these common items are not well characterised through an FFQ. Vitamin and mineral intakes reported are from food only from the FFQ and do not include supplement intakes. To explore which foods were important sources of energy, the energy contribution from each of the 217 items was ranked. (The full list of foods included in the FFQ can be obtained from the corresponding author.)

A lifestyle questionnaire, to identify other possible confounders and provide information to allow registration with the National Health Service (NHS) Central Register, was also included. All questionnaire information was double-entered by hand to reduce error. All subjects who returned completed questionnaires were included in the analysis.

### *Mortality and morbidity data*

All subjects were submitted to the Office of National Statistics to be flagged on the NHS central register using their NHS number, full name and date of birth where possible. Deaths and cancer registrations for the cohort are being recorded. Cause of death is coded according to the International Classification of Diseases 9 and 10. Cancers registered after a subject returned their questionnaire were taken as newly incident cancers. Prevalent cases were also notified.

### *Phase 2 data collection*

Contacting all subjects for a second time began in April 1999 and finished in 2002. This phase of data collection consisted of a 4-day food and drink weighed diary, a 1-day physical activity diary and a questionnaire covering many aspects of both nutrition and the medical history of the subject and her family. A large database of ingredients of dietary supplements that were used by the cohort has been created. The need for such as database was noted in a recent paper on potential harm caused by supplements[25]. Since we are still in the process of contacting non-responders to this phase of the study, all results presented here relate solely to the baseline data collection phase. Results are presented for the sample as a whole and also split according to whether subjects were classified as meat-eaters, oily fish-eaters, other fish-eaters or vegetarians.

## Results

### *Response*

A total of 35 372 women returned the baseline questionnaire (a response rate of 58% from the 61 000 subjects who were mailed). Each subject has provided information on approximately 600 variables.

As of January 2002, we had 34 998 (99%) subjects traced on the NHS central register. In addition to this, we are following up a number of cases that require further information in order to be traced successfully. So far we have had a total of 876 deaths (March 2004) and 1361 incident cancer registrations, including 65 cases of colorectal cancer and 440 cases of breast cancer.

### *Cohort baseline characteristics*

Baseline characteristics of the cohort are presented in Table 1. The mean (standard deviation (SD)) age of the cohort subjects was 52 (9) years at baseline. The majority of the women were white (99%) and middle-class (63% NS-SEC class 1 – Professional and Managerial[26,27]). Seventy-five per cent of the women were married or living as married, and 86% had children. The cohort was well-educated in general, with 27% having degree-level qualifications and over half were currently in employment. The cohort women live in all areas of England, Scotland

**Table 1** Characteristics of the total sample, meat-eaters, oily fish-eaters, other fish-eaters and vegetarians

| | Total sample ($n = 35\,372$) | Meat-eaters ($n = 24\,738$) | Oily fish-eaters ($n = 870$) | Other fish-eaters ($n = 3286$) | Vegetarians ($n = 6478$) |
|---|---|---|---|---|---|
| % of total sample | | 70 | 3 | 9 | 18 |
| Age (years), mean (SD) | 52 (9) | 54 (9) | 51 (9) | 50 (9) | 49 (8) |
| BMI ($kg\,m^{-2}$), mean (SD) | 24.5 (4.3) | 25.0 (4.5) | 23.2 (3.6) | 23.3 (3.5) | 23.3 (3.9) |
| Degree-level education (%) | 27 | 23 | 32 | 37 | 37 |
| Lives in Greater London (%) | 12 | 11 | 16 | 16 | 14 |
| Smokes daily (%) | 8 | 9 | 6 | 7 | 7 |
| Alcohol > 1/week (%) | 52 | 54 | 52 | 55 | 45 |
| Full-fat milk (%) | 12 | 13 | 6 | 10 | 10 |
| Supplements (%) | 58 | 55 | 73 | 67 | 62 |
| Self-reported illness (%) | | | | | |
| Heart attack | 1.5 | 1.8 | 1.7 | 0.8 | 0.8 |
| Angina | 2.2 | 2.6 | 1.6 | 1.4 | 1.1 |
| High blood pressure | 17.3 | 19.6 | 14.0 | 13.0 | 11.4 |
| High cholesterol/lipids | 7.6 | 8.9 | 6.7 | 5.7 | 4.0 |
| Cancer | 7.5 | 8.2 | 6.7 | 7.1 | 5.2 |

SD – standard deviation; BMI – body mass index.

and Wales, with one-third living in the South and East of England. The mean (SD) body mass index (BMI) of the women was 24.5 (4.3) $kg\,m^{-2}$. Only 11% of the cohort were current smokers. In terms of self-reported illness, 8% said that they had or had ever had cancer, 2% diabetes, 17% high blood pressure and 8% high cholesterol or hyperlipidaemia.

### *Cohort food and nutrient characteristics*

Eighteen per cent (6478) of the women were vegetarian based on the FFQ. Fifty-eight per cent of the women reported taking dietary supplements and 27% reported changing their diet in the past 12 months. In general, meat consumption was rather low in the cohort at a mean of 5 portions per week and fish at 2 portions per week.

Nutrient intakes of the cohort are presented in Table 2. The mean energy intake was 2361 kcal (median 2261 kcal). Fat, carbohydrate and protein provided 32%, 53% and 15% of energy, respectively. Vitamin and mineral intakes were high as illustrated by the mean vitamin C intake (172 mg, median 156 mg).

### *Differences by dietary pattern*

To explore variation in the cohort, subjects were classified according to whether they were meat-eaters, oily fish-eaters, other fish-eaters or vegetarians, which resulted in differences emerging in a range of characteristics. Results of significance tests of the differences are not shown because the sample size is so big that even very small differences are 'statistically significant'. Table 1 shows that the meat-eaters were slightly older, had a higher BMI, were less likely to have a degree, live in Greater London or use dietary supplements, and were more likely to smoke daily and use full-fat milk than the other groups. The vegetarians were younger and less likely to have alcohol more than once a week. Self-reported illness also differed by group. There was a tendency for vegetarians to have the least and meat-eaters to have the most self-reported illness. The other fish-eaters were rather similar to the vegetarians. The oily fish-eaters differed in that they had the lowest BMI, were least likely to smoke or use full-fat milk, and were most likely to use dietary supplements. The meat-eaters reported the lowest number of servings of fruit/dishes (10) and vegetable/dishes (11) per week and the oily fish group reported the highest number (12 and 13, respectively) from additional cross-check questions on the FFQ.

An exploration of nutrient intake according to these groupings also revealed differences (Table 2). The oily fish-eaters had the highest total energy intakes and the vegetarians had the lowest. This tended to result in higher nutrient intakes for the oily fish consumers than for the other groups. Percentage energy from protein and fat were highest in the meat-eaters and percentage energy from carbohydrate was highest in the vegetarians. The meat-eaters had the lowest intakes of carbohydrate and percentage energy from carbohydrate, fibre, vitamin C, folate, iron and calcium, but the highest intakes of vitamin A and zinc. The vegetarians had the lowest absolute protein, fat and saturated fat intakes, although percentage of energy from fat was lowest among the oily fish consumers. When the analysis was repeated using nutrient density (i.e. amount of nutrient per 1000 kcal) to adjust for the higher energy intakes of the oily fish consumers, differences between the groups still remained. For example, oily fish consumers still had higher intakes of dietary fibre, vitamin C and folate.

Table 3 summarises the top 10 foods, from the 217 items on the FFQ, that contributed to energy for each group, to indicate differences between the groups in relative proportions of a number of important food items. For all groups, the top 10 items contributed at least one-quarter of their daily energy intake. Semi-skimmed milk, bread, potatoes, wine, bananas and muesli were important

**Table 2** Nutrient intakes for the total sample and by meat-, fish-eating and vegetarian status. Data are expressed as mean (standard deviation)

| | Total sample | Meat-eaters | Oily fish-eaters | Other fish-eaters | Vegetarians |
|---|---|---|---|---|---|
| Calories including alcohol | 2361 (801) | 2370 (810) | 2552 (866) | 2350 (748) | 2303 (773) |
| Protein (g) | 90 (32) | 95 (33) | 96 (31) | 81 (25) | 75 (25) |
| % energy from protein | 15.1 (2.5) | 15.7 (2.4) | 15.2 (2.2) | 13.8 (2.0) | 13.1 (2.0) |
| Carbohydrate (g) | 315 (113) | 310 (112) | 348 (127) | 324 (111) | 323 (115) |
| % energy from carbohydrate | 52.6 (7.0) | 51.5 (6.7) | 54.2 (6.7) | 54.7 (6.7) | 55.7 (7.0) |
| Fat (g) | 85 (36) | 86 (37) | 90 (38) | 84 (34) | 83 (35) |
| % energy from fat | 32.4 (5.8) | 32.6 (5.6) | 31.4 (6.2) | 31.9 (5.9) | 32.0 (6.3) |
| Saturated fat (g) | 29.5 (14.4) | 31 (15) | 28 (14) | 28 (14) | 27 (14) |
| Polyunsaturated fat (g) | 16.4 (7.7) | 16 (7) | 20 (9) | 18 (8) | 18 (9) |
| Monounsaturated fat (g) | 27.8 (12.4) | 28 (12) | 29 (13) | 27 (12) | 26 (12) |
| Fibre (Englyst) (g) | 26 (11) | 24 (11) | 32 (13) | 28 (11) | 29 (12) |
| Vitamin C (mg) | 172 (92) | 168 (89) | 212 (113) | 178 (89) | 179 (99) |
| Folate (μg) | 404 (146) | 397 (142) | 465 (176) | 416 (143) | 416 (154) |
| Vitamin A (μg) | 1249 (633) | 1318 (673) | 1216 (587) | 1077 (457) | 1075 (496) |
| Iron (mg) | 18.9 (8.1) | 18.8 (8.1) | 21.8 (9.1) | 19.2 (8.1) | 18.9 (8.1) |
| Calcium (mg) | 1141 (411) | 1133 (403) | 1280 (491) | 1182 (409) | 1134 (423) |
| Zinc (mg) | 11.5 (4.3) | 12.0 (4.4) | 11.8 (4.4) | 10.4 (3.5) | 10.2 (3.7) |

**Table 3** Top 10 contributors to energy by meat-, fish-eating and vegetarian status (% contribution to total energy)

| Food | Meat-eaters | Oily fish-eaters | Other fish-eaters | Vegetarians |
|---|---|---|---|---|
| Semi-skimmed milk | 3.7 | 2.5 | 3.1 | 2.7 |
| Wholemeal bread | 3.4 | 5.4 | 5.0 | 5.4 |
| Boiled potato | 3.2 | 2.2 | 2.4 | 2.4 |
| White bread | 2.7 | – | – | 1.8 |
| Jacket potato | 2.2 | 2.7 | 2.5 | 2.7 |
| Wine | 2.1 | 2.1 | 2.3 | 1.9 |
| Banana | 2.2 | 2.6 | 2.5 | 2.6 |
| Brown bread | 1.9 | – | 1.8 | – |
| Muesli | 1.7 | 2.1 | 2.3 | 2.2 |
| Mini chocolate bars | 1.7 | – | – | – |
| Oily fish | – | 3.4 | – | – |
| Apples | – | 2.2 | 2.0 | 2.1 |
| Porridge | – | 1.8 | – | – |
| Cheddar cheese | – | – | 2.3 | 2.4 |

Where cells are empty does not imply that the food was not eaten, rather that the food was not featured in the top 10 energy-contributing foods for that group.

contributors to energy for each group. However, there were some differences between the groups. Oily fish was the second most important contributor to energy in the oily fish group. Mini chocolate bars featured in the top 10 foods for meat-eaters but not in any of the other groups. Apples appeared in the top 10 foods for all groups except the meat-eaters. Cheese was in the top 10 for other fish-eaters and vegetarians only. Porridge was in the top 10 foods for the oily-fish-eating group alone.

## Discussion

A large cohort of middle-aged British women has been created, with detailed dietary and lifestyle information. This is one of the largest cohorts looking at diet and cancer in women in the UK. The EPIC study has much larger numbers across the whole of Europe[28]. The Oxford–EPIC cohort also has a large number of non meat-eaters with rather similar characteristics to the UK Women's Cohort[29]. Other cohorts with an emphasis on vegetarian diets are generally smaller[30,31].

This cohort is not representative of the British female population, nor indeed was it ever intended to be. Rather, it was designed to optimise power for relevant comparisons relating to intake of fruit and vegetables and associated nutrients and their impact on the development of cancer and coronary heart disease. Other cohorts have been designed with a wide range of nutrient intakes where the unrepresentative nature of the cohort is seen as a strength[32,33].

In comparison with women of a similar age from the most recent British census (2001), the women in the UKWCS are more likely to be married, have a high social class, have a degree and to live in the South and East of England[34]. Differences between the groups were apparent at baseline in terms of self-reported illness, with meat-eaters appearing to have most and vegetarians the least amount of pre-existing illness. This may be due to a real difference or a selection effect – where vegetarians who are unhealthy are less willing to volunteer for a study such as this, or it could be due to different uses of health services leading to different likelihood of diagnosis between the groups[35].

As anticipated, about one-third of the cohort self-defined themselves to be vegetarians. However, only 18% were defined as vegetarians from the FFQ and ate meat or fish less than once a week. The recent National Diet and Nutrition Survey of British Adults (NDNS) has shown that 4% of women aged 50–64 years report being vegetarian or vegan[36]. The definition of terms is important, to ensure that similar groups and dietary patterns are being compared[37]. In this current analysis, vegans are included within the definitions of vegetarian used. Future work will differentiate these particular groups. Aspects of the protective elements of the vegetarian diet in Western populations have been widely studied. There is still a need to elucidate why a vegetarian diet tends to be healthier than a non-vegetarian diet. Three main routes have been suggested: vegetarians have healthier lifestyles in other ways (such as lower smoking); vegetarians eat less of potentially harmful components in the diet; and they eat more potentially beneficial items[38]. The UK Women's Cohort will be able to explore these issues in detail and relate them to cancer incidence rates and mortality from all and specific causes.

Subjects in the UK Women's Cohort generally follow a healthier lifestyle than average. They have lower rates of smoking and higher intakes of fruit and vegetables recorded on the FFQ than the average British woman. Despite this, it has been possible to show interesting and potentially important differences in food and nutrient intake within the cohort that may have implications for long-term health outcomes. Women in this cohort are more likely to be taking dietary supplements than are women of a similar age from the recent NDNS. In the NDNS, 55% took supplements[36]; this is the same as for the

meat-eaters in our cohort. In addition, nutrient values varied between the previous NDNS adults[39] and the UK Women's Cohort. In particular, energy intakes overall and hence micronutrient levels in general are higher in this cohort. Percentage energy from carbohydrate is higher and percentage energy from fat is lower in this cohort. In part, this will be due to the different methodology used to assess diet. The NDNS used a 7-day weighed intake with the potential for underreporting compared with our use of an FFQ. Also, survey fieldwork for the first NDNS adults was undertaken in 1986 and so dietary patterns may have changed.

Splitting the cohort by dietary patterns, according to the amount of meat, oily fish and other fish consumed, generated some interesting differences[40]. Fish-eaters were split into two groups since oily fish contains high levels of $n-3$ fatty acids which may be beneficial. In our cohort, we found that the meat-eaters were more likely to be older and less well-educated than the others. These characteristics were also seen in subjects who were most likely to eat meat in the East Anglian EPIC cohort[41]. At an international level, these characteristics do not necessarily hold out; for example, a large survey of Norwegian women found that it was the older women who ate more fish[42]. It is important therefore to have nationally relevant data for this and other dietary patterns that can be identified[13]. By careful definition of dietary patterns the high consumers of oily fish have been shown to be different from the other fish-eaters and the vegetarians, who were more similar to each other. For example, the oily fish-eaters not only had the highest fat intakes but also the highest fibre and vitamin C intakes.

In terms of future health risk, a fish-eating dietary pattern may be important. More good-quality epidemiological evidence is needed to further characterise the links between fish intake and risk of heart disease or cancer. The epidemiological literature surrounding potential beneficial effects of fish consumption on coronary heart disease is confused[43–45]. A systematic review of 11 cohort studies concluded that fish consumption was not associated with reduced coronary heart disease mortality in the cohorts from low-risk populations. However, fish consumption at 40–60 g daily was associated with markedly reduced coronary heart disease mortality in the rather smaller cohort studies in high-risk populations. The underlying biochemical mechanism is not fully known and causal inference is premature[46]. The evidence surrounding fish consumption and cancer risk is, if anything, even less clear. Ecological and case–control studies have shown a possible protective effect of higher fish consumption against breast cancer[47–49], whereas others have not[50].

The UK Women's Cohort has particular strengths related to the broad spectrum of dietary patterns represented. It has detailed FFQ and subsequent food diary information along with extensive lifestyle information. There is potential to link the data from this cohort with others within the UK to provide even larger numbers of cases. On the other hand, the cohort does not represent a random sample of the British middle-aged female population in that they tend to be healthier than usual and there are known weaknesses in the FFQ methodology[51].

In conclusion, a large cohort of middle-aged British women has been created which includes a wide range of different dietary patterns. Two distinct groups of fish-eaters, oily fish-eaters and other fish-eaters, have been described. In addition, vegetarians and meat-eaters have also been characterised. Participants will be followed up to explore the effects of different food and nutrient intakes and food patterns on long-term health outcomes.

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