

## Symposium on ‘Nutritional adaptation to pregnancy and lactation’

### Pregnancy as a time for dietary change?

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It is thought that nutrition during pregnancy plays a key role in the well-being of the mother and the newborn infant, and further influences health during childhood and adulthood. Pregnancy is a time of increased nutritional requirements, but many of these requirements will be met by adaptive physiological changes that occur during gestation, with little need to alter maternal dietary intake. A modest increment of food which provides 0.8 MJ/d (above prepregnant requirements) during the third trimester is considered adequate to meet the needs of fetal and maternal growth, and to satisfy the small increase in requirements of many macro- and micronutrients. However, requirements for vitamin D and folic acid increase substantially, and should be met primarily by supplementation. Food selection may also be altered to avoid a range of food-borne diseases and toxic constituents. There are a number of psycho-social reasons why pregnancy might be considered a good time for promoting changes in dietary behaviour for the health of the wider family. However, pregnancy may be a bad time to promote dietary change if it is perceived to involve slimming, if nutritional requirements are greatest before pregnancy, or if dietary changes made are harmful. There is little evidence to support educational interventions as successful at changing dietary behaviour during pregnancy. Pregnancy may be best viewed as an opportunity for maintaining good dietary selections and for building knowledge for future action, and should not be seen as the only opportunity for promoting dietary change within the life course.

#### Pregnancy: Dietary behaviour: Maternal nutrition

Adequate nutrition during pregnancy is important to enable the fetus to grow and develop physically and mentally to full potential. It is widely believed that fetal nutrition plays a key role in the well-being of the newborn infant, and further influences health during childhood and adulthood, with possible effects into the next generation (Hales *et al.* 1991; Barker, 1992; Law *et al.* 1995). Maternal nutrition may also be a key factor influencing the health of women during pregnancy and adult life. During pregnancy, women need to avoid food hazards, maintain a healthy immune system and avoid inappropriate anaemia. Nutrition during pregnancy may be especially important in adolescent mothers who have not yet completed their own growth (Lenders *et al.* 2000).

However, the relationship between fetal nutrition and maternal dietary intake is unclear. Nutrient supply to the

fetus will be influenced by a number of adaptive physiological changes that occur during pregnancy, including alterations in maternal absorption, utero-placental blood flow, placental transfer mechanisms and fetal uptake (Hyttén, 1983). Such mechanisms suggest that the fetus is protected from ‘the vagaries of maternal diet’, and there may be little need, or indeed evidence base, for fetal nutrient supply being altered effectively by change in maternal dietary intake.

It seems appropriate then to review why pregnancy might be considered a good time for dietary change, to examine the possibility that pregnancy might be a bad time for dietary change and to look at the evidence to support pregnancy as a time for successful dietary interventions.

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**Abbreviations:** IEG, intervention education group; REG, routine education group.

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### Why pregnancy might be a good time for dietary change

Pregnancy is a time of increased nutritional requirements, and these requirements are described in some detail in the report on current dietary reference values (Department of Health, 1991). Evidence suggests that in conditions of food abundance, few dietary changes are probably required. Probably the main nutrient of concern should be energy, which needs to be increased to meet the demands of increasing maternal tissues, growth of the fetus, growing fat stores and the increase in BMR. In total it is estimated that 293 MJ are required, but this requirement is seldom met entirely by increases in food intake.

Current evidence suggests an increase in the intake of energy of <math>0.42\text{ MJ (100kcal)/d}</math> in the 3rd trimester (and little change before then) has no apparent risk to the mother or the fetus (Durnin, 1987). Thus, the current recommendations for dietary reference values (Department of Health, 1991) suggest that a very modest increment of  $0.8\text{ MJ/d}$  (above prepregnancy intake) during the last trimester should meet the energy requirements of pregnancy. Energy needs will also vary with body size. The Institute of Medicine (1990) recommendations suggest that women who are underweight at the beginning of pregnancy, or who do not reduce activity levels during pregnancy, should gain more weight, whilst women who are overweight should gain less.

Other nutrient requirements also increase during pregnancy, but it is largely recognised that the increase in energy intake will bring with it an increase in many of the vitamins and minerals required. There may also be good reasons for supposing that nutritional status should be optimum before pregnancy begins. Fe requirements, for example, increase during pregnancy (Bothwell, 2000), but the absence of menstruation and increase in absorption will for well-nourished women be enough to meet needs. The problems arise if anaemia exists prepregnancy due to poor intake or blood losses, and if so, whether Fe status should be changed through diet, dietary advice or by dietary supplements. Many researchers continue to argue that there is a need to 'develop functional criteria for anaemia and establish functional goals of haemoglobin concentration to be achieved during pregnancy especially in developing countries' (Beaton, 2000).

Pregnancy is also a period of high Ca requirement. In a recent review Prentice (2000) concludes that current evidence indicates that pregnancy and lactation are characterised by physiological adaptive processes that are independent of maternal Ca intake and that provide the Ca necessary for fetal growth. She does note, however, that the impact on reproductive or lactation performance of low Ca intake before or during pregnancy is less clear.

Of the wide range of vitamin requirements that increase during pregnancy it is only vitamin D and folic acid that are considered necessary to be increased by diet, and in both cases these increases are recommended primarily by supplementation (MRC Vitamin Research Group, 1991). In the case of vitamin D there seems much less concern to follow recommendations, apart from in South Asian communities. There will also be particular groups 'at risk' of deficiency, such as young women who smoke (Matthews *et al.* 2000).

There are also some very important food constituents that it might be wise to avoid completely, or at least reduce. For example, toxins such as alcohol because of its relationship with fetal alcohol syndrome. This disease presents as a collection of signs and symptoms seen in some children exposed to high alcohol intakes in the prenatal period. It is characterised mainly by physical and mental retardation, cranio-facial anomalies and minor joint abnormalities, and can occur in high consumers of alcohol. The Royal College of Obstetrics and Gynecology (2000), however, concludes that 'there is no conclusive evidence of adverse effects in either growth or IQ at levels of alcohol consumption below 120 gms (15 units) per week. Nonetheless it is recommended that women should be careful about alcohol consumption in pregnancy and limit this to no more than one standard drink per day'.

Other hazards to avoid include liver consumption (Department of Health, 1990), with its highly concentrated vitamin A content arising from animal feeding practices.

The presence of *Listeria monocytogenes* can cause a variety of diseases, including infections in pregnancy ranging from a mild chill to a severe illness, which may precipitate premature birth or miscarriage, and meningitis in newborn children. Current estimates of listeria in pregnancy are approximately 1 in 30 000 live births and stillbirths. Current government recommendations (Department of Health, 1997) are that pregnant women should avoid eating certain ripened soft cheeses such as Brie, Camembert and the blue-veined types such as Danish Blue. In addition, pregnant women should avoid eating any type of meat-based pate. Although the number of listeria found in other foods, such as cooked chilled meals and ready-to-eat poultry, is usually low, the Chief Medical Officer also advises caution with appropriate cooking methods. Salmonella, toxiplasmosis and food poisoning more generally also need to be avoided with greater care during pregnancy than probably at all other times.

One thing nutritionists are not very good at it is remembering to combine toxicological short-term food-safety issues with longer-term nutritional concerns. For example, I will argue later that morning sickness makes early pregnancy a bad time for advocating dietary change, although there is a view that symptoms such as nausea and vomiting are part of the maternal system to protect against toxins. In support of this hypothesis a recent review by Flaxman & Sherman (2000) reported that (1) symptoms peak when embryonic organogenesis is most susceptible to chemical disruption (weeks 6–18), (2) women who experience morning sickness are less likely to miscarry than women who do not (nine of nine studies), (3) women who vomit suffer fewer miscarriages than those who experience nausea alone, (4) many pregnant women have aversions to alcoholic and non-alcoholic (mostly caffeinated) beverages and strong-tasting vegetables, especially during the first trimester.

Flaxman & Sherman (2000) also reported that the greatest aversions are to meats, fish, poultry and eggs. Further work on a cross-cultural analysis revealed twenty traditional societies in which morning sickness has been observed, and seven societies in which it has never been observed. The latter societies were less likely to have animal

products as dietary staples and significantly ( $P < 0.05$ ) more likely to have only plants (primarily maize) as staples than the twenty societies in which morning sickness occurred. The authors suggest that animal products may be considered dangerous to pregnant women and their embryos because they often contain parasites and pathogens, especially when stored at room temperatures in warm climates.

Apart from nutritional and food safety reasons there are a number of good psycho-social reasons why pregnancy might be considered a suitable time for promoting changes in nutrition behaviour for the health of the wider family.

In general, pregnancy occurs in early adulthood when many women are still forming their adult dietary patterns, and thus food habits are less likely to be bound by habit. At this stage in life women may also be adjusting their food intake to coincide with those of their partners. For example, Kemmer *et al.* (1998) reported that the early weeks of marriage or cohabitation are a time of negotiating food choices between partners.

Despite changing trends in social demographics, the family diet is still most often seen as the woman's responsibility (Graham, 1984). Women are more likely to plan, purchase, prepare and cook food served in the home, thus it may be easier for a woman to select the food she wishes to eat than it is for other family members to select the foods they wish to consume (Schafer, 1978). Thus, targeting women for the promotion of dietary change may be fruitful at any stage in life, but if health promotion occurs at a time when partners are sensitive to women's needs for dietary change then health promotion efforts may be more likely to meet with success.

The reproductive years are not generally associated with the chronic debilitating diseases of mid-life, and thus pregnancy presents an opportunity for initiating primary preventive health measures in a group of healthy individuals at a time when family futures are being planned. In addition, the presence of disease may in itself cause so many problems that lifestyle changes become a burden with little positive merit.

Additionally, for some women, the healthy development of their baby may be perceived as positive re-enforcement for dietary and lifestyle changes, although inevitably this perception will also mean that some women will mistakenly think that diet will be the cause of poor obstetric outcome.

Antenatal care is one situation that is unique in providing the opportunity to reach large numbers of healthy women with the potential to influence the health of the next generation. The educational aims of antenatal services have been apparent since the early days of their inception, and are still frequently considered (Short, 1980; Oakley, 1984) with respect to areas ranging from diet to contraception. For many women, antenatal staff may be the first trained staff to inform, advise or re-enforce health messages about nutrition and other lifestyle considerations.

There is some evidence that women welcome, and indeed seek, health advice during pregnancy. Hall *et al.* (1985) reported that 94% of a sample of 165 pregnant women claimed to have done some reading about pregnancy and maternity care, with 53% reading information provided by general practitioner or maternity clinics and 42% reading additional material.

It is said that consumers of antenatal care seem to welcome advice about diet. In a 'study of nutritional care during pregnancy', Orr & Simmons (1979) reported that 81% of obstetric patients perceive pregnant women as needing dietary advice. Of the women who felt they personally needed dietary advice, three-quarters expected advice on general dietary improvements, with the remainder seeking advice on helping to promote or restrict weight gain.

It seems that women change their diet anyway during pregnancy. In work carried out in the 1990s in Aberdeen (Anderson *et al.* 1993), we investigated nutrient intake by means of 4 d diet diaries of a group of women during early pregnancy (i.e. at the very first antenatal clinic booking before receiving any clinic advice) and non-pregnant women matched for age and area of residence. The early-pregnancy group consumed significantly higher amounts of Zn ( $P < 0.05$ ) and vitamin C ( $P < 0.05$ ) and lower amounts of alcohol compared with the non-pregnant group.

It is often assumed that women may have made a conscious effort to improve their food intake in line with health advice. For example, avoiding alcohol (or reducing the amount consumed), eating more fruit and increasing intakes of milk are good examples of basic dietary advice which are widely promoted. However, these differences in food intake may in fact be a response to physical symptoms, including tiredness (which might provoke a change in evening activities such as going to a 'pub' or 'disco' where alcohol is usually consumed). Based on the physical symptoms and the opportunity to discuss diet (and other lifestyle variables), it is easy to appreciate why women receiving antenatal care are seen as 'prime candidates for a patient education programme' (Daelhausen & Guthrie, 1982), a theme we will explore at the end of the present paper.

### Why pregnancy might be a bad time for dietary change

One of the main problems with the whole concept of dietary change is that many individuals still perceive diet to mean slimming and energy restriction. Concern with weight changes during pregnancy clearly affect many women. Hall *et al.* (1985) reported that weight control was the most commonly mentioned health topic for which advice was sought in Aberdeen antenatal clinics. Prentice *et al.* (1987) reported that some women with weight problems who normally keep slim by restrained eating may suffer 'motivational collapse' during pregnancy when their body shape and lifestyle are radically altered. Pregnancy may also be seen as providing an excuse for altered food intake in women of normal weight. In her study of first pregnancies in Aberdeen, Macintyre (1983) described oddities of appetite as welcome by her subjects because of their symbolic value in confirming and signifying pregnancy. It is tempting to speculate that in some sectors pregnancy might be one of the few times in a woman's life when society accepts and even encourages women to eat larger quantities of food (accounting for the continued myth of 'eating for two').

However, it remains that the main question that many women ask in relation to dietary change during pregnancy is about weight gain and perceived loss of control of body shape and size. In-depth qualitative work by Carol Devine

**Table 1.** Birth-weight centile distribution (%) in obese primigravidae (from Campbell, 1983)

Birth-wt centile....	<25	25–<50	50–<75	>75
Diet restricted ( <i>n</i> 91)	25.3	30.8	26.3	17.6
Controls ( <i>n</i> 91)	17.6	29.7	31.9	20.9

and colleagues at Cornell (Devine *et al.* 2000) shows that prepregnancy orientations towards body weight were the primary influence on women's pregnancy and post-partum attitudes towards weight. So the notion that women relax during pregnancy and let go of concerns over body weight and eat for two seem not quite universal.

Considerable debate on the topic of slimming during pregnancy has taken place over the last couple of decades, but the general consensus appears to be that dieting for weight loss during gestation should be discouraged, and may result in a low-birth-weight infant if there is serious energy restriction in the third trimester. Interesting data from Aberdeen demonstrate the difference in the distribution of birth centiles between energy-restricted obese primigravidae and non-restricted controls, with a downward trend to lower birth weight (Campbell, 1983; Table 1). It should also be noted that whilst there has been growing evidence that maternal obesity is associated with an increased risk of congenital malformations (Prentice & Goldberg, 1996), particularly neural-tube defects, it seems unlikely that such risk is related to slimming before or during pregnancy.

There are a number of other reasons why pregnancy might be considered a bad time for dietary change. Possibly the main concern is that optimum nutrient intake should be achieved before pregnancy. Probably the best example of this situation is the case of folic acid. The Department of Health (2000) report on folic acid (and subsequent consultation) made the point very clearly that although about 50% of women of child-bearing age are aware of current recommendations regarding folate, about half of all pregnancies are unplanned, and folic acid can only have a limited effect. To address this problem food fortification is suggested primarily to ensure widespread access to adequate folic acid, in addition to the education campaign. It is estimated that such a move would reduce by 41% the incidence of pregnancies affected by neural-tube defects.

I mentioned earlier that physical symptoms are a reason why women undertake dietary change, but the reality for many women is that the dietary responses made to such symptoms may not always contribute to optimum nutritional status. Physical symptoms experienced during pregnancy which might be alleviated by some form of dietary manoeuvres include nausea and vomiting. Fairweather (1968) described these symptoms as 'accepted as common occurrence which accompany approximately one half of all pregnancies' and he also described a number of dietary and other regimens which have been used in the management of nausea and vomiting, and the extreme condition of hyperemesis gravidarum. Few women would report that their nutritional status improved during those weeks of nausea, and the concept of being asked to follow a healthy balanced

diet (when even keeping a piece of toast down is an achievement) does not seem like the ideal time to preach dietary information. Durmin *et al.* (1987) have demonstrated that energy intake does appear to dip in the weeks in which nausea is common, thus this particular time in pregnancy might be seen as the very poorest in terms of nutrient intake.

Anderson (1984) reported changes in dietary habits in a group of 200 women who claimed to be suffering from constipation during pregnancy. Many of the women claimed to have changed their diets in response to symptoms, although this change included such reported activities as 'avoiding eggs, avoiding hard cheese, avoiding chocolate biscuits, eating liquorice and eating chocolate'.

Women may also seek dietary advice (or wish to discuss diet) following symptoms such as food cravings, aversions and pica. In general, these symptoms create much amusement for those individuals who do not experience them.

Thus, not all dietary changes which occur in response to physical symptoms may be of nutritional benefit, but they may actually make women feel a lot better in the short term.

One of the fundamental problems with advising dietary change during pregnancy is knowing what optimum nutrition really is, not just for immediate birth outcome but also for the future health of that baby. Promising areas such as Ca supplements have proved disappointing in the prevention of pre-eclampsia, but new work has indicated a promising role for vitamin C and vitamin E supplements (Wallenburg, 2001); the relationship between nutrition in pregnancy and adult obesity (Martorell *et al.* 2001); the role of dietary supplements such as cod-liver oil in the prevention of diabetes (Stene *et al.* 2000); nutrition during early pregnancy and its role in lipid profile in adult life (Roseboom *et al.* 2000).

One of the most interesting areas of work in this arena is in relation to maternal diet survey work undertaken 40–50 or more years ago and its relationship with adult health of the offspring. Campbell *et al.* (1996) reanalysed the dietary data of pregnant women collected between 1948 and 1954. They reported that, in late pregnancy, when the mothers' intake of animal protein was less than 50 g daily, a higher carbohydrate intake was associated with a higher blood pressure in the offspring (a 100 g increase in carbohydrate being associated with a 3 mmHg increase in systolic pressure;  $P=0.02$ ). At daily animal protein intakes >50g, lower carbohydrate intake was associated with higher blood pressure (a 100 g decrease in carbohydrate being associated with an 11 mmHg rise in systolic blood pressure;  $P=0.004$ ). These increases in blood pressure were associated with decreased placental size.

Having then got some idea that protein and carbohydrate were important, Godfrey *et al.* (1996) examined the placental and birth weights of 538 mothers who had undertaken a food-frequency questionnaire in Southampton, showing that high carbohydrate intake in early pregnancy appeared to suppress placental growth (especially if combined with a low dairy-protein intake in late pregnancy).

Further analysis from the Aberdeen data (Campbell *et al.* 1996), looking at diet and glucose insulin metabolism of the offspring, showed that high intakes of fat and protein in late pregnancy had a reduced plasma insulin increment between



fasting and 30 min (with a 7.0% decrease in increment ( $P=0.007$ ) per 10 g increase in protein intake and a 4.9% decrease ( $P=0.002$ ) per 10 g increase in fat intake). The authors conclude that high intakes of protein and fat during pregnancy may impair development of the fetal pancreatic beta cells and lead to insulin deficiency in the offspring. They do stress that these findings are not the basis for recommending alteration to current dietary advice.

I'm not sure where these data leave us in terms of dietary change during pregnancy, but they do serve to remind us that if we get our advice to pregnant women wrong we might be risking a lot of future health problems. In other words, we need to remember that intervention is not only about producing benefit, but also preventing harm.

### Promoting dietary change: the evidence base

Although there is an impression amongst health professionals that women are particularly responsive to nutrition advice during pregnancy, especially primigravidae (Stevens, 1990), this factor has never been confirmed. Early work by Taggart (1961) suggested that dietary education was not equally effective in all sections of the community. The lack of data to support the impression that women do respond to dietary advice may be due to the variety of education and assessment programmes used throughout the country.

Dietary alterations aimed at enhancing the well-being of the mother and baby may arise from a number of stimuli, including advice given during pregnancy by health professionals, from lay individuals and from information gleaned from books, magazines and the media. The quality and quantity of dietary advice in pregnancy varies throughout the country. Adams (1982) described dietary advice in her health authority as 'haphazard and often non-existent'. She goes on to say that women were often selected to see a dietitian on an arbitrary basis by nurses at the booking clinic, and on the system of procedures at the clinics little priority was given to the dietitian.

Baric & MacArthur (1977) described three main approaches to food during pregnancy. These were:

1. 'eating the right foods': 35% of their sample of 245 women reported being aware of this approach, with 29% claiming to practise this approach. Right foods were defined as plenty of meat, fish, eggs, milk and fresh vegetables;
2. 'watching weight': 24% expressed awareness about the social expectations of weight control and 24% took care as to how much weight was gained;
3. 'eating for two': 17% believed this approach to be appropriate for pregnancy, but only 1% claimed that they ate for two.

There is some evidence that intervention studies of dietary advice given during pregnancy are effective. The improvement of nutrition and health is a major aim of the American Special Supplemental Food Program for Women, Infants and Children which is directed at low-income nutritionally-at-risk pregnant women and preschool children and provides supplemental food, nutrition education and coordination of health care (Rush *et al.* 1988). Enrolment in the programme during pregnancy was aimed at improving the

outcome of pregnancy, including reduced rates of prematurity and of fetal and infant mortality. Assessments of the effect of these studies suggest that enrolment in the programme is associated with a lower rate of birth weight <2500g, and the effect of supplementation was also associated with a very small increase in birth weight (Rush *et al.* 1988).

Dietary advice alone, without supplementation, has been shown to be effective in encouraging weight control during pregnancy (Grieve, 1974; Campbell & MacGillivray, 1975; Campbell, 1983).

The effect of dietary advice on encouraging healthy eating habits has, however, rarely been studied. In wartime Glasgow Cameron & Graham (1944) reported that when the diets of expectant mothers were improved by instruction and encouragement given at an antenatal clinic by a trained dietitian, the incidence of stillbirths and premature births was significantly reduced ( $P < 0.05$ ).

This area of dietary interventions to promote healthier eating in pregnant women was reviewed by Van Teijeling *et al.* (1998) in the Health Education Authority's *Health Promotion Effectiveness Reviews* series. Using the systematic review approach only four studies of interventions were identified which fulfilled the inclusion criteria.

Of the four studies, two studies were community based and two studies were clinic based. All four studies had an educational component, and in three studies this component was enhanced by counselling and or psycho-social support. As one of these studies refers to my own work (Anderson *et al.* 1995), I think it might be appropriate to look in detail at the sort of approaches and variables that were measured, and the changes observed.

The aim of our intervention study was to test the response of pregnant women to dietary advice by comparing the nutrition knowledge, attitudinal variables to healthier eating and nutrient intake in a group of women receiving routine antenatal clinic dietary education (routine education group; REG) and a group who also received a special intervention education programme (intervention education group; IEG).

The study intervention programme was designed in three stages. Firstly, through formative research we identified current nutrient intake and food selection in pregnant women attending Aberdeen antenatal clinics. (Anderson *et al.* 1988). Secondly, we then undertook a series of qualitative and quantitative studies on beliefs and attitudes to healthier eating during pregnancy (Anderson & Shepherd, 1989), and finally by focus group work established consumer opinions on current nutrition materials.

From this formative research we developed an education programme for the study which was entitled 'Food for Life' and was presented as two information packs. The first pack comprised a self-assessment quiz, an information booklet and a shopping list pad, which were contained in an envelope decorated with 'Food for Life' stickers. The second pack comprised a personalised letter from a named doctor promoting healthier eating during pregnancy and a recipe leaflet with recipes for healthy family meals, enclosed in an envelope decorated with 'Food for Life' stickers.

Additionally, pregnant women received the routine nutrition education material available for pregnant women

**Table 1.** Achievements of dietary goals† by education group for 328 Aberdeen women receiving either routine education material (REG) or routine material and a special intervention education programme pack (IEG)‡

Treatment group.... Goal		IEG	REG	$\chi^2$ (df 1)
Fat	Achievers	29	21	2.17
	Non-achievers	82	92	
Carbohydrate	Achievers	24	25	0.0
	Non-achievers	87	88	
Dietary fibre	Achievers	39	39	0.0
	Non-achievers	72	74	
Fat + carbohydrate	Achievers	14	17	0.54
	Non-achievers	97	96	
Fat + dietary fibre	Achievers	12	3	10.6**
	Non-achievers	99	110	
Carbohydrate + dietary fibre	Achievers	12	8	3.0
	Non-achievers	99	105	
Carbohydrate + fat + dietary fibre	Achievers	10	3	6.1*
	Non-achievers	101	110	

\* $P < 0.05$ , \*\* $P < 0.01$ .

†Fat <35% energy, dietary fibre >22g, carbohydrate >50%.

‡For details of subjects and procedures, see pp. 501–502.

in Aberdeen, which comprises one page in a general pregnancy health guide ('The Book of the Child'; Scottish Health Education Group, 1980).

The study was undertaken as follows. All women attending antenatal booking clinics at Aberdeen Maternity Hospital between November 1987 and October 1988 were randomly allocated to the IEG or the REG. All women received routine education material, but the IEG also received the first education package from the midwife. At 26 weeks of gestation all women in the IEG received their second pack, posted to them personally. All women, IEG and REG, returned for their routine clinic visit at about 30 weeks of gestation, and they were invited to participate by completing the specific knowledge and attitudinal questionnaires, and by recording their food intake.

The attitudinal questionnaire was based on the Fishbein & Ajzen (1985) 'Theory of Reasoned Action Model'. A nutrition knowledge questionnaire was developed, based on a test described by Anderson *et al.* (1988). Nineteen questions were presented in a multiple-choice format. Knowledge of three main topics was tested: nutrition terms; theoretical principles of nutrition; practical application. Dietary intake in pregnancy was assessed prospectively. Women were invited to record all food and drink consumed over a 4 d period (Edington *et al.* 1989), covering two weekend days and two week days.

A total of 328 women were recruited; and numbers in each group by marital status, social class, parity and smoking habit were similar, although age at delivery was significantly higher ( $P < 0.05$ ) in the REG.

In the results for nutrition knowledge, the IEG had a significantly higher score for the practical applications component ( $P < 0.001$ ) and the total score ( $P < 0.01$ ) compared with the REG. There were, however, no significant differences between the two groups for any of the attitudinal components, and no significant differences between the two groups for mean daily nutrient intake or energy composition.

To test for differences involving more than one nutrient, the distribution of individuals achieving combinations of three dietary goals was assessed. The first goal was the recommendation that 35% energy should be derived from fat, the second was the recommendation that 50% energy should be derived from carbohydrate, and the third goal was a local goal for dietary fibre. Numbers of women achieving such goals were small in both groups (Table 2), but significantly more women in the IEG achieved the combination of all three goals (carbohydrate, fat and dietary fibre;  $P < 0.05$ ) and the combination of fat and dietary fibre goals ( $P < 0.01$ ) compared with the REG.

The similarity of nutrient intake between the two education groups (IEG and REG) suggests that the intervention programme was unsuccessful in changing intakes of fat, carbohydrate and dietary fibre. However, the distribution of women achieving combinations of dietary goals shows a trend in the IEG towards a healthier diet in individuals.

From this work we concluded that giving written advice (which is the most widespread method of giving information) can influence knowledge about healthier eating, but does not seem to alter attitudes, or indeed behaviour.

The review by Van Teijeling *et al.* (1998) concluded that 'the rationale for healthy eating interventions in pregnancy needs to be clarified, particularly whether there is good epidemiological evidence that increasing the intake of particular nutrients and energy is of benefit in healthy women and their infants.'

The present review has not looked at interventions designed specifically to address problems such as low birth weight. It is recognised that the babies of women in disadvantaged groups are more likely to have reduced growth rates *in utero*. Babies with fathers in social class 4 and 5 have a birth weight which is on average 130g lower than these of higher social classes (Office for National Statistics, 1997). Much of the work on dietary interventions in this target group in the UK has been undertaken by Wendy

Doyle and colleagues in Hackney (Doyle, 1999). There was surprisingly little impact on birth weight of counselling or of supplements given during the last two trimesters of pregnancy, although there was some association between birth weight and maternal nutrient intakes during the latter part of the first trimester of pregnancy.

Dietary advice may not be acted on for a number of reasons, and there is little evidence that parenting skills are improved by inducing feelings of guilt. Women have responsibility for the nurture of the growing baby, but we as a society also have a responsibility to support women's access to a healthy diet through effective policies.

The area of health and nutrition of women and children was one highlighted in the Acheson (1998) report on inequalities in health. The author recognised that the 'agreed healthy diet' in pregnancy may have long-term benefits in reducing the baby's later risk of cardiovascular disease without greatly influencing birth weight, and expressed concern that mothers reliant on state benefits may not be able to afford a healthy diet. He also cites US work (Kehrer & Wolin, 1979) which has shown that guaranteeing a minimum income to pregnant women has been shown to increase birth weight. A number of policy recommendations relating to nutrition are made, and start with the following: 'we recommend further reductions in poverty in women of childbearing age, expectant mothers, young children and older people should be made by increasing benefits in cash or in kind to them'.

I think that if we truly believe that the incidence of low birth weight can be altered by intervention, then we need to use effective interventions, and it is time to seriously look at something beyond dietary advice.

The focus of the present paper has been to examine whether pregnancy is an appropriate time for dietary change. It is clear that for reasons of food safety, women should undertake certain dietary restrictions in order to decrease the likelihood of harm. In terms of nutrition, the evidence for pregnancy being a prime target for change is less clear. Micronutrient status is, in many cases, more important before pregnancy, and macronutrients, including energy, are clearly an issue during gestation. However, more evidence is required on exactly what is the correct macronutrient ratio at the correct time of gestation.

In conclusion, pregnancy may be best viewed as an opportunity for maintaining good dietary selections and for building a knowledge base for future action, and should not be seen as the only opportunity in a lifetime for nutrition to influence current and future health.

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