British Journal of Nutrition (2009), **101**, 1828–1836
doi:10.1017/S0007114508135899

Effect of the introduction of 'Healthy Start' on dietary behaviour during and after pregnancy: early results from the 'before and after' Sheffield study

Fiona A. Ford*, Theodora Mouratidou, Sarah E. Wademan and Robert B. Fraser

Academic Unit of Reproductive and Developmental Medicine, University of Sheffield, the Jessop Wing, Royal Hallamshire Hospital, Tree Root Walk, Sheffield S10 2SF, UK

(Received 23 May 2008 – Revised 30 September 2008 – Accepted 30 September 2008 – First published online 19 November 2008)

The aim of the study was to examine the effect of the introduction of a new food-support benefit 'Healthy Start' (HS) on dietary intakes and eating patterns of low-income, Caucasian, pregnant and postpartum women living in Sheffield (UK). A before-and-after study comparing nutritional behaviour of participants, who were beneficiaries or eligible for the Welfare Food Scheme (WFS) (phase 1) or HS (phase 2), was conducted. Dietary intakes and eating patterns were assessed using a validated semi-quantified FFQ. In phase 1, 176 WFS subjects (ninety pregnant and eighty-six postpartum) were recruited and in phase 2, there were 160 HS subjects (ninety-six pregnant and sixty-four postpartum). The results suggested that pregnant and postpartum HS women significantly increased their daily intakes of energy, Fe, Ca, folate and vitamin C compared with the WFS women. Observed differences remained significant after controlling for potential confounding effects of known factors, i.e. education and age. HS women were more likely to meet the recommended nutrient intakes for Fe, folate, Ca and vitamin C. HS women ate significantly more mean portions of fruit and vegetables per d ($P=0{\cdot}004$ and $P=0{\cdot}023$) respectively. None of the HS recipients was receiving HS vitamin supplements. The present study showed that pregnant and postpartum HS women increased their food consumption, and a higher proportion of them than the earlier WFS scheme met the recommended intakes for Ca, folate, Fe and vitamin C.

Dietary behaviour: Healthy Start: Maternal nutrition

The health status and financial condition of mothers and their babies came into focus after the release of the Independent Inquiry into Inequalities in Health[1]. It recommended that 'a high priority should be given to policies aimed at improving health and reducing health inequalities in women of childbearing age, expectant mothers and young children' including elimination of food poverty and the prevention and reduction of obesity. These issues have been addressed in a series of policy initiatives including a programme to tackle inequalities in infant mortality and life expectancy at birth[2].

In October 2002, the Department of Health launched a public consultation on proposals to reform the Welfare Food Scheme (WFS) which was established in 1940. It provided tokens that could be exchanged for liquid milk and infant formula, and vitamin supplements to pregnant women, nursing mothers and children under age 5 years in families receiving qualifying benefits. It also provided non-means-tested milk to those in nurseries or other forms of day-care, and to a very few disabled children between ages 5 and 16 years who are not attending any school[3].

In November 2006, 'Healthy Start' (HS)[4] a new food benefit support scheme, replaced the WFS. The HS scheme offers more flexibility and choice because it provides vouchers that can be exchanged for fresh fruit and vegetables as well as milk and infant formula. HS is also designed to ensure that pregnant women and families participating in the scheme have the opportunity to access good-quality information and advice about health and lifestyle advice, including diet in pregnancy, breast-feeding, stopping smoking, and the roles of milk, fresh fruit, vegetables and vitamins in the diet. Breast-feeding and non-breast-feeding mothers are set to benefit equally from the scheme. Eligible beneficiaries of the scheme include those receiving qualifying benefits, i.e. income support, income-based Jobs Seekers' Allowances and Child Tax Credit with an income of £15 575 per year or less.

The HS project in Sheffield is a 'before-and-after' study investigating nutrition practices in pregnant and postpartum women and their infants before and after the introduction of the new food-benefit scheme. Dietary intakes of the two groups were assessed at 20 weeks of pregnancy and at each month during the first year of the baby's life. In the present paper, we report dietary intakes and eating patterns of low-income, Caucasian pregnant and postpartum women in Sheffield, before and after the introduction of HS to evaluate the short-term effect of the new food-provision benefit on these behaviours.

Abbreviations: HS, Healthy Start; WFS, Welfare Food Scheme.

* **Corresponding author:** Fiona A. Ford, fax +44 114 226 8538, email f.a.ford@sheffield.ac.uk

Materials and methods

Study design and settings

A before-and-after study design was used to compare the nutritional behaviour of pregnant and postpartum women who were either beneficiaries of or eligible for the WFS (phase 1) with pregnant and postpartum women who were either beneficiaries of or eligible for HS (phase 2). Sample size calculations were not performed as it was not possible to identify potential study participants in advance and thus the sample size was opportunistic. Data for phase 1 pregnant and postpartum women were collected between November 2005 and mid-November 2006, i.e. before the introduction of HS. This interval between sampling periods allowed for a transition period when the change was becoming established locally. Phase 2 data collection for pregnant and postnatal women took place between April 2007 and November 2007, i.e. after the introduction of HS (Fig. 1).

The initial identification of potential pregnant and postpartum study participants was similar for phase 1 and phase 2, i.e. via the patient administration system of the hospital. The patient administration system was interrogated monthly to generate lists of pregnant and postnatal women, which were then filtered to reflect some of the eligibility criteria for the study, i.e. maternal ethnicity, maternal age and subjects' postcodes. Postcodes were used to identify subjects living in deprived electoral wards of Sheffield using the Index of Multiple Deprivation[5]. Thereafter, women fulfilling those criteria were approached.

Recruitment of phase 1 and phase 2 antenatal study participants

Pregnant participants previously identified as potentially eligible were approached, given an explanatory information leaflet and invited to participate in the study. Eligibility criteria included: Caucasian ethnic origin (white British); English speaking; living in Sheffield; free of any nutrition-related pre-existing medical condition such as diabetes or coeliac disease; a recipient of, or eligible for, food-support benefit. Agreeable pregnant women were interviewed at the antenatal clinic of the Jessop Wing, Royal Hallamshire Hospital in Sheffield at 20 weeks of pregnancy.

Recruitment of phase 1 and phase 2 postpartum study participants

Postpartum women were initially approached at the postnatal wards at the Jessop Wing, Royal Hallamshire Hospital (Sheffield, UK) by midwifery staff and asked if they were willing to be introduced to the study. Participants were formally introduced to the study by trained interviewers. Following a study overview and provision of an explanatory information leaflet, potential participants were asked for their permission to be telephoned by a researcher at 4 weeks postpartum to determine if they would participate in the study. The eligibility criteria for postpartum women were similar to the pregnant group in addition to having a live, healthy baby. Participants were interviewed at home by a trained interviewer.

The present study was performed as a Service Evaluation with the approval of the North Sheffield Local Research Ethics Office. Pregnant women were given an explanatory information leaflet 8 weeks in advance before recruitment. Postpartum women were given an explanatory information leaflet 3 weeks in advance before recruitment. Participation was based on oral consent.

Dietary assessment

Information on the anthropometric (i.e. height), sociodemographic (i.e. employment) and behavioural (i.e. supplement usage) characteristics of the participants was obtained via face-to-face, interviewer-administered, closed-question questionnaire interviews. BMI (kg/m^2) calculations were based on self-reported heights and pre-pregnancy weights for both the pregnant and postpartum sample. Characteristics of participants that were potential confounding factors for differences in dietary intakes and eating patterns between the groups were identified and examined for unequal distribution. These included BMI, maternal age, educational status, smoking status, use of pre- and post-conceptional folic acid supplements, parity, partner's employment status and maternal employment status.

Dietary intakes were determined using a validated, interviewer-administered, semi-quantified FFQ, adapted from the FFQ used by Rogers *et al.* [6]. The FFQ, validated for use in pregnant[7] and postpartum women (T Mouratidou, FA Ford and RB Fraser, unpublished results) in Sheffield, asks about the weekly frequency of consumption using sixty-two quantitative and qualitative questions, forty of which are about the frequency of consumption of meat, poultry, fish, seafood, common vegetables and fruits, breakfast cereals and confectionery, and uses standard portion sizes. There are also detailed questions about the type and amount of fat, bread, alcohol and milk consumed. Frequency options include: never or rarely, once per 2 weeks, one to three times per week, four to seven times per week and more than once per d. Mean nutrient intakes

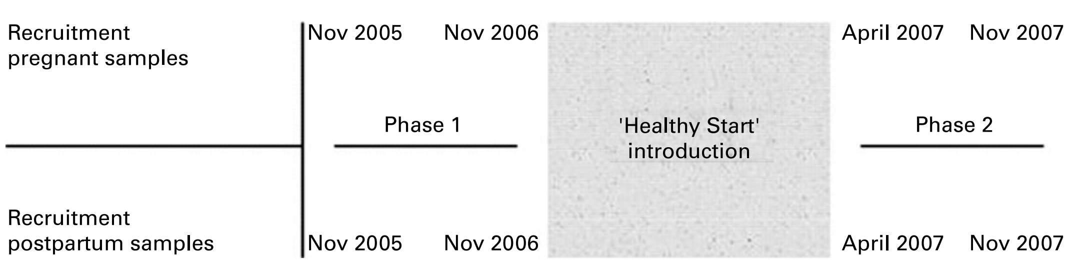

Fig. 1. Recruitment timeline of pregnant and postpartum samples before (phase 1) and after (phase 2) the introduction of 'Healthy Start'. Nov, November.

were calculated from foods and did not include any provided from supplements as well as estimated mean weekly frequency of consumption of the food items included in the FFQ. QBuilder was used to analyse daily intakes of energy, nutrients and food items obtained from the FFQ (Tinuviel Software, Anglesey, UK)[7].

To minimise errors in coding and data a series of steps was taken to independently verify the data, such as dual entry. Trained nutrition field workers were used throughout the study and little observer variation was found. Participants reporting unfeasibly high or low energy intakes (above 20·9 MJ/d) were removed from the dataset before the analysis[8,9]. Misreporting of energy intake was determined by the use of the energy intake:BMR ratio with a physiological plausible total energy expenditure:BMR ratio also referred to as the physical activity level. The physical activity level cut-off used was 1·55. Valid reporters were defined as the number of individuals whose reported energy intake:BMR ratio was within the determined 95 % CI. Consequently, individuals with a ratio below the lower or above the higher limit were classed as under- or over-reporters[10,11].

Statistical methods

The Statistical Package for Social Sciences (version 15.0; SPSS Inc., Chicago, IL, USA) was used to analyse the data at individual and group level. Mean values, standard deviations and differences in the anthropometrical characteristics between pregnant WFS and HS women and between postpartum WFS and HS women were assessed using an independent-sample *t* test. Standard cross-tabulated tables were conducted in order to compare categorical variables between pregnant WFS and HS women and between postpartum WFS and HS women and to identify any relationships. The χ^2 test was used to assess the significance of the relationships. All statistical tests and corresponding *P* values were two-sided and $P<0{\cdot}05$ was considered statistically significant.

The analysis of data obtained from the FFQ included means, standard deviations and CI for energy, and selected macro- and micronutrients for the pregnant and postpartum WFS and HS women. Nutrient intake estimates did not meet the assumptions of normal distribution and the non-parametric Mann–Whitney *U* test was used to compare differences in crude intakes between pregnant WFS and HS women and between postpartum WFS and HS women. Response values were grouped for each relevant FFQ food item, in order to estimate mean weekly food frequency of consumption. For this purpose, ‘more than once a day’ became fourteen times per week, ‘4 to 7 times a week’ became 5·5 times per week and so on. Univariate analysis was used to control for the possible effects of confounding factors on nutrient intakes between pregnant WFS and HS women and between postpartum WFS and HS women.

Results

The pregnancy study recruited 186 pregnant women (ninety WFS and ninety-six HS subjects). Three pregnant WFS women were removed from the dataset because of incomplete dietary data. Four WFS and nine HS pregnant women were removed from the analysis because of excessive energy intakes. In total, eighty-three WFS and eighty-seven HS pregnant women were included in the analysis. The postpartum study recruited 150 women (eighty-six WFS and sixty-four HS). Four postpartum WFS women were removed from the dataset because of incomplete dietary data. Two WFS and two HS postpartum women were excluded from the analysis because of excessive energy intakes. In total, eighty WFS and sixty-two HS postpartum women were included in the analysis.

Misreporting

Of the WFS pregnant participants, 18 % reported energy intakes significantly lower than their estimated total energy expenditure compared with 2·5 % in the HS group. Percentage over-reporting was 10 % for the WFS participants and 37·5 % for the HS participants. Of the WFS postpartum women, 9 % under-reported their energy intakes compared with 11·5 % in the HS group. Percentage over-reporting was 7 % for the WFS participants and 25 % for the HS participants.

Pregnant women

Table 1 presents the anthropometric, sociodemographic and behavioural characteristics of WFS and HS pregnant women in the study. Statistically significant differences were observed for the usage of periconceptional folic acid supplements ($P=0{\cdot}006$) and multivitamin/mineral supplements ($P=0{\cdot}001$), where more WFS than HS women reported taking them.

Postpartum women

Table 2 presents the anthropometric, sociodemographic and behavioural characteristics of WFS and HS postpartum women in the study. WFS women had a significantly higher self-reported pre-pregnancy BMI ($P=0{\cdot}003$), pre-pregnancy weight ($P=0{\cdot}010$) and were significantly older ($P=0{\cdot}021$) than HS women.

Dietary intakes

Mean daily intakes and standard deviations for energy, macro- and micronutrients assessed by the FFQ for pregnant WFS and HS and for postpartum WFS and HS participants are reported in Tables 3 and 4. Pregnant HS women had significantly higher energy and nutrient intakes. Postpartum HS women also had significantly higher energy and nutrient intakes.

After controlling for the effect of possible confounders, the association between receipt of HS vouchers with increased mean nutrient intakes still existed for energy, Ca, folate, Fe and vitamin C in both pregnant and postpartum samples. Exceptions included maternal employment and post-conceptional folic acid supplementation for Ca and Fe, and BMI $<30\,kg/m^2$ for vitamin C, which were shown to explain some of the differences observed in the pregnant sample. Similarly, pre-conceptional folic acid supplementation was shown to explain some of the differences observed in the postpartum population for energy, Ca, folate and Fe, and educational attainment for vitamin C.

Table 1. Anthropometrical, sociodemographic and behavioural characteristics of pregnant participants under the Welfare Food Scheme (WFS; *n* 83) and the Healthy Start (HS) scheme (*n* 87)

(Mean values and standard deviations or frequency)

	WFS	HS	*P**
Height (m)†			0·138
Mean	1·63	1·63	
SD	0·5	0·6	
Pre-pregnancy weight (kg)‡			0·809
Mean	62	58	
SD	16	9	
BMI (kg/m^2)§			0·064
Mean	23·4	21·4	
SD	6	4	
Age (years)‖			0·432
Mean	22	21·5	
SD	5	6	
Maternal age category (%)			0·224
$<$ 19 years	35	49	
20–24 years	41	29	
25–34 years	18	14	
$>$ 34 years	6	8	
Recipients of food support (%)			0·968
Yes	57	56	
No	43	44	
Educational attainment (%)			0·576
Five GCSE passes or more	65	61	
No qualification¶	35	39	
Self-reported smoking status (%)			0·429
Non-smoker	58	48	
Current smoker	42	52	
Pre-conceptional vitamin supplementation (%)			0·001
Yes	25	7	
No	75	93	
Pre-conceptional folic acid supplementation (%)			0·006
Yes	16	3	
No	84	97	
Post-conceptional folic acid supplementation (%)			0·344
Yes	79	85	
No	21	15	
Pregnancy planning (%)			0·056
Yes	52	37	
No	48	63	

GCSE, General Certificate of Secondary Education (a general educational examination taken at age 16 years).
* As tested by independent-sample *t* test for anthropometrical variables and by χ^2 test for categorical variables (two-tailed).
† WFS, *n* 63; HS, *n* 60.
‡ WFS, *n* 56; HS, *n* 40.
§ WFS, *n* 53; HS, *n* 31.
‖ HS, *n* 86.
¶ Includes current students, no qualifications.

Table 2. Anthropometrical, sociodemographic and behavioural characteristics of postpartum participants under the Welfare Food Scheme (WFS; *n* 80) and the Healthy Start (HS) scheme (*n* 62)

(Mean values and standard deviations or frequency)

	WFS	HS	*P**
Height (m)†			0·068
Mean	1·65	1·61	
SD	0·6	0·7	
Pre-pregnancy weight (kg)‡			0·010
Mean	61	65	
SD	14	13	
BMI (kg/m^2)§			0·003
Mean	22·3	25·4	
SD	4·8	4·9	
Age (years)‖			0·021
Mean	25	22	
SD	7	6	
Maternal age category (%)			0·184
$<$ 19 years	24·5	39	
20–24 years	24	26	
25–34 years	40	28	
$>$ 34 years	11·5	7	
Recipients of food support (%)			0·077
Yes	71	84	
No	29	16	
Educational attainment (%)			0·222
Five GCSE passes or more	75	66	
No qualification¶	25	34	
Self-reported smoking status (%)			0·137
Non-smoker	49	56	
Current smoker	51	44	
Pre-conceptional folic acid supplementation (%)			0·901
Yes	8	8	
No	92	92	
Post-conceptional folic acid supplementation (%)			0·077
Yes	71	84	
No	29	16	
Pregnancy planning (%)			0·181
Yes	34	26	
No	66	71	
Feeding practices 4 weeks postpartum (%)	30	20	0·186

GCSE, General Certificate of Secondary Education (a general educational examination taken at age 16 years).
* As tested by independent-sample *t* test for anthropometrical variables and by χ^2 test for categorical variables (two-tailed).
† WFS, *n* 60; HS, *n* 48.
‡ WFS, *n* 59; HS, *n* 52.
§ WFS, *n* 59; HS, *n* 48.
‖ WFS, *n* 78; HS, *n* 61.
¶ Includes current students, no qualifications.

Significantly more HS pregnant women than WFS subjects met the estimated average requirements for energy and the recommended nutrient intakes for Ca, Fe, folate and vitamin C (Table 5). Significantly, more lactating HS postpartum women than WFS subjects met the recommended nutrient intakes for Fe. More non-lactating HS postpartum women than WFS subjects met the recommended nutrient intakes for Ca, Fe and vitamin C (Table 6).

Pregnant HS women consumed a mean of 3·3 portions of fruit and vegetables per d compared with 2·5 for WFS women ($P=0·004$) and 15 % of pregnant HS women met the recommended 'five a day' compared with 2·4 % of the WFS women (Table 7). Postpartum HS women consumed a mean of 3·3 portions of fruit and vegetables per d compared with 2·7 for WFS women ($P=0·023$) and 19 % of pregnant HS women met the recommended 'five a day' compared with 11·5 % of the WFS women ($P=0·262$) (Table 8).

Comparisons of the mean frequencies of consumption of selected food items are presented in Table 9. For most food items examined, the distribution of mean weekly intakes tended to be higher for the HS groups. Not all differences were statistically significant.

Table 3. Crude daily intakes for selected nutrient intakes of pregnant participants under the Welfare Food Scheme (WFS; *n* 83) and the Healthy Start (HS) scheme (*n* 87) based on the food-frequency questionnaires

(Mean values, standard deviations and 95 % confidence intervals of the difference)

	WFS		HS			
Nutrient	Mean	SD	Mean	SD	95 % CI	*P**
Energy (MJ)	7·8	2·1	10·4	2·8	3·2, 1·7	0·0001
Protein (g)	59	17	85	28	34, 19	0·0001
Total fat (g)	77	23	105	31	37, 18	0·0001
Carbohydrate (g)	253	82	320	101	95, 39	0·0001
Fibre (g)	17	5·4	23	11	−8, −3	0·001
Ca (mg)	720	276	1144	386	−526, −322	0·0001
Fe (mg)	9·6	3·3	15	8·5	−7, −3	0·0001
Zn (mg)	6·4	2·1	9·6	3·7	−4, −2	0·0001
Total folate (μg)	217	76	306	124	−121, −59	0·0001
Vitamin C (mg)	66	32	88	47	−34, −9·5	0·001
Alcohol (g)	0·72	2·3	0·73	2·1	−0·69, 0·68	0·658

* As tested by the Mann–Whitney *U* test (two-tailed).

Discussion

The study presented here is an assessment of the early effects of the introduction of 'HS' on the dietary intakes and eating patterns of pregnant and postpartum low-income women.

About half of all pregnancies in the UK are unplanned which limits the usefulness of periconceptional supplements in reducing the risk of neural tube defects[12]. Results from the present study showed that about 50 % of both WFS and HS women planned their pregnancies and far fewer women took periconceptional folic acid supplements. None of the pregnant or postpartum HS group had been supplied with HS supplements which contain 400 mcg of folic acid. A recent national survey found that 40 % of low-income women aged 19 years and over were current smokers which are consistent with other surveys[13]. A similar proportion of smokers (50 %) was reported in the present study population. About one-third of both WFS and HS women had gained five or more General Certificate of Secondary Education (GCSE) passes, and there was no statistical difference in parity between the pregnant WFS and HS women.

The nutritional findings reported here suggest that pregnant and postpartum women under the new HS scheme had increased energy, Fe, Ca, folate and vitamin C intakes compared with pregnant and postpartum women under the WFS scheme. These observed differences between WFS and HS women remained significant after controlling for the potential confounding effect of known factors such as education and age and can be attributed to an increased frequency of consumption of FFQ food items by HS women. In other words, it appears that these differences are because the HS women were simply eating more. HS pregnant women consumed a mean of 2·6 MJ/d and HS postpartum women a mean of 1·7 MJ/d more than WFS women. The source of these increased energy intakes was primarily increased milk consumption, but also higher mean frequencies of consumption of chocolate bars, cakes and buns, puddings, cheese, sausages and burgers, and crisps.

HS pregnant and postpartum participants had significantly higher Ca intakes than WFS women primarily due to increased milk consumption, either as milk drunk on its own, on breakfast cereals, or as milky drinks. HS pregnant and postpartum

Table 4. Crude daily intakes for selected nutrient intakes of postpartum participants under the Welfare Food Scheme (WFS; *n* 80) and the Healthy Start (HS) scheme (*n* 62) based on the food-frequency questionnaires

(Mean values, standard deviations and 95 % confidence intervals of the difference)

	WFS		HS			
Nutrient	Mean	SD	Mean	SD	95 % CI	*P**
Energy (MJ)	8·0	2·1	9·7	2·9	3·0, 0·79	0·001
Protein (g)	66	19	78	25	−19, −5	0·002
Total fat (g)	82	26	101	31	−28, −9	0·0001
Carbohydrate (g)	239	66	292	106	−82, −24	0·006
Fibre (g)	12	4	15	7	−4·7, −1	0·011
Ca (mg)	768	284	1027	423	−376, −141	0·0001
Fe (mg)	9·7	3	12·6	5·5	−4·4, −1·4	0·003
Zn (mg)	6·9	2·2	8·8	3·2	−2·8, −0·9	0·001
Total folate (μg)	228	71	271	101	−72, −14	0·023
Vitamin C (mg)	62	30	89	42	−40, −16	0·001
Alcohol (g)	3·7	9	0·81	2·5	−56, −5	0·013

* As tested by the Mann–Whitney *U* test (two-tailed).

Table 5. Estimated average requirements (EAR) for energy and recommended nutrient intakes (RNI) of selected nutrients and proportion of pregnant participants under the Welfare Food Scheme (WFS; *n* 83) and the Healthy Start (HS) scheme (*n* 87) meeting the recommendations*

	RNI	% WFS	% HS	*P*†
Energy EAR				
MJ	8·12	44	79	0·0001
kcal	1940			
Ca (mg)	700	52	88	0·0001
Fe (mg)	14·8	63	83	0·003
Folate (μg)	300	16	46	0·001
Vitamin C (mg)	50	61	78	0·017

* The EAR and RNI shown in the Table are those for women aged 19–50 years with the addition where appropriate of an increment for pregnancy.
† As tested by the χ^2 test at the $P<0.05$ level (two-tailed).

Table 7. Portions of fruit and vegetables consumed per d by pregnant Welfare Food Scheme (WFS; *n* 83) and Healthy Start (HS) scheme (*n* 87) women based on the food-frequency questionnaires

	WFS	HS	*P*
Number of portions per d (%)			0·045*
Less than one	12	10·3	
One	8·6	8	
Two	31	17·2	
Three	29	32·2	
Four	17	17·2	
Five or more	2·4	15	
Mean no. of portions consumed	2·5	3·3	0·004†

* As tested by χ^2 test (two-tailed).
† As tested by the Mann–Whitney *U* test (two-tailed).

participants had significantly higher Fe intakes than WFS women and were eating more meat, poultry, other fish and breakfast cereals. HS pregnant and postpartum women had significantly higher folate intakes than WFS women because of an increased intake of vegetables, fruit, fruit juice and breakfast cereals. HS pregnant and postpartum participants had significantly higher vitamin C intakes than WFS women because they consumed more fruit, fruit juice and vegetables. HS women were more likely to meet the daily target of five portions of fruit and vegetables per d. It should be noted, however, that in both pregnant and postpartum WFS and HS women, a significant proportion of participants did not meet the recommended intake for Fe and folate and to a lesser extent for Ca and vitamin C.

Study limitations

The new HS food-support programme was introduced nationwide to a fixed timetable and there was no opportunity to perform any type of randomised controlled study or include any prospective design for equivalent comparison groups. In this knowledge we conducted a 'before-and-after' cross-sectional study. ANOVA by regression was used to control for as many confounding factors as possible that might be related to dietary intake and eating patterns. Although this type of study is useful for understanding broad trends and highlighting possible relationships for further exploration, it does not account for potential selection bias and only observes individuals at one point in time, and so is limited in drawing causal conclusions. Suggestibility by interviewers has been raised as a potential source of bias in interviewer-administered questionnaires. This risk of bias was substantially eliminated in the present study because the interviewers were well trained and the questionnaire was piloted and preliminary findings discussed by the nutrition research team beforehand.

It is likely that a more comprehensive picture of the women's diets and therefore of the effect of the introduction of HS on their dietary intakes and behaviours might have been achieved by using a more precise dietary assessment methodology, to determine absolute intakes or by the use of biochemical markers. Other dietary assessment methods, however, are less practical and easy to use. For example, weighed food records, which are considered to be the gold standard of dietary assessment methodologies and provide a more precise estimation of an individual's actual nutrient intake, are associated with a large respondent burden, low response rate and may impact on usual food consumption(14). The use of biomarkers is limited in epidemiological studies because of high cost and low practicality(15). Our previous research has shown that FFQ give useful estimates of nutrient intakes in pregnant women and the FFQ is a valid tool compared with 24 h recalls, for most nutrients examined(7).

The authors did not consider it appropriate to adjust for energy intake, because this might have masked the main outcome of the present study which refers to alterations in energy intakes. In addition, as stated in Willet (1998), 'It is also possible that overeating or under eating is a primary cause of

Table 6. Estimated average requirements (EAR) for energy and recommended nutrient intakes (RNI) of selected nutrients and proportion of postpartum lactating and not-lactating women meeting the recommendations*

	RNI for lactating women	% LWFS (*n* 24)	% LHS (*n* 12)	*P*†	RNI for non-lactating women	% NLWFS (*n* 56)	% NLHS (*n* 50)	*P*†
Energy EAR								
MJ	10	18	42	0·138	8·12	50	61	0·291
kcal	2390				1940			
Ca (mg)	1250	13	42	0·056	700	49	80	0·001
Fe (mg)	14·8	0	46	0·001	14·8	5·5	20	0·026
Folate (μg)	260	39	58	0·279	200	62	76	0·134
Vitamin C (mg)	70	48	68	0·288	40	71	94	0·002

LWFS, lactating Welfare Food Scheme; LHS, lactating Healthy Start; NLWFS, not-lactating Welfare Food Scheme; NLHS, not-lactating Healthy Start.
* The EAR and RNI shown in the Table are those for women aged 19–50 years with the addition where appropriate of an increment for lactation.
† As tested by χ^2 test (two-tailed).

Table 8. Portions of fruit and vegetables consumed per d of postpartum Welfare Food Scheme (WFS; *n* 80) and Healthy Start (HS) scheme (*n* 62) women based on the food-frequency questionnaires

	WFS	HS	*P*
Number of portions per d (%)			0·262*
Less than one	9	13	
One	7·5	3	
Two	36	21	
Three	19	23	
Four	17	21·0	
Five or more	11·5	19·0	
Mean no. of portions consumed	2·7	3·3	0·023†

* As tested by χ^2 test (two-tailed).
† As tested by the Mann–Whitney *U* test (two-tailed).

differences observed. It could be argued that adjustment for caloric intake in this situation would represent over control of a variable in the causal pathway'[16].

It is difficult to compare our findings with those of others because of differing dietary intake methodologies, age categories, socio-economic status and the studies of populations that were neither pregnant nor breast-feeding. The recent Low Income Diet and Nutrition Survey[17] conducted by the Food Standards Agency failed to find either malnourishment or evidence that poor individuals are forced into unhealthy diets compared with the population as a whole. Individuals in low-income households were less likely to consume wholemeal bread and vegetables, both of which make a significant contribution to nutrient and dietary fibre intakes. Additionally, 39 % of individuals from low-income groups reported that they worry about having enough food to eat before they receive money to buy more, i.e. food insecurity. Similarly, about a third reported that they cannot afford to eat balanced meals. Overall, one-fifth of adults in low-income groups reported reducing the size of, or skipping, meals. Also, 5 % reported that, occasionally, they did not eat for a whole day because of insufficient money to buy food[17].

The Low Income Diet and Nutrition Survey also showed that women had a mean intake of 2·5 portions of fruit and vegetables per d and only 9 % of women met the 'five-a-day' target. In the present study, 15 % of the HS pregnant and 19 % of the postpartum HS women met the target compared with 2·4 and 11·5 % of the WFS women. Individuals on low incomes eat more fat spreads and oils, pizza, processed meat and full-fat milk. These foods were widely eaten by all the women in the Sheffield study but in greater amounts by the HS women. The Low Income Diet and Nutrition Survey raised concerns about lower reported energy intakes in poorer households despite higher levels of obesity. Pregnancy leads to a modest increase of energy needs in the order of 0·37, 1·19 and 1·94 MJ/d for the first, second and third trimesters of pregnancy, respectively[18,19]. Well-nourished lactating women have a net increase of energy needs in the order of 1·88 MJ/d above the energy requirements of non-pregnant, non-lactating women. These added energy needs can normally be met by a modest increase in consumption of a balanced diet. There is no indication that recommendations for dietary total fat intake, expressed as a percentage of energy intake, need to differ in pregnancy and lactation from those for non-pregnant, non-lactating women[18,19].

Table 9. Estimated mean weekly frequency of consumption (portions/week) for selected food items of the FFQ for pregnant and postpartum Welfare Food Scheme (WFS) and Healthy Start (HS) scheme participants

	Pregnant			Postpartum		
Food item	WFS (*n* 83)	HS (*n* 87)	*P**	WFS (*n* 80)	HS (*n* 62)	*P**
Pies, pastries	0·78	1·22	0·025	1·50	1·20	0·203
Sausages, burgers	1·02	1·27	0·213	1·15	1·31	0·482
Poultry	2·02	2·35	0·172	1·98	2·23	0·356
Meat (beef, lamb, pork, ham, bacon, etc)	2·12	2·51	0·090	2·15	2·61	0·154
Other fish (for example, tuna, salmon)	0·46	1·02	0·007	0·71	0·82	0·639
Roast potatoes	1·39	1·87	0·014	1·99	1·83	0·511
Boiled, mashed, jacket potatoes	2·21	2·58	0·094	2·91	2·72	0·568
Chips (oven, homemade, fries)	2·89	2·47	0·162	2·19	3·09	0·018
Crisps	3·21	3·33	0·720	3·53	5·07	0·048
Cheese	2·51	2·58	0·294	2·81	3·83	0·060
Pasta (for example, spaghetti, pot noodles, lasagna)	1·60	1·81	0·387	2·10	1·73	0·285
Green leafy vegetables (for example, cabbage)	1·53	1·60	0·761	1·63	2·01	0·130
Other green vegetables (for example, cauliflower, runner beans)	1·56	1·65	0·701	2·15	2·25	0·708
Carrots	1·96	2·29	0·154	2·78	2·66	0·789
Fresh fruit	3·43	3·46	0·917	3·47	6·57	0·001
Fruit drinks from concentrate	3·59	4·00	0·219	6·30	10·09	0·001
Fruit juice (not from concentrate)	2·77	2·97	0·546	2·15	4·99	0·001
Other cereals (for example, Cornflakes, Rice Crispies)	2·21	2·78	0·112	2·11	2·48	0·526
Wholegrain or bran cereals, (i.e. Weetabix, All Bran)	1·42	1·85	0·189	1·65	2·49	0·143
Cakes or buns	1·39	1·70	0·268	1·78	2·56	0·120
Chocolate bars	1·67	1·74	0·828	1·22	2·49	0·004
Biscuits (for example, digestive, rich tea, chocolate)	2·05	2·01	0·906	2·56	4·21	0·023
Puddings (for example, custard, milk pudding, yogurt)	1·33	1·71	0·178	1·61	2·55	0·061
Milk in breakfast cereals	3·40	4·21	0·018	3·28	5·86	0·001
Milk on its own	2·33	3·15	0·019	2·36	4·99	0·001
Milk in milky drinks	0·74	1·41	0·013	0·60	1·72	0·014

* As tested by the Mann–Whitney *U* test (two-tailed).

NS British Journal of Nutrition

Concern has been raised recently that obesity is a by-product of food-support programmes such as Women, Infants, and Children (WIC) and food stamps that enable participants to consume more food than they otherwise would. A meta-analysis of food-support programmes in the USA showed that non-elderly adult women, who account for 28 % of the caseload, are the only group of food-support recipients for whom multiple studies show a link between food-support receipt and an elevated BMI and obesity. According to these studies, food-support participation over a 1- or 2-year period increased the probability of a woman becoming obese by 2 to 5 percentage points and may lead to a 0·5-point increase in BMI, or about 1·4 kg for a woman 165 to 170 cm tall[20].

Meaning of the study

Designing supplemental food packages that optimise the potential benefit for long-term health poses mixed challenges. Problems of malnutrition for energy and essential nutrients must be addressed in the context of the current high prevalence of overweight and obesity in the UK. Health professionals advising women in their care about food-support schemes should have sufficient nutritional skills to competently advise them about the foods to include to improve nutrient intakes and also in compensation which foods should be excluded, to reduce the risk of excess energy intakes. Some of these issues have been addressed in recommendations in the recent Maternal and Child Nutrition guidance[21] on improving the nutrition of pregnant and breast-feeding mothers and children in low-income households.

One of the biggest challenges when trying to improve the diets of women, children and families is how to help them change their behaviour (rather than just their knowledge and attitudes). Maternal and Child Nutrition guidance recommends that a multidisciplinary approach (involving and supporting the families themselves and the wider community) is the most effective option. It is important that advisers adopt a non-judgmental, informal and individual approach based on advice about food (rather than just nutrients). Three recent models that could be adapted for promoting dietary change are health trainers/community volunteers for health, breast-feeding peer supporters[21] and the food competencies framework[22].

The present study showed that women did not take periconceptional folic acid supplements and were deficient in dietary folate and vitamin C. HS vitamins are designed to address these deficiencies but must be widely available. The recent Maternal and Child Nutrition guidance[21] has some key recommendations in this area for primary care trusts, health professionals, commissioners and community pharmacists.

Conclusion

A limited number of nutritional interventions targeting low-income women in the UK with dietary and health outcomes have been reported and despite the limitations of the present study design, this is the only research with data on maternal and infant feeding practices before and after the introduction of HS. These findings are based on preliminary results and only short-term effects are reported. There are still a number of unanswered questions though and analysis of other priority outcomes, such as gestational weight gain, postpartum weight retention or loss, breast-feeding rates, infant feeding practices, reasons why distribution of HS vitamins is problematic, women's practical cooking skills and nutrition training for health professionals who give dietary advice, would allow a more comprehensive picture of the effectiveness of the new scheme. The present study showed that because pregnant and postpartum HS women increased their food consumption, a larger proportion of them than the earlier WFS scheme met the recommended intakes for Ca, folate, Fe and vitamin C and energy intakes were increased.

Acknowledgements

We would like to thank all the participants in the study. We would like to acknowledge the guidance of Jean M. Russell MA MSc FSS, Computer Officer/Statistician, University of Sheffield and Stephen Walters BSc, PGCE, MSc, PhD, CStat, Reader in Medical Statistics, University of Sheffield. We would like to thank Rebecca Roberts, Jo Pearce, Antony Renshaw, Kate Percival, Stephanie Parker, Fazeelat Akhtar, Catherine Cliff and Helen Nicholson, assistant researchers at the University of Sheffield.

The research on which this paper is based was funded by a programme grant from The Leverhulme Trust (award number F/00 118/AQ).

F. A. F., T. M. and R. B. F. designed the study. F. A. F., T. M. and S. E. W. carried out the study. T. M. analysed the data. F. A. F. and T. M. wrote the paper, which was critically read by all the authors. All authors contributed to the interpretation of the data and approved the final version.

The authors have no conflicts of interest.

References

1. Acheson D (1998) *Independent Inquiry into Inequalities in Health: Report*. London: The Stationery Office.
2. Department of Health (2003) *Tackling Health Inequalities: A Programme for Action*. London: Department of Health.
3. Department of Health (2002) *Healthy Start. Proposals for Reform of the Welfare Food Scheme*. London: Department of Health.
4. Department of Health (2004) *Choosing Health: Making Healthier Choices Easier*. London: The Stationery Office.
5. Noble M, Wright G, Dibben C, *et al.* (2004) *Indices of Deprivation 2004. Report to the Office of the Deputy Prime Minister*. London: Neighbourhood Renewal Unit.
6. Rogers I & Emmett P (1998) Diet during pregnancy in a population of pregnant women in South West England. ALSPAC Study Team. Avon Longitudinal Study of Pregnancy and Childhood. *Eur J Clin Nutr* **52**, 246–250.
7. Mouratidou T, Ford F & Fraser R (2006) Validation of a food-frequency questionnaire for use in pregnancy. *Public Health Nutr* **9**, 515–522.
8. Wei EK, Gardner J, Field AE, *et al.* (1999) Validity of a food frequency questionnaire in assessing nutrient intakes of low-income pregnant women. *Matern Child Health J* **3**, 241–246.
9. Suitor CJ, Gardner J & Willett W (1989) A comparison of food frequency and diet recall methods in studies of nutrient intake of low-income pregnant women. *J Am Diet Assoc* **89**, 1786–1794.
10. Goldberg GR, Black AE, Jebb SA, *et al.* (1991) Critical evaluation of energy intake data using fundamental principles of

energy physiology: 1. Derivation of cut-off limits to identify underreporting. *Eur J Clin Nutr* **45**, 569–581.
11. Schofield WN (1985) Predicting basal metabolic rate, new standards and review of previous work. *Hum Nutr Clin Nutr* **39**C, 5–41.
12. Botting B (2001) Trends in neural tube defects. *Health Stat Q* **10**, 5–12.
13. Department of Health (2005) *Delivering Choosing Health: Making Healthier Choices Easier*. London: Department of Health.
14. Willet W (2001) Invited Commentary: a further look at dietary questionnaire validation. *Am J Epidemiol* **154**, 1100–1102.
15. Gibney MJ, Margetts BM, Kearney JM, *et al.* (2004) *Public Health Nutrition*, 1st ed. London: Blackwell Publishing.
16. Willet W (1998) *Nutritional Epidemiology*, 2nd ed. New York: Oxford University Press.
17. Nelson M, Erens B, Bates B, *et al.* (2007) *Low Income Diet and Nutrition Survey*, Volumes 1–3. London: The Stationery Office.
18. Prentice AM & Goldberg GR (2000) Energy adaptations in human pregnancy: limits and long-term consequences. *Am J Clin Nutr* **71**, Suppl. 5, 1226S–1232S.
19. Butte NF & King JC (2005) Energy requirements during pregnancy and lactation. *Public Health Nutr* **8**, 1010–1027.
20. Ver Ploeg M & Ralston K (2008) *Food Stamps and Obesity: What Do We Know?* EIB-34. Washington, DC: US Department of Agriculture, Economic Research Service.
21. National Institute for Health and Clinical Excellence (2008) *Improving the Nutrition of Pregnant and Breastfeeding Mothers and Children in Low-Income Households*. Public Health Guidance no. 11. London: National Institute for Health and Clinical Excellence.
22. Food Standards Agency (2007) Food Competency framework: food skills and knowledge for children and young people aged 7–9, 11–12, 14 and 16+. http://www.food.gov.uk/multimedia/pdfs/competencyria.pdf

NS British Journal of Nutrition