

Women's compliance with nutrition and lifestyle recommendations before pregnancy: general population cohort study

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ABSTRACT

Objective To examine the extent to which women planning a pregnancy comply with recommendations for nutrition and lifestyle.

Design Prospective cohort study.

Setting Southampton, United Kingdom.

Participants 12 445 non-pregnant women aged 20-34 recruited to the Southampton Women's Survey through general practices, 238 of whom became pregnant within three months of being interviewed.

Main outcome measures Folic acid supplement intake, alcohol consumption, smoking, diet, and physical activity before pregnancy.

Results The 238 women who became pregnant within three months of the interview were only marginally more likely to comply with recommendations for those planning a pregnancy than those who did not become pregnant in this period. Among those who became pregnant, 2.9% (95% confidence interval 1.2% to 6.0%) were taking 400 µg or more of folic acid supplements a day and drinking four or fewer units of alcohol a week, compared with 0.66% (0.52% to 0.82%) of those who did not become pregnant. 74% of those who became pregnant were non-smokers compared with 69% of those who did not become pregnant ($P=0.08$). Women in both groups were equally likely to consume five or more portions of fruit and vegetables a day (53% in each group, $P=1.0$), but only 57% of those who became pregnant had taken any strenuous exercise in the past three months compared with 64% in those who did not become pregnant ($P=0.03$).

Conclusion Only a small proportion of women planning a pregnancy follow the recommendations for nutrition and lifestyle. Greater publicity for the recommendations is needed, but as many pregnancies are unplanned, improved nutrition and lifestyles of women of childbearing age is also required.

INTRODUCTION

Advice on nutrition and lifestyle during pregnancy is widely available from health practitioners, the internet,¹⁻⁴ magazines, and other publications. Much less

emphasis is on advice for women who are planning a pregnancy.

Impaired fetal development and poor growth in infancy have been associated with increased risks of coronary heart disease, stroke, type 2 diabetes mellitus, the metabolic syndrome, and osteoporosis in later life.⁵ In recent years there has been increasing focus on optimising women's nutrition and lifestyle in the periconceptual period, as this is a key time for fetal development.⁶ For example, clinical trials have shown that folic acid supplementation during the periconceptual period reduces the risk of neural tube defects.⁷ Women are, however, often unaware that they are pregnant for the first few weeks of embryonic life, and any subsequent changes miss the periconceptual period. Therefore promoting good health and nutrition before pregnancy may be at least as important as during pregnancy.

Recently the National Institute for Health and Clinical Excellence has reinforced this focus on the periconceptual period. Its guidance on nutrition of mothers and children⁸ not only advises improving the nutrition of pregnant women but also includes recommendations for those who may become pregnant. Indeed a review commissioned by the National Institute for Health and Clinical Excellence focused exclusively on interventions to improve the nutrition of women during the periconceptual period.⁹

Arguably the best known recommendation for women who are planning a pregnancy is to take 400 µg of folic acid a day in supplements to prevent neural tube defects.¹⁰ Until recently women planning a pregnancy in the United Kingdom were encouraged to limit alcohol consumption to one or two units, once or twice a week. In 2007 the advice was modified to urge women to avoid alcohol altogether or at most to consume one or two units (8-16 g of alcohol), once or twice a week.¹⁻⁴ Additional advice is the same as for the general population, encouraging women to eat a healthy diet, take exercise, and avoid smoking.

Table 1 Characteristics of women who did or did not become pregnant within three months of being interviewed. Values are numbers (percentages) unless stated otherwise

Variables	Not pregnant within 3 months	Pregnant within 3 months
Study sample	12 207 (98)	238 (2)
Median (interquartile range) age (years)	28.5 (24.7-31.8)	28.9 (25.6-31.3)
Highest educational qualification:		
None	706 (6)	7 (3)
GCSE grades D-G	1345 (11)	31 (13)
GCSE grades A*-C	3217 (26)	65 (27)
A levels	3629 (30)	70 (29)
Higher national diploma or equivalent	699 (6)	16 (7)
University degree or above	2547 (21)	49 (21)
In receipt of social security benefits	2163 (18)	29 (12)
Median (interquartile range) height (cm)	163 (159-167)	163 (159-167)
Median (interquartile range) body mass index (kg/m ²)	24.1 (21.8-27.5)	24.3 (21.8-28.9)

Despite the information available for women planning a pregnancy, data are limited on how closely the recommendations are followed. Various surveys have asked pregnant women or those who have recently delivered a baby about their lifestyle and folic acid intake around conception.¹¹⁻²⁷ However, the information obtained in this way is subject to recall bias. To our knowledge no studies have assessed women drawn from the general population when they were not pregnant and followed to pregnancy and beyond.

Studies have shown that the median time to conception in those planning a pregnancy is two to three months.²⁸⁻³¹ Using the Southampton Women's Survey,³² we examined the nutrition and lifestyle of interviewed women during the three months before they became pregnant and compared them with participants who were not pregnant during that period. We assessed the extent to which women comply with the recommendations for nutrition and lifestyle leading up to pregnancy.

METHODS

Between 1998 and 2002, 12 583 women aged 20-34 and living in Southampton were recruited to the Southampton Women's Survey and interviewed in their homes by research nurses. Women were recruited through their general practices. The full details are published elsewhere.³² The focus of the study was to examine the factors operating before and during pregnancy on the growth and development of the fetus, infant, and child. Non-pregnant women were recruited and information recorded on their diet, physical activity, smoking, alcohol consumption, and use of nutritional supplements over the preceding three months. Diet was assessed using a 100 item food frequency questionnaire,³³ from which principal components analysis was used to derive a "prudent" diet score.³⁴ High scores reflect diets in line with the healthy eating recommendations, characterised by high intakes of fruit, vegetables, wholemeal bread, rice, and pasta and low intakes of white bread, added sugar, and tinned vegetables. We derived the number of

portions of fruit and vegetables consumed daily from the food frequency questionnaire. The women were asked about the brands of dietary supplements used, the amount taken daily, and how many days each supplement had been taken over the past three months. From these reported intakes, we derived the amount of folic acid taken in nutritional supplements over the three months before the interview and identified those women who reported taking 400 µg or more of folic acid a day. Given that some women may only have started taking folic acid recently and that the required amount may have been taken on most but not all days, we also classified women according to whether or not they averaged an intake of 200 µg or more folic acid a day over the previous three months.

When the women became pregnant they attended Southampton's Princess Anne Maternity Hospital for fetal ultrasonography at 11, 19, and 34 weeks' gestation. We collected data on menstruation and ultrasonography from the women early in pregnancy³² and estimated the date the pregnancy started using an algorithm that combined these data. For the main analyses we compared women who became pregnant within three months with those who did not. We did a similar analysis for women who became pregnant within one month of the interview, to see if those close to pregnancy at the interview were more likely to conform to the recommendations. Our data also enabled us to identify a further group of women who became pregnant 30 to 60 months after the interview to assess whether their lifestyles were more similar to the general population or to the group who became pregnant within three months.

Statistical analysis

We compared proportions using χ^2 tests and, when appropriate, Fisher's exact tests, and we derived exact binomial confidence intervals. To compare continuous variables we used *t* tests, with skewed data being transformed using a logarithmic transformation before analysis.

RESULTS

Thirty two of the 12 583 women interviewed were outside the age range 20-34 and were therefore excluded. A further 106 women were excluded as calculations showed that they were already pregnant at the time of the interview. Data on 12 445 women were thus available for analysis. Of these women, 238 became pregnant within three months of the interview.

Table 1 shows the personal characteristics of the women who did and did not become pregnant within three months. The only significant difference between the groups was the percentage in receipt of social security benefits: 12% of those who became pregnant and 18% of those who did not ($P=0.03$).

Table 2 summarises the ways in which the women conformed to both the general healthy lifestyle guidelines and the specific recommendations for those planning a pregnancy. The women who became pregnant within three months of the interview were

slightly less likely to be smoking than those women who did not become pregnant (74% *v* 69% were non-smokers), but the difference did not reach statistical significance ($P=0.08$). They were, however, less likely to have taken any strenuous exercise in the three months before the interview ($P=0.03$). Their diets were marginally more healthy but the effect was small, and in both groups 53% of women reported consuming five or more portions of fruit and vegetables a day, as derived from the food frequency questionnaire.

Those women who became pregnant within three months consumed a median 4.0 units of alcohol a week, which corresponds to the upper limit recommended for women planning a pregnancy; for those who did not become pregnant the median was slightly higher at 4.8 units a week. The data were, however, strongly positively skewed, and some women reported high levels of alcohol consumption. As other reports quote means rather than medians, table 2 also shows mean intakes. Proportionally, more women who became pregnant consumed 14 units or less of alcohol a week compared with those who did not become pregnant (85% *v* 80%), and this difference was of borderline significance. Among those consuming alcohol at the higher levels of more than 14 units a week, reported units consumed weekly differed little between those who did and did not become pregnant, with a median of 22 units a week in both groups.

Significant differences were seen in the expected direction between the groups for amount of alcohol

consumed on average and intake of folic acid from supplements. However, only 44% of the women who became pregnant had taken any folic acid supplements in the three months before the interview and only 5.5% had taken 400 μg or more a day. At 11 weeks' gestation, 203 of the 238 women were interviewed and by this time 93% were taking some folic acid and 12% reported taking 400 μg or more a day over the preceding three months.

Although the difference between the two groups was highly significant for conforming to the two specific recommendations on alcohol and folic acid intake before pregnancy, the actual differences were small. Only seven of the 238 women (2.9%) who became pregnant were following these recommendations fully at the time of being interviewed, compared with 0.66% of those who did not become pregnant. Thus women who became pregnant were 4.5 times more likely to follow the recommendations than those who did not (relative risk 4.5, 95% confidence interval 2.1 to 9.6), with an absolute difference in risk of 2.3% (95% confidence interval 1.2% to 3.4%).

Only two of the 71 women (2.8%) who became pregnant within one month of the interview reported complying with the recommendations on alcohol and folic acid intake at the time of the interview. Forty eight per cent were taking some folic acid, but this figure is only marginally higher than the 44% among the larger group of those who became pregnant within three months of the interview.

At interview, 55 (23%) of the 238 women who became pregnant within three months of the interview had said that they did not anticipate trying for a baby in the next 12 months. Among this "unplanned" pregnancy group only one woman (1.8%) who became pregnant within three months complied with the recommendations for alcohol and folic acid, but among the remainder, who were in some sense planning a pregnancy, the percentage was only slightly higher at 3.3% ($n=6$). Nonetheless, 48% of women who planned a pregnancy were taking some folic acid at the time of the interview compared with 29% among those in the unplanned pregnancy group ($P=0.013$).

An analysis of 263 women who became pregnant at 30 to 60 months after the interview showed that they were more similar to all women in the population than to those who became pregnant within three months of the interview. Sixty three (24%) of these women were taking some folic acid in supplements at the time of the interview. This is closer to the overall percentage of 26% (difference $P=0.5$) seen among all women who did not become pregnant within three months, than the 44% ($P<0.001$) among those who did become pregnant in that time. This indicates that some women do alter their behaviours, albeit slightly, in the immediate few months before pregnancy, although the proportion of women is small.

DISCUSSION

Few women succeed in complying with the nutrition and lifestyle recommendations for planning a

Table 2 | Compliance with general healthy lifestyle recommendations and specific pre-pregnancy recommendations in women who did or did not become pregnant within three months of being interviewed. Values are percentages (95% confidence intervals) unless stated otherwise

Variables	Not pregnant within 3 months (n=12 207)	Pregnant within 3 months (n=238)
General healthy lifestyle recommendations		
Not smoking	69 (68 to 70)	74 (68 to 80)
Healthy eating:		
Mean (95% CI) prudent diet score (SD)	0.00 (-0.02 to 0.02)	0.07 (-0.06 to 0.19)
Consumes ≥ 5 portions of fruit and vegetables daily	53 (52 to 54)	53 (46 to 59)
Any strenuous activity in past 3 months*	64 (63 to 65)	57 (50 to 63)
Specific pre-pregnancy recommendations		
Alcohol intake:		
Median (interquartile range) units consumed per week†	4.8 (1.3-12.0)	4.0 (1.0-9.5)
Mean (range) units consumed per week†	9.0 (0-251)	7.6 (0-92)
Never	10 (9.5 to 11)	7.6 (4.5 to 12)
≤ 4 units/week	46 (45 to 46)	51 (44 to 57)
≤ 14 units/week‡	80 (79 to 80)	85 (80 to 89)
Folic acid supplements in past 3 months:		
Any§	26 (25 to 26)	44 (37 to 50)
≥ 200 $\mu\text{g}/\text{day}$ §	4.4 (4.0 to 4.7)	19 (14 to 24)
≥ 400 $\mu\text{g}/\text{day}$ §	1.1 (0.91 to 1.3)	5.5 (2.9 to 9.2)
≤ 4 units alcohol per week and folic acid ≥ 400 $\mu\text{g}/\text{day}$ §	0.66 (0.52 to 0.82)	2.9 (1.2 to 6.0)

Comparisons are not statistically significant at 5% level unless stated otherwise.

* $P=0.03$.

† $P=0.007$ for differences among those drinking any alcohol.

‡ $P=0.049$.

§ $P<0.001$.

pregnancy; only 2.9% complied fully with the recommendations on alcohol and folic acid intake in the three months before becoming pregnant. Less than half the women who became pregnant within the three months of being interviewed were taking any folic acid supplements at the time of the interview. Although those who became pregnant within three months were slightly less likely to smoke and tended to eat a marginally more healthy diet, they were less likely to undertake strenuous exercise than those who did not become pregnant.

Comparison with other studies

Several studies asked women retrospectively about folic acid intake in the periconceptional period.¹¹⁻²⁷ Generally, fewer than half the women took any folic acid, comparable with our findings. In some studies less than 10% of women reported having taken folic acid.¹²⁻²¹ These studies are from a variety of countries, however, and the information provided to young women about preparing for pregnancy varies in content and detail.

Studies from Denmark and the United States have shown lower levels of alcohol consumption than found in our study. No alcohol consumption was reported by 28% of Danish couples currently planning a pregnancy,²⁰ and retrospectively reported by 12% of Danish women who had planned their pregnancy.³⁵ In women in the US who were asked in pregnancy or after the birth of their child around 50% reported drinking no alcohol in the months leading up to the pregnancy.¹³⁻¹⁴⁻¹⁷ These abstinence rates are higher than in our study, although it should be noted that alcohol consumption in the general population varies widely by country. In the British general household survey mean weekly intakes of about 8 units of alcohol have been reported for women aged 25-44³⁶ and these levels are more similar to those seen in our study, whether or not in the time leading up to pregnancy.

Strengths and weaknesses

The major strength of this study is that we obtained information about the women before they became pregnant. The women were asked about their lifestyles and diet as part of a general survey on health and were not influenced by their knowledge of whether they would become pregnant. Only at the end of the interview were they asked whether they anticipated planning a pregnancy in the next 12 months, so their pregnancy intentions should not have biased their answers. We believe that this is a unique study design in that all other studies have obtained information retrospectively and thus may be affected by recall bias, or they have focused specifically on women planning a pregnancy.

The Southampton Women's Survey is broadly representative of the general population of England and Wales except for a lower than average percentage of women from non-white ethnic groups.³² Some 75% of those women contacted agreed to take part, which is

a high participation rate for studies on a general population.

We may have missed some women who became pregnant within three months of the interview as they moved away from the area. However, the number of such women is likely to be small, and given the large number of women who did not become pregnant, they will hardly have distorted the figures in that group in any noticeable way.

A limitation is that we asked about lifestyles and alcohol and folic acid intakes over the three months before the interview. Some women may have started planning their pregnancy during that time window, or after they had been interviewed but before they became pregnant. It is thus possible that some women were better equipped for their pregnancy than our data reveal. However, among women who became pregnant within one month of the interview the increase in those conforming to the recommendations was marginal. Even among women who indicated that they might be contemplating a pregnancy the percentages conforming to the recommendations were low.

Interpretation and implications

Our study shows that few women follow the recommendations for those preparing for pregnancy. This is not surprising, as women do not know when they will conceive. Planning for an event that may or may not occur is far from easy. Among the women who became pregnant within three months, 23% answered no at interview when asked if they intended to become pregnant within the next 12 months. This proportion is lower than the true unplanned pregnancy rate, as many of those women we have classified as planning a pregnancy may not have planned to become pregnant within the three month time window, and so, according to definitions used in other studies, their pregnancy would have been unplanned. Estimates of unplanned or unintended pregnancies elsewhere vary from about one third to more than a half of pregnancies.¹⁸⁻³⁷⁻³⁸ Our rate of "unplanned" pregnancies cannot be compared directly with these other estimates because of the differences between definitions.

No amount of advice for planning a pregnancy will affect those who become pregnant unintentionally. Nonetheless, even for women who want to plan for pregnancy, the advice is not promoted widely. It is neither a high priority within the medical profession nor widely discussed in the media and among the general public. Thus it is not surprising that such a small proportion of women follow the advice.

In the period leading up to pregnancy the recommendations for smoking, exercise, and diet are similar to those for women in the general population. However, our data show that there are no significant improvements in compliance with the recommendations for smoking and diet among women in the time leading up to pregnancy. Those who became pregnant within three months of the interview were less likely to be taking strenuous exercise. This is hard to explain

WHAT IS ALREADY KNOWN ON THIS TOPIC

Nutrition and lifestyle guidelines are provided for women planning pregnancies, but whether these are followed is unclear

Data on the general population have been obtained after women have become pregnant or given birth, and are prone recall bias

WHAT THIS STUDY ADDS

Few women adhere to the nutrition and lifestyle recommendations for planning a pregnancy

Greater efforts are needed to improve compliance with the recommendations

unless women are influenced by perceptions about the risks of exercise in pregnancy.

Folic acid was taken in sufficient quantities by only a small percentage of women, and supplementation in the periconceptional period is considered important for the prevention of neural tube defects.¹⁰ However, folic acid intakes from supplements were higher among the women who became pregnant within three months of the interview than among those who did not. The comparison with women who became pregnant 30-60 months later indicates that our findings are not simply showing that women who are healthy enough to become pregnant at some time in the future follow health and lifestyle recommendations more closely. This is encouraging as it implies that messages about folic acid have reached some women and that they act on the advice. The percentages also increased in early pregnancy showing that considerably more women comply with the recommendations once they become pregnant. Nonetheless, women's intakes of folic acid supplements leading up to pregnancy generally fall far short of the recommendations.

In those who became pregnant within three months, median alcohol intakes before conception were slightly lower than in those women not planning a pregnancy. However, almost half of those who became pregnant within three months reported drinking at levels above the recommended limit for those planning a pregnancy that was in operation at the time of the study. Only 7.6% of those who became pregnant within three months were not drinking any alcohol at the time of the interview, and it is only these women who would comply fully with the current recommendations for alcohol intake. Women may not want to admit to trying for a pregnancy, and cutting alcohol out of their lifestyle could be difficult. Once pregnant, many women do report lower levels of alcohol consumption than before pregnancy³⁹ and so are aware of the recommendations for pregnant women. In a culture in which around a quarter of young women report drinking at levels that are in excess of 14 units a week (the maximum level recommended for women not planning a pregnancy),³⁶ a noticeable downwards shift in alcohol consumption in the general population would be required before levels of alcohol consumption in those planning a pregnancy are likely to reduce to previously recommended levels. Reducing intake to zero would be an even greater challenge.

In conclusion, our data show limited evidence of changes in health behaviours before pregnancy. Higher percentages of women conform to recommendations during pregnancy,³⁹ indicating that change in behaviour is possible. This may indicate that the prepregnancy recommendations are not publicised widely enough. Although this might be improved by greater publicity of the recommendations, substantial rates of unplanned pregnancies^{18 37 38} mean that greater efforts are needed to improve the nutrition and lifestyles in women of childbearing age.

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Contributors: HMI, KMG, SMR, and CC designed and ran the Southampton Women's Survey. HMI and SRC developed the idea for the analyses. HMI carried out the analyses. SEB and SMR interpreted the nutritional and dietary data. All authors discussed and interpreted the findings and contributed to the final report. HMI drafted the report and is guarantor.

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