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IJFNPH
5,4

225

DO PUBLIC HEALTH MESSAGES IMPACT ON KNOWLEDGE, DIET AND LIFESTYLE CHOICES OF WOMEN DURING PREGNANCY?

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Abstract

Purpose: This paper summarises the scientific rationale supporting the need to promote healthy diet and lifestyle choices during pregnancy and describes a pilot study assessing the impact of public health messages on diet quality and lifestyle choices among a population of pregnant women.

Design/methodology/approach: 18 women (ages 21–46 years) in their second trimester of pregnancy completed an online questionnaire entitled “Your Health in Pregnancy”.

Findings: Results found that knowledge of the roles of specific nutrients important in pregnancy—folic acid 89%, iron 72%, vitamin D 78%, calcium 100%—were higher than those gained for translating knowledge into practical ‘food-based’ skills, i.e., identifying food sources of the same (folic acid 61%, iron 83%, Vitamin D 67% and calcium 94%).

Practical implications: Women are aware of public health messages during pregnancy but are inconsistent when translating knowledge into behaviour change. Encouraging positive changes requires a greater understanding of complexities of factors which influence dietary and health choices.



International Journal
of Food, Nutrition and
Public Health (IJFNPH)
Vol. 5 No. 4, 2012

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Keywords: Diet quality, Nutrition, Pregnancy, Nutrients, Public health messages, Physical activity, Healthcare professionals

Paper type: Research paper

Do public health messages impact on knowledge, diet and lifestyle

INTRODUCTION

226

Public health campaigns promote adherence to healthy diet and lifestyle choices throughout life, and often focus on women planning and during pregnancy. Nutritional needs differ with maternal age and health status, and although “pregnancy” offers an ideal time for health promotion initiatives, the impacts of associated health promotion strategies are variable (NICE, 2010). Some women meticulously plan conception, realising the opportunities good diet and lifestyle choices made from conception to 2 years can have to build a lasting foundation for good health. From a global perspective, this period has been identified as a “window of opportunity,” a time when good nutrition is acknowledged to reduce mortality and morbidity rates, to improve long term physical and mental health (Bryce *et al.*, 2008; SUN initiative, 2010). More often however, women fall pregnant without planning and/or ignore public health guidance. This paper summarises the scientific evidence which rationalises the need for healthy diet and lifestyle choices in pregnancy, then describes a pilot study conducted to assess the extent to which knowledge of public health messages and dietary guidelines impact on the quality of dietary intake among a population of pregnant women. These data are used to demonstrate the need for increased knowledge of why pregnant women do not—generally—follow healthy diet and lifestyle advice.

SCIENTIFIC RATIONALE FOR STUDY

Theories of intrauterine programming originally proposed by Barker and colleagues (1990) identified a relationship between birth weight and weight gain in infancy, and lifetime risk of chronic diseases such as cardiovascular disease, type II diabetes and metabolic syndrome (Barker *et al.*, 1993; Hales *et al.*, 1991; Forsén *et al.*, 2000). This work quantified the effects of under-nutrition during foetal development and infancy, highlighting the potential for poor dietary and lifestyle choices to make permanent alterations to an infant’s body structure, physiology and metabolism (Hales and Barker, 2001; Ozanne and Hales, 2002; Symonds

et al., 2003). These findings have been confirmed, and understanding extended through subsequent studies among different populations (Pettitt *et al.*, 1993); perhaps most convincingly during adverse foetal environments such as those experienced during the Dutch Hunger Winter (Ravelli *et al.*, 1998; Roseboom *et al.*, 2006). Scientists today continue investigations aiming to increase understanding of modifiable factors critical in early development, to inform public health guidelines for pregnancy worldwide, and to mitigate the impact of poor diet/lifestyle choices on future development of non-communicable diseases.

Growth *in utero* is constrained by the capacity of the mother and her placenta to deliver nutrients, and hence, pregnancy is a time when a mother's nutrition—her diet, her nutritional status and her metabolism—are of crucial importance (Jackson, 2000). Intakes must meet the mother's usual energy and nutrient requirements, and they must also be sufficient to support foetal development (Anderson, 2001). Maternal nutrition has most impact during the vulnerable periods of peri-implantation and placental development (Kumarasamy *et al.*, 2005; Waterland *et al.*, 2004; Wu *et al.*, 2004) when the formation and development of major structural features (central nervous system, organogenesis and external features) occurs. These constitute occasions when nutrient deficiencies cannot typically be overcome. Folate, for example, has been identified to have a profound effect on prevention of neural tube defects (NTDs) in the peri-conceptual period (Scholl and Johnson, 2000). Although scientists do not yet completely understand the actions of folate in this process, its role in DNA development and therefore in cell growth, development and tissue formation is well acknowledged. Adequate intakes (defined by COMA as 400µg folic acid/day during planning of pregnancy and up to 12 weeks gestation) are recommended, since intakes above this level have been associated with a 72% reduction in incidence of NTDs (MRC, 1991, COMA, 2000).

Opportunities for public health guidance are often missed during this crucial period when pregnancies are unplanned or women are not aware they are pregnant in the early weeks, for example. The Southampton Women's Survey highlights the low numbers of UK women who comply with public health guidelines for planning a pregnancy: 2.9% being fully compliant with folic acid guidelines and alcohol intake cessation in 3 months prior to becoming pregnant, for example (Inskip *et al.*, 2009). Evidence suggests that pregnant women are selective in their compliance with recommendations, and that they find alcohol, smoking, folic acid

and caffeine guidelines more “manageable” than diet and exercise changes (Inskip *et al.*, 2009; Crozier *et al.*, 2009). This is particularly the case for younger women (those aged 20-34 years) and those with fewer (no qualifications above GCSE grade D) educational qualifications (Crozier *et al.*, 2009; Robinson *et al.*, 2004). The reasons for lack of compliance have not yet been elucidated, but a lack of understanding, knowledge or misconceptions about certain guidelines (many women may still consider exercise of high to moderate intensity, such as jogging “unsafe” during pregnancy, for example) (Clarke *et al.*, 2004; Duncombe *et al.*, 2009) are assumed to contribute. Although women continue to view pregnancy as an opportunity to change and adopt a healthier lifestyle, like so many other public health guidelines, many of them find such actions difficult to achieve.

To promote healthy behaviours and reach the women most at risk of poor pregnancy outcomes, in depth knowledge is required of the factors influencing lifestyle and dietary choices. Healthcare professionals cannot prioritise public health recommendations on diet and lifestyle during antenatal appointments due to lack of time or competence (or both); therefore information is often given out in “bounty packs”³, free promotional samples and advice leaflets given to mothers at various stages of pregnancy and throughout the child’s first year. This study was designed to assess the extent to which health education materials obtained by pregnant women impacts their knowledge and subsequently, the quality of dietary and lifestyle choices made in a small cohort of pregnant women in their second trimester of pregnancy. This paper examines the factors affecting behaviour change in women during pregnancy when trying to meet public health guidelines for maintaining a healthy balanced diet and active lifestyle, and considers whether poor comprehension and engagement with these guidelines is related to the timing, quality and current strategies of delivering and disseminating public health messages.

METHODOLOGY

Participants

Eligibility for the study was defined as, women between 18-40 years old; in their second trimester (12-28 weeks) of pregnancy; and sufficiently fluent in English for completion of study questionnaires and to give

³<http://www.bounty.com/ppc-test/landingppc-welcome-to-bounty-01?gclid=CLTWje3HtLICFeXMtAodoRYAsQ>

informed consent. Data collection targeted women in their second trimester to prevent confounding effects linked to anxieties, nausea and vomiting traditionally associated with the first trimester, which can affect nutrient intakes (Huxley, 2000; Latva-Pukkila, 2010).

Recruitment

Study participants were recruited using a convenience sampling method initiated at three Sure Start Centres in the borough of Croydon, London. Croydon is the 107th (out of 326 local authorities) most deprived local authority in England (The English Indices of Deprivation, 2010), yet also contains several high income wards, and therefore provided a good opportunity to collect data from a heterogeneous sample. Difficulties in recruitment led to development and use of a group page “Your Health in Pregnancy” on the Facebook® social media site. This enabled use of a snowball sampling method (Atkinson and Flint, 2001; Trochim, 2006), with those completing the questionnaire having a link to it posted on their web pages, potentially alerting their network of contacts. Invitations to complete were initiated using the email addresses of pregnant women attending Sure Start centres in Croydon; however the locale of all respondents was not requested to protect confidentiality. Eighteen women participated in the study, 5 recruited from one Sure Start Centre (Woodland) and 13 via Facebook®.

Study design

Participants joining the study were directed to a self-administered online questionnaire containing four sections, and which took approximately 20–25 minutes to complete. The questionnaire was piloted using the web-interface by 3 mothers of similar socio-economic background to those targeted here (children ages 4, 5, 8 and 15 years). Section one comprised closed questions collecting anthropometric characteristics (age, self-reported height and current pregnancy weight) and socio-demographic information (e.g., marital status, maternal occupation, partners’ occupation, maternal ethnicity and number of children). Self-reported height and pregnancy weight was used to calculate body mass index (BMI Kg/m²) and categorised using World Health Organization (WHO) BMI categories (James *et al.*, WHO, 2004).

Section two assessed the women’s knowledge of dietary guidelines. Questions were based on current UK dietary guidelines and included questions on folic acid, vitamin D, iron and calcium. These nutrients are identified

within UK Government recommendations (Department of Health, 2009) as being of special importance. Questions considered why these nutrients were important to health during pregnancy and where they could be found in the diet. Knowledge of safe intake levels for alcohol consumption, foods to avoid during pregnancy and where the women accessed information on health and diet during pregnancy were also considered.

The third section considered barriers and motivators encountered when considering a healthier diet or lifestyle during pregnancy. It was designed to gather a snapshot of the personal factors that may influence perception of the barriers, benefits and self-efficacy to engaging in healthier behaviours. Barriers incorporated perceptions of expense of healthier foods, inconvenience, difficulty and time required to engage in healthy eating or physical activity. Motivators for encouraging changes considered practical and situational factors that might lead to improvements in dietary intakes and lifestyle (Chang *et al.*, 2008; Fowles 2008; Duncombe *et al.*, 2009; Weir *et al.*, 2010; Evenson *et al.*, 2008; Hurley *et al.*, 2005).

Dietary intakes were assessed in the final section of the questionnaire using a modified and updated Food Frequency Questionnaire (FFQ) based on the FFQ designed and validated by Rogers *et al.* (1998a) for the Avon Longitudinal Study of Pregnancy and Childhood (ALSPAC) Study (permission was kindly granted by ALSPAC Committee Team 25/08/11). Answers were used to consider the “quality” of dietary intakes using a specifically devised Diet (and Lifestyle) Quality Index (data not presented here) designed to incorporate UK Dietary Reference Values (DRVs), UK Food Standards Agency, Scientific Advisory Committee on Nutrition (SACN), Committee on Medical Aspects of Food and Nutrition Policy (COMA), Food and Agricultural Organisation of the United Nations (FAO) and World Health Organisation (WHO) dietary guidelines as indicators for “a healthy diet” for women during pregnancy, and behavioural questions on alcohol intake, smoking habit, levels of physical activity and attitudes towards breastfeeding and diet during pregnancy. This work was completed as part of a BSc (hons) research project (Salisbury, 2012).

The Statistical Package for Social Sciences version 19 (SPSS Inc., Chicago, IL, USA) and Microsoft Excel 2010 (Microsoft, Washington DC, USA) were used to complete descriptive summaries of collected data as presented here.

Ethics approval

All methods included in this project were approved by the University of Westminster Ethics Committee (App. No. 11_12_01, permission received 20/10/11).

RESULTS

Eighteen women in their second trimester (12–28 weeks) completed the online questionnaire. As complete responses were required to address the study aims, information collected from a further 9 women who only partially completed the questionnaire were excluded. Seven of the 9 women who partially completed the questionnaire were in full-time employment; therefore time constraints may have affected their engagement with the study aims. Of the 18 women completing the questionnaire, only 7 were in full-time employment. The mean age was 36 years (\pm SD 6.4) and mean maternal BMI was 26.0 kg/m² (\pm SD 4.0). Data on pre-pregnancy weight was not collected and BMI was calculated from current self-reported height and weight; therefore rates of gestational weight gain cannot be made for this group of women. Interestingly, only one woman in this study received advice from their doctor or health visitor regarding their weight during pregnancy (Table 4).

A summary of maternal characteristics is detailed in Table 1.

All women had received information on diet and lifestyle guidelines during pregnancy via a health professional other than a doctor (health visitor/nurse/midwife etc), and 78% from a doctor. Data describing women's comprehension of public health messages are shown in Table 2. Knowledge and awareness was generally good, a high percentage (89%) being able to identify the benefit of taking folic acid, only 1 woman (6%) had not received advice about taking folic acid supplements and had not taken them during pregnancy. However, only 61% of the women knew foods fortified with folic acid. Women were able to identify foods that are good sources of iron (83%) but had more difficulty explaining why it is important in the diet, 72% recognising the role iron plays in preventing anaemia and "to keep your blood healthy" and only 67% correctly identified orange juice as a means of improving iron absorption. 78% correctly identified the role of Vitamin D in prevention of rickets, and when asked 67% selected the correct sources of Vitamin D from those listed (sardines, sunlight and some breakfast cereals being good

Maternal characteristic	Mean \pm SD	n	%
Age (years)	36 (6.4)		
BMI (kg/m ²)*	26 (4.0)		
Normal (18.5-24.9 kg/m ²)		7	39
Overweight (25.0-29.9 kg/m ²)		9	50
Obese (\geq 30.0 kg/m ²)		2	11
Ethnicity			
White		16	89
Black		2	11
Marital status			
Never married		3	17
Currently married		11	61
Living with partner		4	22
Education			
CSE		3	17
GCSE O' Level		14	78
A' Level/Highers		9	50
Teaching diploma, HNC, HND		2	11
Degree		10	56
Post graduate Degree		5	28
Other		2	11
NS-SEC** of partner			
Managerial and professional occupations		10	44
Intermediate occupations		5	39
"Routine and manual occupations		3	17
Never worked and long-term unemployed"			
Employment Status			
Working full time		7	39
Working part-time		4	22
Not currently working		6	33
Not stated		1	6
Number of children			
0		7	39
1		5	28
2		4	22
3		2	11

Table 1. Socio-demographic summary and maternal characteristics of study recruits (continuous data is presented as mean values \pm standard deviation, categorical variables as counts and frequencies)

* James *et al.*, WHO, 2004.

**NS-SEC is based on The National Statistics Socio-economic Classification Analytic Classes, 2001

Item	Total study n=18 Response %
Do you know the benefit of taking folic acid?	
Yes	Accurate* 94
No	Inaccurate** 6
Please state the benefit if you know it. (e.g. to prevent neural tube defects)	Accurate 89 Inaccurate 11
Please state which foods are fortified with folic acid? (e.g. breakfast cereals)	Accurate 61 Inaccurate 39
Please state why iron is important in your diet, if you know. (e.g. to prevent anaemia)	Accurate 72 Inaccurate 28
State some foods that are good sources of iron? (e.g. red meat)	Accurate 83 Inaccurate 17
Which of the following helps with the absorption of iron in the body? (e.g. orange juice)	Accurate 67 Inaccurate 33
Which of the following does Vitamin D protect against? (e.g. to prevent rickets in offspring)	Accurate 78 Inaccurate 22
Which of the following is a good source of Vitamin D? (e.g. sunlight, oily fish)	Accurate 67 Inaccurate 33
Which of the following is calcium vital for? (e.g. for bone and teeth development)	Accurate 100 Inaccurate 0
Which of the following is a good source of calcium? (e.g. milk, cheese)	Accurate 94 Inaccurate 6
Which of the following can be affected by high intakes of caffeine? (e.g. to prevent low birth weight)	Accurate 83 Inaccurate 17
Which of the following should you avoid during pregnancy? (e.g. liver, raw/undercooked meats, soft cheese, raw fish)	Accurate 80 Inaccurate 20
If you were suffering from a headache/toothache, which of the following medications would you take? (e.g. Paracetamol)	Accurate 89 Inaccurate 11
Do you know how many units of alcohol are safe to drink whilst pregnant? (e.g. none, 1-2 units)	Accurate 78 Inaccurate 22
	% Accuracy Mean ±SD
Sure Start participants	83 (4)
Facebook participants	78 (14)

Table 2. Accuracy of responses of study participants to questions relating to knowledge and awareness of public health messages

*Accurate is defined having enough knowledge to illicit a healthy behaviour.

**Inaccurate is defined as having insufficient knowledge to illicit a healthy behaviour.

sources, citrus fruits, pasta and green leafy vegetables not). All women had good knowledge of why calcium is vital in the body, and the majority (%) correctly chose milk and cheese as good sources. The women also had good awareness (83%) that high caffeine intakes (>200mg per day or the equivalent of approximately two cups of instant coffee, 2 litres of cola, four 50g bars of plain chocolate or eight 50g bars of milk chocolate) could result in babies of low birth weight, of which foods should be avoided during pregnancy (80%), which form of headache medication (89%) is advisable for pregnant women and the advised level of alcohol consumption during pregnancy (78%). Despite typically good knowledge and awareness of public health messages, it is acknowledged that these results may be skewed due to use of an online data collection method (n=13 respondents), since answers could be researched online prior to completion. All results must therefore be treated with caution. Women recruited through the Sure Start Centre had higher mean knowledge scores than those recruited via Facebook® (83% compared to 78%).

Overall, 78% of respondents considered their diets to be “quite healthy”, 39% strongly agreed that what they eat during pregnancy is very important to “my long term health”, increasing to 61% when considering what they eat during pregnancy is “very important to their child’s long term health”. Encouragingly, when asked about breastfeeding 72% stated they felt breastfeeding was a “good idea” and intended to exclusively breastfeed their baby.

Table 3 displays the percentage responses to questions identifying barriers and motivators to healthier practices. Most women had experienced some form of discomfort during pregnancy with 89% suffering from nausea, 67% heartburn and 67% wanting to eat all the time. Reasons cited for what had prevented them from eating a healthier diet included the perception that their diet was already healthy (67%), lack of time (33%) and cost (33%). Financial changes (e.g., lower cost of healthy food) was stated by half of the women as a motivator for making improvements to the way they ate, while personal health requirements would motivate just 44%. The majority of women in this study (72%) were most likely to participate in light to moderate intensity physical activity (walking, housework, gardening), 33% (n=6) of women “didn’t feel like [exercising] whilst pregnant”. Only 11% (n=2) of women reporting participation in moderate to vigorous intensity activity (jogging, gym class, cycling, swimming etc) for 3 hours or more a week.

Variable	% Response			
What stops you eating a healthier diet?				
I don't have time	33			
It costs too much	33			
I don't have the cooking ability	6			
It doesn't satisfy hunger	22			
My family won't eat healthy foods	6			
It is hard to change my eating habits	17			
It is hard whilst being pregnant	6			
I am not motivated to	11			
Something else	6			
I think my diet is already healthy	67			
What would encourage you to make improvements to the way you eat?				
Advice from doctor or nurse	39			
Advice from family member	11			
My own ill health	44			
Family member's ill health	28			
Increased income	39			
Lower cost of food	50			
Better access to shops and supermarkets	6			
Clearer advice from the government	22			
Clearer labelling of foods	39			
Being motivated to	28			
Something else	6			
Which factors prevent you from doing more physical activity, exercise or sport?				
I'm not the sporty type	6			
I'm worried about injury	6			
I prefer to do other things	11			
I am not motivated to do more	17			
I don't feel like it whilst I'm pregnant	33			
I don't feel it's safe whilst I'm pregnant	11			
Something else	11			
None of these	33			
During the last week, how many hours did you spend on each of the following:	None	<1 hour	>1 hour < 3 hours	> 3 hours
Physical activity of moderate to vigorous intensity (e.g. swimming, jogging, aerobics, football, tennis, gym workout, cycling)	72	6	11	11
Physical activity of light to moderate intensity (e.g. walking, housework, childcare, gardening or DIY)*	0	11	17	72

Table 3. Responses of study participants to questions relating to perceived barriers and motivators to achieving healthier practices during pregnancy

Which of the following conditions have you experienced during pregnancy?	
Nausea	89
Diarrhoea	39
Constipation	56
Eating all the time	67
Throwing up	39
Food cravings	33
Heartburn	67
None of these	6

Overall, would you say that what you usually eat is;	
Very healthy	11
Quite healthy	78
Not very healthy	6
Very unhealthy	0
N/A	6

I think what I eat during pregnancy is very important to my long term health;	
Strongly agree	39
Agree	50
Neither agree or disagree	11
I think what I eat during pregnancy is very important to my child's long term health;	
Strongly agree	61
Agree	28
Neither agree or disagree	11

Table 3. Responses of study participants to questions relating to perceived barriers and motivators to achieving healthier practices during pregnancy

* Categorized using Department of Health (2004) At least five a week: Evidence on the impact of physical activity and its relationship to health. A report from the Chief Medical Officer

No women reported smoking during pregnancy, but 72% of women reported having smoked prior to pregnancy, 28% giving up on confirmation of pregnancy and 44% giving up for another reason. Almost one quarter of the sample reported consumption of alcohol in the previous week, two women consuming 1 unit and two between 2.1–4.2 units of alcohol.

Most women considered themselves to be competent preparing meals using basic ingredients, only 11% reporting completion of such tasks “never or rarely”. The majority (56%) reported eating processed foods never or rarely; however, 39% reported eating fast food more than once a week. The traditional “3 meals a day” (breakfast, lunch and dinner) routine was followed by most (89%), with 44% also snacking between meals.

Variable	% Response
Do you qualify for Healthy Start NHS vouchers?	
I don't know about the vouchers	44
No	56
Meals and snacks	
Breakfast	94
Morning snack	83
Lunch	89
Afternoon snack	83
Dinner/Supper	94
Evening snack	67
What best describes your smoking history?	
I smoked, but I gave up for another reason	44
I smoked, but gave up when I found out I was pregnant	28
I have never smoked	28
During the last week how many of each type of alcoholic drink did you have?	
Beer, lager or cider (no. of ½ pints)	6
1 (1 unit of alcohol)*	94
0	
Wine (no. of glasses)	6
2 (4.2 units of alcohol)	17
1 (2.1 units of alcohol)	78
0	
Spirits (no. of single pub measures)	6
1 (1 unit of alcohol)	94
0	
What are your thoughts about breastfeeding?	
Good idea, I plan to exclusively breastfeed my baby	72
Not sure, I would like more information	6
I plan to both breastfeed and formula feed my baby	17
I plan to feed my baby formula	0
Have you received any advice from your doctor or health visitor regarding your weight during pregnancy?	
No	94
Yes	6
Are you following a prescribed special diet, weight control diet, vegetarian, vegan or macrobiotic way of eating?	
No	89
Yes - vegetarian	11
For your main meal of the day, how often do you: Eat takeaway foods or have meals out?	
More than once a day	0
4-7 times a week	6
1-3 times a week	33
Once in 2 weeks	44
Never or Rarely	17

Table 4.
Supplementary
results of maternal
behaviour

Table 4.
Supplementary results of maternal behaviour

For your main meal of the day, how often do you: Eat a processed meal?	
More than once a day	0
4-7 times a week	0
1-3 times a week	17
Once in 2 weeks	28
Never or Rarely	56
For your main meal of the day, how often do you: Eat a meal you have cooked from basic ingredients (e.g. making a soup or stew from raw ingredients)?	
More than once a day	11
4-7 times a week	39
1-3 times a week	22
Once in 2 weeks	17
Never or Rarely	11
How many times a week do you drink bottled or tap water?	
More than once a day	94
Once in 2 weeks	6

*units of alcohol taken from NHS guidance <http://www.nhs.uk/Livewell/alcohol/Pages/alcohol-units.aspx#table>

DISCUSSION

Public health guidance for pregnant women is understood by a large percentage of women; 89% knew why folic acid is recommended, 80% knew which foods to avoid and 78% knew the safe alcohol intake. Yet translation of knowledge into practice is not consistent. Advice on practices known to influence foetal development had better adherence (94% taking folic acid supplements, only 6% drinking >1–2 units/week of alcohol and no women smoking) than guidelines on diet and lifestyle: only two women adhering to Royal College of Obstetrics and Gynaecology (2006) recommendations for physical activity in pregnancy, for example. The rationale for variable adherence is not yet fully understood, but results presented here are consistent with those seen elsewhere in the literature (Fowles, 2000; Inskip *et al.*, 2009).

The women in this study were mature (mean age 36 years \pm SD 6.4), of higher than average socioeconomic status (educated, employed, with partners who were employed in primarily professional occupations) and over half (61%) were already mothers. These factors may have contributed to higher than average knowledge scores. In addition, 94% of the mothers sampled here reported use of folic acid as guidelines required as compared to 72% in national estimates (SACN, 2006); therefore we can assume they planned pregnancy. Considering this, interpretation of data

describing poor comprehension of how nutrient recommendations could be translated into practical “food-based” skills indicates a high potential for pregnant women to consume insufficient intakes of micronutrients considered particularly important during pregnancy. Studies of dietary intakes among pregnant women have found that women are often not meeting all of their nutritional requirement for pregnancy, particularly for folate and iron (Rogers *et al.*, 1998a; Mouratidou *et al.*, 2006; Inskip *et al.*, 2009; Baker *et al.*, 2009), calcium and vitamin D (Mouratidou *et al.*, 2006; Baker *et al.*, 2009). Although higher levels of knowledge and education may typically be associated with more affluent populations (Darmon and Drewnowski, 2008; Turrell *et al.*, 2003; Robinson *et al.*, 2004), results infer that translation of knowledge to practice cannot be assumed, therefore the need for guidance to promote “healthy dietary choices” may be required by all.

Women may not act on advice about diet and lifestyle during pregnancy for a number of reasons. Over half the women in this study (67%) perceived their diet as “already healthy”, and therefore may consider significant dietary changes unnecessary, particularly if this requires substituting food they like more for food they like less (Rosenstock *et al.*, 1988; Roberts and Marvin, 2011). Cost (33%) time (33%) and difficulty changing eating habits (17%) were also identified as barriers to eating a healthier diet. Similar responses were reported in the Health Survey for England (Craig and Shelton, HSE, 2008) when asked what barriers would prevent them from making improvements to the way they eat, 29% (n=1787) of women responded “I don’t have time” and 21% (n 1294) responded “It costs too much” (Craig and Shelton, HSE, 2008).

Discomfort (nausea, vomiting, food cravings) associated with early-stage pregnancy was experienced by most women in this study. The physicality of these responses can impact on a women’s ability to eat, on the individual food choices they make (Fowles, 2008), and also increase levels of stress and the risk of depression (Chou, 2003; Chou, 2008; Davis, 2004). These factors contribute to inadequate nutrient intakes and increased preference for consumption of energy-dense, nutrient-poor foods (Hurley *et al.*, 2005; Fowles, 2008). This makes advocating dietary change particularly challenging to women suffering these symptoms (Anderson, 2001). Early recognition and management of these conditions can have a significant impact on the health and quality of life of women during pregnancy, however (Ebrahimi *et al.*, 2010).

Women in this study had accessed their information on diet and lifestyle guidelines for pregnancy through a health professional other than a doctor (health visitor/nurse/midwife) with only 78% accessing information from a doctor. Given the traditional contact time with the former group of professionals typically beginning approximately 10 weeks into pregnancy (NICE, 2008), this represents a missed opportunity to advocate healthier diet and lifestyle choices during the critical window of foetal development of embryogenesis. This situation highlights the need for greater efforts to educate nurses and doctors on nutritional advice to enable them to promote such practices within general practice clinics. Interestingly, those women accessing this study via a Sure Start Centre demonstrated higher knowledge scores than those accessing it via Facebook®, and may suggest Sure Start Centres provide women with additional access and opportunities to improve their knowledge of nutrition and public health guidance. Ideally, improved nutritional status must be targeted for all women of child-bearing age as for many pregnancies are unplanned and women may consider changing their diet or lifestyle only on confirmation of pregnancy.

The quality of information concerning nutrition and physical activity during pregnancy given out by GPs and other health professionals can be inconsistent. A lack of time (and in some situations, also competence) often means that this information is given out in text format, and whilst this may influence knowledge about healthier eating, there is an assumption that the woman will read the information, understand it, and process the guidance contained on the leaflet into a change in attitudes, or indeed behaviour (Anderson, 2001). In the absence of medical and nursing training expanding to include core completion of nutritional science modules, a Department of Health funded project conducted by the Association for Nutrition (AfN) has been conducted to raise and enhance nutrition competencies in the wider workforce. Publication of an online toolkit, specifically targeted at improving nutrition competences among frontline workers (e.g., nursery nurses, midwives, pharmacists) is due for launch in late 2012. The intention is to provide a quality assurance framework designed to enable workers who deliver nutrition advice as part of their job to become demonstrably more competent in nutrition by defining ethical, scientific and quality standards for the practice of nutrition and public health nutrition, providing guidance to all levels of the workforce. Thereby increasing the opportunity to reduce nutrition health inequalities among the public (Radford and Hall, 2011). The success of this project is yet to be realised,

but its potential to promote positive health outcomes is—as seen here—required by all healthcare professionals.

CONCLUSION

When designing public health guidelines for women during pregnancy, more consideration should be given to whether poor comprehension and engagement in these guidelines is related to the timing, quality and current strategies of delivering and disseminating public health messages. The opportunities to impact maternal health within the healthcare setting should not be missed. The initiative launched by the Association of Nutrition may go some way to reducing nutrition health inequalities throughout the UK and help improve the quality of nutritional advice given to women during pregnancy.

However, further investigations are now required to understand the most appropriate methods for translating knowledge of public health messages into positive changes in behaviours among women of childbearing age. One approach may be modelling behaviour change strategies on groups who manage to follow public health guidelines or whose health status requires them to follow certain dietary recommendations, such as type 1 diabetics who follow the DAFNE programme (DAFNE Study Group, 2002). This may help to elucidate the motivations and the diversity of influences involved in making a positive behaviour change, as well as informing how to re-create these motivators more consistently in others and could provide a pregnant woman with the tools for adopting healthy eating habits and lifestyle choices, not just during her pregnancy, but throughout her lifetime.

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