Costs of a healthy diet: analysis from the UK Women's Cohort Study

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Submitted 30 September 1998: Accepted 10 March 1999

Abstract

Objective: To investigate the direct and indirect cost differences associated with eating a 'healthy' or 'unhealthy' diet.
Design: Analysis of data from a baseline postal questionnaire for the UK Women's Cohort Study, including a detailed food frequency questionnaire (FFQ), supplemented by a telephone interview on a sub-sample.
Subjects: The first 15 191 women who responded to the questionnaire, aged 35–69 years with similar numbers of meat eaters, fish eaters and vegetarians.
Results: A healthy diet indicator (hdi), with values from 0 (lowest) to 8 (highest) was developed based on the WHO dietary recommendations. Direct monetary cost of the diet was calculated using prices from the 1995 National Food Survey and the Tesco home shopping catalogue. Women in the healthy diet group were almost four times as likely to be vegetarian and have a higher educational level. For direct costs, the difference between the most extreme hdi groups was £1.48 day^{-1} (equivalent to £540 $year^{-1}$), with fruit and vegetable expenditure being the main items making a healthy diet more expensive. Forty-nine per cent of the food budget was spent on fruit and vegetables in hdi group 8 compared to 29% in hdi group 0. Interestingly, 52% of those questioned in both extreme hdi groups did not think that it was difficult to eat healthily.
Conclusions: To achieve a particularly healthy diet independent predictive factors were spending more money, being a vegetarian, having a higher energy intake, having a lower body mass index (BMI) and being older.

Keywords
Cost
Direct cost
Indirect cost
Healthy diet

There is increasing evidence that eating a healthy, balanced diet can reduce mortality as well as the risk of contracting illness, including coronary heart disease and cancer[1–3]. The importance of a healthy diet was stressed in the government's *Health of the Nation* White Paper[4]. Studies by the Health Education Authority[5] reveal increasing public knowledge about what constitutes a healthy diet. On the other hand, problems concerning healthy eating have been identified. Within the general population these include beliefs that 'the tastiest foods are the ones that are bad for you' (44%), that 'eating healthy food is expensive' (39%) and that 'healthy eating is just another fashion' (16%). People with low incomes are least likely to eat healthy diets[5–7].

Apart from the potentially higher direct costs of eating a healthy diet, the indirect cost increase might be considerable. This could for instance include additional time (shopping more frequently for fresh produce, longer cooking and preparation times) and acquiring more knowledge; as well as intangible costs, such as the stress of convincing family members to forgo chips and sweets in favour of vegetables, etc. Even though costs are considered a barrier towards eating a healthier diet hardly any research exists as to what extent costs of a healthy diet really differ from those of an unhealthy one[8].

The aim of this current study is to investigate the marginal cost differences between eating a healthy and unhealthy diet.

Methods

The sample used for this analysis was from the UK Women's Cohort Study. The cohort was taken from respondents to a short UK-wide World Cancer Research Fund questionnaire. These women were aged 35–69 years at recruitment to the cohort. Subjects were selected to ensure a high proportion of vegetarians in the cohort. This was in order to obtain a group which was heterogeneous with respect to food and nutrient intake to maximize the chances of detecting any diet–disease relationship. The final cohort size was just

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Table 1 Healthy diet indicator components (from WHO[11])

Food group/nutrient	Indicator value		% cohort meeting WHO recommendation
	1	0	
Saturated fatty acids (% total E)	0–10	>10	43
Polyunsaturated fatty acids (% total E)	3–7	<3 or >7	67
Protein (% total E)	10–15	<10 or >15	57
Complex carbohydrates (% total E)	50–70	<50 or >70	54
Free sugars* (% total E)	0–10	>10	60
Dietary fibre (g)	27–40	<27 or >40	32
Fruits and vegetables (g)	>400	<400	75
Pulses, nuts, seeds (g)	>30	<30	13

E, energy.
*Fructose and lactose were excluded from the calculation of this score.

under 35 000 women. Detailed dietary information was obtained using a 217-item FFQ[9], assuming standard portion sizes. The FFQ has been adapted to be suitable for vegetarians as well as meat eaters, from one currently being used in a large cohort of diet and cancer[10]. The current work is based on an analysis of the first 15 191 subjects who had responded to the baseline questionnaire.

A healthy diet indicator was developed based on the WHO recommendations for the prevention of chronic disease[11]. The approach used here was similar to that of Kromhout *et al.*[12]. A dichotomous variable was generated for each food group or nutrient included in the recommendations (Table 1). If a woman's intake, estimated from the FFQ, was within the recommended range this variable was coded as 1, otherwise it was coded as 0 (i.e. not meeting the recommended level). The healthy diet indicator equals the sum of all these eight dichotomous variables (i.e. it can take a value from 0 to 8). To avoid overlap with their constituent parts, *total* fat and *total* carbohydrates were omitted in the calculation of the healthy diet indicator. Salt was not included because only information about the sodium content in foods was available for the cohort and it was not known how much salt was added during preparation of meals or at the table. Fructose and lactose were not included in the free sugar target. These sugars are considered less harmful than, for example, sucrose in processed food like sweets[13]. If free sugars had been calculated as the sum of all kinds of monosaccarides and disaccarides not a single woman out of the 15 191 had a sugar intake within the recommended range of 10% or below of total energy intake[11]. This was due to the relatively high fruit intake of the women in the study. Components 1 to 5 of the healthy diet indicator were calculated as a percentage of energy intake including the energy provided by alcohol.

Direct costs were calculated for the whole sample by multiplying the amount of food consumed from the FFQ for an individual with average national prices. Prices were taken from the 1995 National Food Survey[14] and from the 1997 Tesco supermarket home shopping catalogue*. The latter was particularly necessary for special food items whose prices are not published in the National Food Survey. A comparison of the Tesco prices with those from a York Sainsburys supermarket showed negligible differences in price.

Indirect costs were assessed by telephone interviews of women in the extreme hdi groups. Fifty-two women in hdi group 8 were interviewed from a total of 57 eligible women identified in this group by the FFQ. Of the five not interviewed, one woman refused and four could not be contacted despite up to 10 attempts to call. (An additional 18 women in this group were not contactable on the telephone because they had moved, died, were taking part in another sub-study or did not have a telephone.) Fifty-two women in hdi group 0 were interviewed. Only the first 100, of the 122 women identified in this group, were targeted for interview; of these 27 were not eligible to be contacted by telephone. The interview focused on the costs and implications of buying and preparing food including where the food was purchased, how often, how they reached the shops, and how much time was spent cooking. Women were not told whether their diet was particularly healthy or unhealthy.

The association between healthy diet and costs, level of education, being a vegetarian, total energy intake, BMI and age were modelled using polychotomous logistic regression for ordinal outcomes (ordinal logistic regression)[15]. The variables chosen for the model were those which appeared to be related to the healthy diet indicator in univariate analysis. Six separate regression models were first fitted for each of the six predictor variables, then one model was fitted with all six predictor variables together to investigate which were independently associated with healthy diet after adjusting for the other variables. This modelling was done using MINITAB version 11[16]. The odds ratios presented are equivalent to average odds between adjacent hdi

*These prices do not exceed Tesco store prices. A single £5 fee is charged for the home delivery service.

https://doi.org/10.1017/S1368980099000683 Published online by Cambridge University Press

Table 2 Characteristics of the study sample by healthy diet indicator (hdi)

hdi group	No. of women (%)	Age (years): mean (95%CI)	Energy intake (kcal): mean (95%CI)	Vegetarian (%)	BMI (kg m^{-2}): mean (95%CI)	Degree level education (%)	Cost per day (£): mean (95%CI)
0	122 (1)	51 (49–52)	1683 (1596–1769)	21	24.6 (23.8–25.4)	23	2.33 (2.20–2.46)
1	859 (6)	51 (51–52)	1854 (1818–1890)	25	24.3 (24.0–24.6)	24	2.66 (2.60–2.72)
2	2017 (13)	52 (52–53)	2092 (2065–2119)	26	24.1 (23.9–24.2)	27	3.04 (2.99–3.09)
3	2787 (18)	53 (52–53)	2241 (2210–2273)	32	24 (23.8–24.1)	27	3.28 (3.23–3.33)
4	3285 (22)	53 (53–54)	2385 (2357–2413)	40	24 (23.8–24.1)	27	3.46 (3.41–3.51)
5	3052 (20)	54 (54–54)	2509 (2480–2537)	47	23.7 (23.6–23.9)	28	3.61 (3.56–3.66)
6	2190 (14)	54 (53–54)	2640 (2609–2672)	55	23.6 (23.5–23.8)	30	3.84 (3.79–3.91)
7	805 (5)	53 (52–54)	2724 (2677–2771)	63	23.3 (23.0–23.6)	31	4.02 (3.93–4.11)
8	75 (1)	52 (50–53)	2622 (2535–2710)	78	22.9 (22.0–23.8)	55	3.81 (3.58–4.03)
Total	15 191 (100)	53 (53–53)	2365 (2352–2378)	41	23.9 (23.8–23.9)	28	3.43 (3.41–3.46)

scores. Ordinal logistic regression models the cumulative odds of having any particular hdi score or better. The model assumes the change in odds associated with each predictor is the same for all hdi groups. So, for example, the odds ratios indicate how much a woman's odds of having a better diet improve if she is educated to 'A'-level standard compared with having no qualifications.

Results

A total of 15 191 subjects were available for analysis from the UK Women's Cohort Study – a response rate of 51% to the baseline questionnaire at that time. The telephone interview to 104 women was a response of 73% of the available women in hdi group 0 and a response of 91% of the available women in hdi group 8.

The percentage of women meeting any one particular target is shown in Table 1. In general, women were most likely to eat the recommended amounts of fruits and vegetables and to stay within the recommended range of polyunsaturated fat. They were least likely to consume more than 30 g of pulses/nuts/seeds per day. The characteristics of the women by hdi are summarized in Table 2. Women in the healthy diet group were almost four times as likely to be vegetarian and had a higher educational level than women in the least healthy diet group. Total energy intake increased and BMI decreased with increasing hdi group. Women with the healthiest diets (hdi 8) ate about 1000 kcal more per day and had the lowest BMI at 22.9 kg m^{-2}.

The cost distribution for the daily diet is shown in Table 2 and Fig. 1. The figure presents a box and whisker plot. The boxes contain the values falling between the 25th and 75th percentiles and the whiskers extend from the box to the highest and lowest values. The thick line across the box indicates the median. The lower hdi groups have a mean food cost lower than average and the higher hdi groups have a mean cost higher than average. The maximum difference in costs is between hdi group 0 and 7 at £1.69 day^{-1} (95%CI £1.44 to £1.93; $P < 0.001$) or £617 year^{-1} (95%CI £526 to £704). The cost difference between the extreme hdi groups (0 and 8) was £1.48 day^{-1} (95%CI £1.24 to £1.71; $P < 0.001$), which is equivalent to £540 year^{-1} (95%CI £453 to £624).

An exploration of which food groups contributed to the total cost is shown in Table 3. The unhealthy diet group (hdi 0) spent more money on meat, fish and eggs and these constitute a higher percentage of the budget spent on food than for the healthy diet group (hdi 8). In

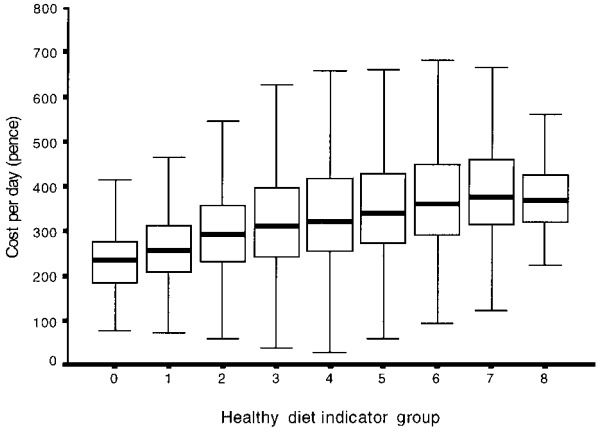

Figure 1 Distribution of cost of food per day by hdi group

https://doi.org/10.1017/S1368980099000683 Published online by Cambridge University Press

Table 3 Food groups contributing to the cost of daily diets comparing lowest hdi group (0) with the highest hdi group (8)

	hdi group 0			hdi group 8		
	Cost (pence)	Rank	% of budget	Cost (pence)	Rank	% of budget
Meat	42	1	17	5	13	1
Fish	15	7	6	10	10	3
Vegetables	37	2	17	89	2	24
Fruit	27	3	12	98	1	25
Bread	6	11	3	12	9	3
Cereals	2	16	1	5	12	1
Potatoes/pasta/rice	11	8	5	16	7	4
Eggs	5	13	2	4	16	1
Non-dairy products	18	6	8	29	4	7
Margarine/butter/spreads	2	15	1	5	14	1
Sauces/soups	6	10	3	9	11	2
Grains/nuts/seeds	6	12	3	22	6	6
Savoury snacks	4	14	2	4	15	1
Sweets	10	9	4	15	8	4
Non-alcoholic beverages	22	4	10	29	3	8
Alcoholic beverages	21	5	8	27	5	7
Total	£2.33		100%	£3.81		100%

hdi group 8, women spent on average £1.87 day^{-1} on fruit and vegetables combined, three times as much as was spent by hdi group 0 (£0.64) (difference £1.23, 95%CI £1.10 to £1.37; $P<0.001$). Fruit and vegetables were the items costing the most money in hdi group 8 whereas in hdi group 0 meat was the most expensive item followed by vegetables.

Results of the ordinal logistic regression model, including all six predictor variables together (Table 4), showed that being a vegetarian, spending more money, having a higher energy consumption, having a lower BMI and being older were all independent predictors of a better diet score, even after adjusting for each of the other predictor variables. Although a higher level of education tended to be associated with slightly better diet in a univariate analysis, this effect was no longer statistically significant after adjusting for the other predictor variables.

The assumption that the associated effects of these predictor variables is the same across all dietary indicator groups was broadly met. However, there was a tendency for spending more money on food to be associated with a much better diet if the healthy diet indicator was low, but if the diet was fairly healthy already (with a high healthy diet indicator) then spending more money was associated with a lesser improvement. However, this tendency was not statistically significant ($P>0.2$).

Indirect costs were assessed by telephone interviews on a sub-sample from hdi groups 0 and 8. Table 5 summarizes the results from these interviews. Shopping frequency for hdi group 0 was 2.3 (SD 2.3) and for hdi group 8 it was 3.1 (SD 1.4) times a week. Most of the shopping was done at large supermarkets by both groups; however, only 3 (6%) of hdi group 0 shop at health food shops compared to 17 (33%) in hdi group 8 ($P=0.001$). The time taken for women to reach the

Table 4 Odds ratios for healthier diets based on an ordinal logistic regression model with educational status, vegetarian status, cost of meals per day, energy consumption, body mass index and age all in the model at the same time

	Odds ratio*	95%CI	*P* value
Education			
None	1.00	–	
Below A-level	1.00	0.91–1.11	
A-level	1.05	0.95–1.17	
Above A-level	1.04	0.94–1.15	0.619
Vegetarian			
No	1.00	–	
Yes	2.52	2.36–2.69	<0.001
Cost per day (pence)			
<200	1.00	–	
200–299	1.37	1.22–1.54	
300–399	1.92	1.69–2.18	
400–499	2.25	1.95–2.59	
500+	2.53	2.16–2.96	<0.001
Energy consumption (kcal)			
<1500	1.00	–	
1500–1999	1.47	1.30–1.66	
2000–2499	2.55	2.25–2.89	
2500–2999	3.47	3.03–3.98	
3000+	3.81	3.28–4.42	<0.001
Body mass index ($kg\,m^{-2}$)			
<20	1.00	–	
20–24.99	0.98	0.89–1.08	
25–29.99	0.87	0.77–0.97	
30+	0.86	0.75–1.00	0.002
Age (years)			
<45	1.00	–	
45–54	1.11	1.03–1.21	
55–64	1.49	1.35–1.64	
65+	1.67	1.49–1.87	<0.001

* The odds ratios presented are adjusted for each of the other variables. Odds ratios greater than 1.0 indicate increased odds of a healthier diet compared to the reference group (in each case the first group listed).

https://doi.org/10.1017/S1368980099000683 Published online by Cambridge University Press

Table 5 Differences between hdi groups 8 and 0 in indirect costs (n=52 in each group of telephone interviews)

Indirect cost	hdi group 8	hdi group 0
Mean shopping frequency per week	3.1	2.3
Time to main shop		
% reaching in 10 min	73	83
Mobility		
% using car	85	90
Entire shopping + travelling time		
% shop in 1–1.5 hours	60	81
Organic produce		
% yes	63	12
Home-grown produce		
% yes	52	15
For how many people food shopping		
% 1 person	19	10
% 2 persons	37	32
% 3–4 persons	44	45
% 5+ persons	0	13
Difficult to eat healthily?		
% yes	52	52
Difficult to convince family?		
% yes	46	35
More expensive to eat healthily?		
% yes	29	40
More time consuming?		
% yes	46	62
Availability problem?		
% yes	38	27

shops was compared. A total of 43 (83%) women in hdi group 0 reached their food shop within 10 min compared with about 38 (73%) in hdi group 8 (P=0.34). Overall, 91 (88%) of women used their car to go shopping; this was 47 (90%) in hdi group 0 compared with 44 (85%) in group 8 (P=0.55). The time taken for women to complete their supermarket shopping was more variable in hdi group 8 than in hdi group 0. A total of 42 (81%) in hdi group 0 completed their supermarket shopping in 1–1.5 hours compared with only 31 (60%) in group 8 (P=0.03).

Organic foods were bought by 33 (63%) of women in hdi group 8 compared with just 6 (12%) in hdi 0 ($P<$ 0.001). Home-grown produce was used by 27 (52%) of women in hdi group 8 compared with 8 (15%) in hdi group 0 ($P<0.001$). Many added comments like 'I wish I could but we do not have a garden', etc. The amount of home-grown produce consumed was very variable. When more detail was requested, for example 'Could you say *how much* home-grown produce …' the answer was often similar to 'Well, if friends offer me apples from their garden I take them' whereas others reported that they hardly did any shopping because they grew all their own fruit and vegetables.

If a healthy diet is associated with higher costs, the number of people for whom the food shopping is done may influence the decision whether a certain diet is affordable. We found that hdi group 8 women were more likely to shop for themselves or do the food shopping for only one other person. Only in the hdi group 0 did women shop for five or more people. The time required to prepare a meal could be important when it comes to deciding what to cook. In order to assess whether eating a healthy diet involves longer preparation and cooking times, women were asked how much time they spent in cooking and preparing the main meal on an average day. There was considerable variability within both groups but no striking differences between healthy and unhealthy diet eaters.

Attitudes to healthy eating were explored. The same number of women in both groups did not think that there were any difficulties when it comes to eating a healthy diet (27 of the 52 in each group (52%); P=0.84). A total of 24 (46%) of women in hdi group 8 thought it was difficult to convince their family to eat healthily compared to 18 (35%) of women in hdi group 0 (P= 0.32). Many women pointed out that additional time constraints and/or stress would often keep them from preparing healthy food. Several vegetarian women said that they would usually have to cook two meals: one for themselves and one for non-vegetarians in the family, adding to the time and effort involved. For costs, 15 (29%) of hdi group 8 thought it was more expensive to eat healthily compared with 21 (40%) of hdi group 0 (P=0.30). Even among women who thought that a healthy diet was more expensive many pointed out that they felt it is worth it and that they could afford the difference. This attitude may be due to the particular study sample involved here, and may not reflect true population attitudes. Also, 24 (46%) of hdi group 8 thought that it was more time consuming to eat healthily compared with 32 (62%) in hdi group 0 (P= 0.17). Availability of healthy food was considered to be a problem by 20 (38%) of hdi group 8 and 14 (27%) of hdi group 0 (P=0.30). The healthy diet group also seemed to have higher quality expectations (e.g. they often thought that availability of *good* fruit and vegetables was unsatisfactory).

Discussion

The UK Women's Cohort Study sample is not a representative sample of British women. It has been constructed to get a wide range of food and nutrient intakes so as to maximize variability of nutrient intake data within the sample. Nevertheless, this analysis is comparing groups within the UK Women's Cohort Study chosen according to whether or not they meet certain predefined criteria for healthy eating. The key findings from the ordinal logistic regression model including all six predictor variables were that being a vegetarian, spending more money, having a higher energy consumption, a lower BMI and being older were all *independent* predictors of a better diet score.

The UK Women's Cohort Study population are a group who are interested in their diet, 41% in this

https://doi.org/10.1017/S1368980099000683 Published online by Cambridge University Press

analysis were vegetarian, and they may well eat more healthily compared to a representative population sample. The hardest target for the women to reach was the target for pulses, nuts and seeds. Women were most likely to eat the recommended amounts of fruit and vegetables and stay within the recommended range of polyunsaturated fat. Women who had the highest hdi score (8) were more likely to be vegetarians and to have a high level of education than women with the lowest hdi score (0). Women with hdi score 8 also ate about 1000 kcal more per day than those in the lowest group. This difference is large, although there appears to be a gradual increase over the eight groups with no evidence of a threshold. This increase in energy intake with increasing hdi score was shown to be independent of BMI, educational level and vegetarian status. It may be that people with low energy intakes are not able to consume the range of foods required to meet all the recommendations.

This study was only able to explore dietary costs in terms of direct costs and indirect costs which occurred to individual women. It was not possible to consider societal cost aspects, such as influence on the environment[17].

Prices were taken from the 1995 National Food Survey[14] and from the Tesco home shopping catalogue of some 2 years later. The fact that 95% of the women interviewed did (part of) their food shopping at these kind of supermarkets justified that lower priced supermarkets (e.g. Kwiksave, etc.) were not taken as a reference. This method only gives an approximation of actual direct diet costs. It does not take into account differences which may systematically arise. These may depend on where people live and shop; the number of people in the household (e.g. higher prices for the same food item for small households due to smaller packet sizes); educational background; household income; or the extent to which people eat out at restaurants and takeaways[14]. People who eat out a lot would undoubtedly have had their costs underestimated.

Our analysis shows that there seems to be a trend towards the healthier the diet the higher the direct costs[17,18,19]. The maximum difference was between hdi groups 0 and 7 at £1.69 day^{-1}, i.e. £617 $year^{-1}$. This is partially explained by the higher energy intake for women in the healthier diet groups. However, it does not take into account that food items may have higher prices when bought by people in hdi group 8, for example, because they buy more organic produce than people in hdi group 0. Since women in hdi group 8 are more likely to live in a one- or two-person household they might have to buy smaller portion sizes, which again would make the same food item more expensive. Therefore, even though the method used to assess the direct costs is an approximation of what women might have spent in reality, the observed incremental cost difference between an unhealthy and a healthy diet is likely to be even greater.

Other work has also suggested that to achieve a healthy diet it is necessary to spend more money[8,19,20]. However, it is not possible to say whether it would have been relatively easy for the women to eat a healthy diet, but at less expense. In general, irrespective of cost, it is not easy for people to consume a diet that meets the healthy eating guidelines[21]. Fruit and vegetables contributed the largest amount to costs of the diet in hdi group 8. Even in hdi group 0, vegetables were the second most expensive food group. The most recent National Food Survey[22] found that the average daily cost of all food and drink was £2.35 per person. This survey records food purchases and includes the whole household (men, women and children) and so is not directly comparable. Nevertheless, this value is similar to the hdi group 0 cost of the daily diet at £2.33. The hdi group 8 spent considerably more on fruit (98p day^{-1}) and vegetables (89p day^{-1}) than the national average which was 31p day^{-1} for vegetables excluding potatoes and 17p day^{-1} on fruit.

There are other costs to a diet apart from the direct payment for food, including indirect and intangible costs[23]. Women in the healthiest diet group (hdi 8) went shopping for food three times a week compared with only twice a week in hdi group 0. It may be that to achieve a healthy, balanced diet it is necessary to go shopping more often per week. But causality could also be the other way around, in that women who shop more often (because shops are closer, because they have got more spare time or because they simply enjoy shopping more) are in the end more likely to come up with a healthy diet. However, we found that women in hdi group 8 faced *slightly* longer times to reach the shop where they do their main shopping. Therefore, the fact that they go shopping more often cannot be explained by the notion that they live closer to their shops than women in the unhealthier diet groups.

If it was necessary to go shopping more frequently in order to eat a healthy diet, the availability of a car could be seen as making shopping for a healthy diet easier. The fact that women in the hdi group 0 seem to be as likely to go shopping by car would not support this idea, at least in this population. Women found it difficult to estimate shopping time during their main food shop (usually at the supermarket). They usually follow this with 'top up' shopping several times a week in the local shops, with the time taken for this being even more difficult to estimate.

More women in hdi group 8 were purchasing organic foods. However, the extent to which this increases the (direct) costs of those women's diet cannot be estimated without further knowledge. For example, what kind of produce is bought from organic manufacturers, and in what amounts at what prices, in what kind of

shops, in which regions, during which seasons (high variability in organic fruit and vegetable prices depending on the time of year), and so on. Apart from these higher direct costs of organic produce, several women pointed out the perishable nature of organic food, i.e. consumers of organic produce might face increased costs due to the fact that they have to throw away a higher percentage of food as it turns bad before being eaten.

In terms of the composition of food, home-grown produce can often be seen as equivalent to organically produced food. The indirect cost arising from cultivating your own fruit and vegetables has a different character, compared to the financial ones for organic produce. For instance, people with limited household budgets but extra time (e.g. due to unemployment or retirement) are more likely to grow their own vegetables than to buy organic food, particularly if they do not live in cities and have a garden. Hdi group 0 was less likely to eat home-grown produce than hdi group 8.

Healthy diet eaters did not spend more time on cooking and preparing food than people who consumed a less healthy diet. Although time taken in cooking was similar between hdi groups 0 and 8, the conclusion is not necessarily that women of hdi group 0 would need the same amount of time if they were to cook a more healthy diet. They might lack knowledge and experience when trying to change their diet into a healthier one and hence need more time.

Exploring perceptions of eating a healthy diet we found that despite higher direct costs, almost 71% in the healthiest diet group and 60% in the least healthy group did not agree that it was more expensive to eat healthily. This is contrary to most evidence from research[8,18,19,24,25] into the costs of a healthy diet and it demonstrates to what extent the individual assessment of costs is a matter of subjective perception rather than of objective facts[26]. In this case, our study group tended to have higher income and educational levels than the general population, which may have influenced their views.

About 39% in the healthy diet group thought that availability of healthy food was a problem (compared to 27% in the unhealthy group). This was explained by the higher consumption of more unusual foods like organic produce, lentils, seeds, etc. in hdi group 8. Hence, in order to achieve a healthy diet additional indirect costs are likely to arise due to limited availability of particular foods.

Conclusion

In conclusion, to achieve a particularly healthy diet women incurred higher expenditures, were more likely to be vegetarian, had a higher energy intake and lower BMI and were older than those with a less healthy diet. For the direct costs there was a difference between the most extreme groups of £1.48 day^{-1}, equivalent to £540 year^{-1}. Fruit and vegetable expenditures seem to be the main factor making a healthy diet more expensive. Subsidizing these foods in combination with health promotion policies to increase knowledge and attitude towards healthy eating may be a cost-effective way of increasing the health of the nation. The UK Women's Cohort Study will be followed up in terms of health outcomes for the next 10 years. Compared to the costs required by most other health policies to gain a quality-adjusted life year it will be interesting to find out about the marginal differences in health outcomes for people with healthy and unhealthy diets.

Acknowledgements

The UK Women's Cohort Study is funded by the World Cancer Research Fund. We acknowledge the support of the Steering Group and administrative team in the running of the study.

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