VIRTUAL ISSUE: NUTRITION DURING PREGNANCY

Diet and pregnancy: Keeping abreast of changes in advice

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There is no special diet recommended for women before and during pregnancy, and, with a few exceptions, dietary recommendations are, in fact, very similar to those for other adults. The World Health Organization (WHO) promotes a healthy diet based mainly on plant foods (WHO 2001) and in the UK, the main recommendation is to eat a healthy, balanced diet based on the '*Eatwell Plate'* model (DH 2009). However, it is particularly important for women who are trying to conceive or who are pregnant to be made aware of the specific recommendations that apply during pregnancy, for example taking folic acid supplements to reduce the risk of neural tube defects (NTDs). There are also recommendations regarding food safety, for example the avoidance of certain foods to minimise the risk of food borne illness from harmful bacteria.

Pregnancy is an ideal opportunity for health professionals to encourage positive dietary and lifestyle behaviour change as women are motivated to adapt their food and lifestyle choices to do the best for their unborn child. It is therefore essential that we capitalise on this opportunity and offer up-to-date, evidence-based and consistent advice on diet, weight gain, dietary supplements, and food safety. We are therefore delighted to be involved in this virtual issue collating recent papers from *Nutrition Bulletin* and *Maternal and Child Nutrition* (MCN) to produce a valuable resource for health professionals looking for the latest information on a wide range of topics in this area.

The British Nutrition Foundation's (BNF) *Briefing Paper* on 'Nutrition in Pregnancy' has continued to be within the list of the top ten papers downloaded from *Nutrition Bulletin* since its publication in 2006. This paper reviews the physiological changes that occur during pregnancy; the influence of maternal diet and nutritional status on fetal outcome; food safety issues; diet-related conditions during pregnancy, such as anaemia and gestational diabetes; and issues relating to specific groups, including vegetarians and teenagers (Williamson 2006). In addition, it discusses the dietary recommendations in the UK for women both prior to and during pregnancy, together with their evidence base. However, some of these recommendations have changed over the last few years, as subsequent articles in our journal have highlighted (Miles 2008; Miles & Buttriss 2010; Miles & Foxen 2009). For those accessing the *Briefing Paper*, this virtual issue enables us to ensure awareness of all relevant changes in advice in the UK. This accompanying editorial outlines the significant changes in dietary recommendations before and during pregnancy and includes other updates in this area, including around

folic acid fortification in the UK. Although the focus is on developments within the UK, we also highlight global advice of relevance. In so doing, we call attention to the inconsistencies inherent in the nutrient recommendations for this population across the world, as highlighted in a recent supplement in MCN (EURRECA: How to Derive Recommendations for Infants, Children, Adolescents, Pregnant and Lactating Women: 2010, Volume 6, Supplement 2). We acknowledge that food and nutrition decision making during pregnancy is contingent on macro-level (structural) factors such as socio-economic and political contexts, gender relationships and food availability, along with micro-level factors such as local practices, norms, lifestyles, attitudes and beliefs. With this in mind, this virtual issue also presents recently published work that highlights some of the biopsychosocial and environmental influences on the nutrition of pregnant women.

Alcohol

The question of whether moderate alcohol consumption during pregnancy is linked to health risks for the offspring has been widely debated for some years. Despite the lack of evidence of detrimental effects on any outcome at low-to-moderate maternal alcohol consumption (<10 units/week), many professional bodies err on the side of caution. The WHO recommends abstinence from alcohol during pregnancy and similar advice is given in North America (United States and Canada) and Australia. In 2008 the UK's National Institute of Health and Clinical Excellence (NICE) issued revised guidance on alcohol consumption during pregnancy, as part of its clinical guideline on antenatal care, 'Antenatal care: routine care for the healthy pregnant woman', and advised that pregnant women and those planning a pregnancy avoid alcohol in the first three months of pregnancy (NICE 2008). This created a number of media headlines, which were discussed in a *Facts Behind the Headlines* article by Lisa Miles in 2008 (Miles 2008). The new clinical guideline is largely consistent with the Department of Health's advice since 2007, which also advises pregnant women and those trying to conceive to avoid alcohol completely (DH 2007). Before 2007, the DH recommended that pregnant women and those who may become pregnant should drink no more than 1-2 units of alcohol, once or twice a week at any stage of pregnancy, and should avoid binge drinking (DH 1995).

Interestingly, the 2008 NICE advice was not driven by the emergence of new scientific evidence and this is acknowledged by both the Department of Health and NICE. This is perhaps why there is a lack of clarity about the necessity for pregnant women to avoid alcohol completely.

Caffeine

The Food Standards Agency (FSA) revised its advice on maternal caffeine intake in 2008 following new research that linked levels of caffeine intake above 200mg/day with an increased risk of giving birth to a baby with low birth weight. Prior to this, the FSA's intake guidance figure was no more than 300mg/day. This benchmark was based on a

review conducted in 2001 by the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) which concluded that caffeine intakes above 300mg/day may be associated with low birth weight and, in some cases, miscarriage. However, COT acknowledged at the time that the evidence was inconclusive. Hence, the FSA funded further research on the effects of caffeine in pregnancy which supported the new threshold of 200mg/day as the safe limit to help minimize the risk of fetal growth restriction. This change in advice also caught the attention of the media and was summarised in a *Facts Behind the Headlines* article by Miles and Foxen in 2009 (Miles & Foxen 2009).

Peanuts

In 2009, the Government in the UK revised its guidance on maternal peanut consumption during pregnancy and breastfeeding. Pregnant women in the UK are now advised that they can choose to eat peanuts or foods containing peanuts irrespective of whether their child has a family history of allergies. Previously, the Government issued precautionary advice to avoid eating peanuts during pregnancy if there was a history of allergy in the child's immediate family. The advice changed because the latest research, based on a systematic review commissioned by the FSA and conducted by the British Nutrition Foundation, demonstrated that there is no clear evidence that eating or not eating peanuts during pregnancy, breastfeeding or early childhood affects the chances of a child developing a peanut allergy (Thompson et al. 2010). This advice is in line with that given in many other countries and in the US the March of Dimes now advises that women who are not allergic to peanuts can safely eat peanuts during pregnancy. The change in advice in the UK is discussed in a *News and Views* article by some of those involved in the systematic review at BNF. This article highlighted the need for careful communication of the new advice by health professionals (Miles and Buttriss 2010).

Folic acid fortification

Since the early 1990s when research showed that daily consumption of 400 µg of folic acid before conception and during early pregnancy dramatically reduces the occurrence of neural tube defects (NTDs) (MRC 1991, Czeizel & Dudas 1992), governments and health organisations worldwide have made recommendations for women, before and during pregnancy, to take folic acid supplements. If adequate folic acid is taken before conception and in the early stages of pregnancy, it can prevent 50-70% of NTDs, which annually affect more than 300,000 pregnancies worldwide (CDC 2009, Christianson et al. 2006).

In 2000, the UK Department of Health Committee on Medical Aspects of Food and Nutrition Policy (COMA) published a report on 'Folic acid and the prevention of disease'. The report concluded that fortification of flour with folic acid would prevent a significant proportion of births affected by NTDs in the UK (COMA 2000). In 2002, the Food Standards Agency (FSA) Board started discussions on the possibility of folic acid

fortification in the UK. The Scientific Advisory Committee on Nutrition (SACN), an independent group of scientific experts who advise the Government, also began reviewing the reported risks and the benefits. In 2004, UK Health Ministers requested consideration of the wider impact of folic acid fortification. At this stage, it was decided that mandatory fortification should not be implemented, due to outstanding concerns about vitamin B_{12} deficiency, especially in the elderly. However, in December 2006 after the review, SACN recommended that mandatory fortification should be introduced and the FSA launched a consultation on the proposal to fortify flour with folic acid prior to ministers making a final decision in May 2007 (MRC 2007).

In May 2007, the FSA Board agreed unanimously that mandatory fortification with folic acid of either bread or flour should be implemented, together with recommendations on controls of voluntary fortification for manufacturers and advice for the public on folic acid supplementation. However, mandatory fortification was not introduced at this time because the Chief Medical Officer requested SACN to consider emerging research that suggested folic acid might increase the risk of colorectal cancer. SACN reviewed the evidence and agreed, in October 2009, to maintain its previous recommendation for the implementation of mandatory fortification with folic acid, with controls on voluntary fortification. In addition, SACN advised that people at higher risk of developing colorectal adenomas or colorectal cancer (i.e. people over 50 and those with a history of colorectal adenomas) should not take folic acid supplements containing more than 200µg a day without medical advice. However, due to the subsequent change in Government and the restructure of the FSA and DH, it is unlikely that there will be a move towards mandatory fortification.

At the global level, nearly 60 countries have already introduced mandatory folic acid fortification of flour to prevent NTDs (see table 1) (Flour Fortification Initiative (FFI) 2010a), although not yet within the EU. Incidentally, the prevalence of NTDs tends to be lower in these countries.

Table 1: Countries with mandatory fortification of flour with folic acid

Central and Eastern Europe	**East & Southeast Asia**	**North America**	**Sub-Saharan Africa**
Kazakhstan	Indonesia	Canada	Côte d'Ivoire
Kyrgyz Republic		United States	Ghana
Turkmenistan			Guinea
			Senegal
			South Africa
Caribbean	**Middle East/North**	**Latin America**	**Oceania**
Barbados	Africa	Argentina	Australia
Cuba	Bahrain	Belize	Fiji
Dominican Republic	Egypt	Bolivia	Vanuatu
Grenada	Iran	Brazil	
Guadeloupe	Iraq	Chile	
Guyana	Jordan	Colombia	
Haiti	Kuwait	Costa Rica	
Jamaica	Mauritania	Ecuador	
Puerto Rico	Morocco	El Salvador	
Saint Vincent	Oman	Guatemala	
	Palestine, Occupied Territory	Honduras	
		Mexico	
	Qatar	Nicaragua	
	Saudi Arabia	Panama	
	Yeman	Paraguay	
		Peru	
		Suriname	
		Uruguay	

Source: FFI (2010b) Fortification Status – June 2010 Available at : www.sph.emory.edu/wheatflour/globalmap.php

The countries that have introduced legislation are at various stages in the flour fortification process and any evaluation of the effectiveness of the intervention (table 2). However, the number of NTDs that may be prevented through flour fortification will, of course, depend on how much folic acid is added to flour and the baseline prevalence.

Table 2: Examples of the impact of global folic acid fortification on NTD prevalence

Country	Introduction of mandatory folic acid fortification	Quantity and delivery method	Decrease reported in NTD prevalence since introduction of folic acid fortification
Canada	November 1998	150µg/100g wheat flour	46% by 2002[a]
Chile	January 2000	220 µg/100g wheat flour	40% by 2002[b]
Costa Rica	1999 2000 2001	180µg/100g wheat flour 180µg/100g maize flour 40µg/100g milk	35% by 2000[c]
South Africa	October 2003	150µg/100g wheat flour 221 µg/100g maize meal	31% by 2005[d]
United States	November 1998	140µg/100g wheat flour	27% by 2000[e]

[a]De Wals et al. 2007; [b]Hertrampf & Cortés 2004; [c]Chen & Rivera 2004 ; [d]Sayed et al. 2008 ; [e]CDC 2004

Vitamin D

Low vitamin D status is common in pregnancy. For example, in a study of pregnant women in Southampton, during 1990–1991, the prevalence of vitamin D deficiency was 31% among white Caucasian women (Javaid et al. 2006). The Reference Nutrient Intake (RNI) for vitamin D for pregnant and lactating women is 10µg/day, and daily vitamin D supplements containing 10µg/day are advised (DH 1991). The most recent antenatal guidance from the National Institute for Health and Clinical Excellence (NICE) (2008), advises health professionals to inform pregnant women about the importance of maintaining adequate vitamin D stores during pregnancy and to advise them to take supplements of 10µg/day, particularly for high risk women such as women of South Asian, African, Caribbean or Middle Eastern family origin or women who are housebound. Prior to this 2008 advice, NICE's position had been that there was insufficient evidence to evaluate the effectiveness of vitamin D supplementation in pregnancy and that, in the absence of evidence of benefit, vitamin D supplementation should not be offered routinely to pregnant women (NICE 2003). Inconsistency between these recommendations has led to a lack of clarity for health professionals giving advice to the general public (SACN 2007).

Global recommendations also vary regarding supplementation during pregnancy. The WHO/FAO and Australia/New Zealand suggest 5µg/day

(www.moh.govt.nz/moh.nsf/pagesmh/4678], as recommended for adult non-pregnant women (19-50y). Recommendations in US/Canada are 15 ug/day, assuming minimal exposure to sunlight. Recommendations for women in Europe vary between 5 (Germany, Austria and Switzerland) and 10 ug/day (Belgium).

Weight gain

The issue of weight gain during and after pregnancy was highlighted by the recent NICE guidelines on this issue (NICE 2010, Riley 2011). Almost half of all women of childbearing age in England are overweight or obese, and this number is predicted to rise significantly in the coming years (The NHS Information Centre 2010). Weight gain during pregnancy varies a great deal and is often dependant on pre-pregnancy weight. However, it influences both maternal and infant health outcomes as well as postpartum weight retention. Women weighing more than 100kg may require specific advice from a health professional but such advice needs to be given sensitively to ensure that women are not encouraged to 'diet' but to remain active through normal daily activity and exercise.

In the UK, at present, there are no formal, evidence-based guidelines from the UK government or professional bodies on what constitutes appropriate weight gain during pregnancy (NICE 2010). However, COMA's report on dietary reference values advises that women do not need to increase their energy intakes during the first two trimesters. It is only during the last trimester that an additional 200kcal a day is needed (DH 1991). Having reviewed the evidence, recently, the SACN's Energy Requirements Working Group agreed in a draft report that this additional intake remains appropriate (SACN 2009). Riley (2011) describes the recently updated US Institute of Medicine guidelines, which recommend that healthy American women who are of normal weight for their height (Body Mass Index (BMI) 18.5 to 24.9) should gain between 11.5-16kg (25-35lbs) during pregnancy. Overweight women (BMI 25.9 to 29.9) should gain less, 7-11kg (15-25lbs), and obese women (BMI >30.0) should gain only 5-9kg (11-20lbs) (IOM 2009).

The controversy over the clinical utility of gestational weight gain has been reviewed recently in MCN (Amorim et al 2008). Whilst there is a growing body of literature that indicates that weight gain during pregnancy is an inexpensive anthropometric indicator to monitor maternal and fetal nutritional status, predict pregnancy outcomes and identify women at risk, others have argued that the relationship between maternal weight gain and pregnancy outcomes is not strong enough to make it a sensitive or specific screening tool for identifying undesirable outcomes. Much of the contention is related to when weight measurements are taken, and research has suggested that only maternal weight at entry to prenatal care is significantly associated with birth weight. Possible reasons for weak or non-significant associations between gestational weight gain and maternal and neonatal outcomes are due to the poor quality of obstetric records and selection of the wrong indicators to compute gestational weight gain. Amorim et al. (2008) examined the strengths and limitations for measuring gestational

weight gain and postpartum weight changes and provided valuable insights into the implications for practice.

Variability in micronutrient recommendations for pregnancy across Europe

Berti et al. (2010) described the effect of prenatal micronutrients on pregnancy, lactation and postnatal outcomes and discussed the critical issues in setting micronutrient recommendations for pregnant women. This paper illustrated the heterogeneity of micronutrient recommendations that exists across Europe. For example, recommendations for zinc intake vary from 7 mg/day in Italy and the UK to 20 mg/day in Spain, whereas iodine recommendations range from 135 (Spain) to 230 ug/day (Germany and Austria) (Berti et al 2010). As nutrient recommendations form the basis of food policy and food-based dietary guidelines, and are used in nutrition labelling, the need to harmonise recommendations across Europe is clear. As well as the physiological variations of pregnancy, Berti et al. (2010) also described the macro-level factors, such as socio-economic and political context and food availability, along with micro-level factors, such as local cultural practices, norms, lifestyles and beliefs, which influence food consumption in this population.

Birth spacing and maternal nutrient depletion

Short birth intervals could adversely affect the nutritional status of both mother and child by allowing the mother insufficient time to recover from the nutritional burden of pregnancy. If the mother breastfeeds the nutritional impact may be larger still, as lactation represents an even greater nutritional burden than pregnancy (Dewey 2004). Dewey & Cohen (2007) published a systematic review to address the question of whether a short birth interval, with or without the additional burden of lactation, is associated with adverse nutritional outcomes for the mother or the child. They reported that, in studies conducted in non-industrialised countries, longer birth interval was associated with a lower risk of child malnutrition in some populations. The findings for maternal anthropometric and micronutrient status were less clear, although there may be an increased risk of maternal anaemia when interpregnancy interval is short. Dewey and Cohen (2007) claim that, while maternal nutrient depletion can and does occur, encouraging a longer interval between pregnancies is not likely to be an effective means to prevent this outcome. Rather, nutrition support for women before, during and after pregnancy may be a more promising approach.

Maternal age and nutritional requirements in pregnancy

Maternal age represents a critical factor in nutritional requirement, particularly during pregnancy. Adolescent pregnancy is associated with poor obstetric outcomes, particularly with respect to fetal growth restriction and preterm delivery. As approximately one fifth of all births worldwide are to adolescent mothers, this

represents a significant global public health issue. A systematic review has identified that intakes of energy, iron, folate, calcium, vitamin E and magnesium of pregnant adolescents are lower than recommended intakes (Hall Moran 2007a). A systematic review published provided evidence to suggest that indicators of anaemia and iron status are compromised in pregnant adolescents, particularly in the third trimester (Hall Moran 2007b), a concern since iron deficiency anaemia has been associated with reduced fetal oxygenation and poor birth outcomes, such as greater risk of low birth weight, prematurity and an increased perinatal mortality. A recent prospective, observational study drew attention to the extent of the problem in the UK. Baker et al. (2009) highlighted a clear relationship between maternal folate and iron status and the incidence of small for gestational age (SGA) birth and preterm delivery amongst adolescents. They also reported the high incidence of poor vitamin D status in pregnant adolescents, who derived only a small proportion of their vitamin D requirements from dietary sources. Of additional concern was the lack of a correlation between serum 25(OH)D concentration and ambient solar radiation in darker-skinned adolescents, implying that these individuals were unable to absorb sufficient ultraviolet B radiation, even during the summer months. Poor maternal vitamin D status may result in impaired maternal-fetal transfer of 25(OH)D and consequently reduced bone mineral content during infancy and childhood (Javaid et al 2006). Such research highlights the urgent need to address poor nutritional status of adolescents during pregnancy.

Developmental origins of adult disease

Nutrition during pregnancy has long-lasting effects on the wellbeing of the mother and fetus, and may further influence the health of the offspring in later life. The developmental origins of adult disease is a concept based on the consequences of fetal response to its environment. Whereas early research focused on birth size and it's relation to adult disease (Barker & Osmond 1986), more recent data strongly suggest that size itself is not part of the causal pathway leading to disease. Instead the consensus is that the pathway is one of the early environmental cues inducing changes in functional development that in turn alter disease risk. Nutritional signals, conveyed to the fetus through maternal diet, are likely to be of the greatest relevance to this phenomenon. In their MCN paper, Gluckman and colleagues (2005) review these issues and place the underlying biology in the broader perspective of evolutionary and life history concepts. They suggest that the identification of optimal nutritional regimens for women before and during pregnancy, which may have important implications for prevention and intervention given the current epidemic of childhood obesity and adult metabolic and cardiovascular disorders, remain a critical knowledge gap. An article by Wyness (2011) highlights the forthcoming Task Force Report from the British Nutrition Foundation on this topic.

Supporting Health Professionals

Recommendations during pregnancy continue to change from time to time as new evidence emerges and guidelines are published. It is hoped that this joint virtual issue, which brings together a collection of articles describing recent changes in nutritional recommendations as well as critical contemporary issues that impact on these requirements during pregnancy, will act as a useful resource for all those advising and supporting women before, during and after their pregnancy. It is also particularly timely as the Foundation has recently produced new website-based information for pregnant women and new mums (For more information visit www.nutrition4baby.co.uk).

References

Amorim AR, Linne Y, Kac G *et al*. (2008) Assessment of weight changes during and after pregnancy practical approaches. *Maternal & Child Nutrition* 4, 1-13

Baker PN, Wheeler SJ, Sanders TA *et al.* (2009) A prospective study of micronutrient status in adolescent pregnancy. *American Journal of Clinical Nutriiton* 89, 1114-24.

Barker DJ & Osmond C (1986) Infant mortality, childhood nutrition, and ischaemic heart disease in England and Wales. *Lancet* 1, 1077-1081

Berti C, Decsi T, Dykes F *et al.* (2010) Criticak issuesin setting micronutrinet recommendations for pregnant women: an insight. *Maternal & Child Nutrition* 6 (Suppl 2), 5-22

CDC (Centers for Disease Control and Prevention) (2004) Spina Bifida and Anencephaly Before and After Folic Acid Mandate - United States, 1995-1996 and 1999-2000. Available at: www.cdc.gov/mmwr/preview/mmwrhtml/mm5317a3.htm (accessed 19 November 2010).

CDC (Centers for Disease Control and Prevention) (2009) Facts About Folic Acid. Available at: www.cdc.gov/ncbddd/folicacid/about.html (accessed 19 November 2010).

Chen LT & Rivera MA (2004) The Costa Rican Experience: reduction of neural tube defects following food fortification programs. *Nutrition Reviews* 62: S40-43

Christianson A, Howson CP & Modell B (2006) March of Dimes global report on birth defects: the hidden toll of dying and disabled children. March of Dimes Birth Defects Foundation, White Plains, USA.

COMA (Committee on Medical Aspects of Food and Nutrition Policy) (2000) Folic acid and the prevention of disease. TSO: London.

Czeizel AE & Dudas I (1992) Prevention of the first occurrence of neural tube defects by periconceptional vitamin supplementation. *New England Journal of Medicine* 327: 1832-1835

DH (Department of Health) (1991): Dietary Reference Values for Food Energy and Nutrients for the United Kingdom. Report on Health and Social Subjects No. 41. HSMO, London.

DH (Department of Health) (2007) Updated alcohol advice for pregnant women. Available at: www.dh.gov.uk (accessed 30 November 2010).

DH (Department of Health) (2009) The Pregnancy Book. COI: UK.

DH (Department of Health) (1995) Sensible Drinking. The Report of an Inter-departmental Working Group. Department of Health: London.

Dewey KG (2004) Impact of breastfeeding on maternal nutritional status. In: Protecting Infants Through Human Milk: Advancing teh Scientific Evidence Base (eds LK Pickering, AL Morrow, GM Ruiz-Palacios & RJ Schanler) pp 91-100. Kluwer Academic/Plenum Publishers: New York

Dewey KG & Cohen RJ (2007) Does birth spacing affect maternal or child nutritional status? A systematic review. *Maternal & Child Nutrition* 3, 151-173

De Wals P, Tairou F, Van Allen MI et al. (2007) Reduction in neural tube defects after folic acid fortification in Canada. *The New England Journal of Medicine* 357: 135-142.

FFI (Flour Fortification Initiative) (2010a) Effectiveness, Safety and Economics of Fortifying Flour with Folic Acid. Available at: www.sph.emory.edu/wheatflour/DOCS/FFIFolicAcidStatement.pdf (www.FFInetwork.org)

FFI (Flour Fortification Initiative) (2010b) Fortification Status – June 2010 Available at : www.sph.emory.edu/wheatflour/globalmap.php

Gluckman PD, Hanson MA & Pinal C (2005) The developmental origins of adult disease. *Maternal & Child Nutrition* 1, 130-141

Hall Moran V (2007a) A systematic review of dietary assessments of pregnant adolescents in industrialized countries. British Journal of Nutrition 97, 411-425

Hall Moran V (2007b) Nutritional status in pregnant adolescents: a systematic review of biochemical markers. *Maternal & Child Nutrition* 3, 74-93

Hertrampf E & Cortés F (2004) Folic acid fortification of wheat flour: Chile. *Nutrition Reviews* 62(6): S44-48.

Javaid MK, Crozier SR, Harvey NC *et al.* (2006) Maternal vitamin D status during pregnancy and childhood bone mass at age 9 years: a longitudinal study. *Lancet*. 367: 36–43.

MRC (Medical Research Council) Vitamin Study Research Group (1991) Prevention of neural tube defects. *Lancet* 338: 131-137.

MRC (Medical Research Council) (2007) Folic acid. Available at: www.mrc.ac.uk/Achievementsimpact/Storiesofimpact/Folicacid/index.htm (accessed 19 November 2010)

Miles, L. (2008). Alcohol in pregnancy: is there a safe amount? *Nutrition Bulletin* 33(3): 224-226.

Miles, L. & J. L. Buttriss (2010). Government advice revised – early life exposure to peanut no longer a risk factor for peanut allergy. *Nutrition Bulletin* 35(3): 240-244.

Miles, L. & R. Foxen (2009). New guidelines on caffeine in pregnancy. *Nutrition Bulletin* 34(2): 203-206.

NICE National Institute for Health and Clinical Excellence) (2003) Antenatal care: routine care for the healthy pregnant woman
http://guidance.nice.org.uk/CG62

NICE (National Institute for Health and Clinical Excellence) (2008) Antenatal care: routine care for the healthy pregnant woman
www.nice.org.uk/nicemedia/pdf/CG062NICEguideline.pdf

NICE (National Institute for Clinical Excellence) (2010) Dietary interventions and physical activity interventions for weight management before, during and after pregnancy. NICE Public Health Guidance 27.Available at: www.nice.org.uk/nicemedia/live/13056/49926/49926.pdf (accessed 7th October 2010)

Riley H (2011) Weight management before, during and after pregnancy – what are the 'rules'? *Nutrition Bulletin* 36(2) 212-215.

SACN (Scientific Advisory Committee on Nutrition) (2007) Update on vitamin D. www.sacn.gov.uk/pdfs/sacn_position_vitamin_d_2007_05_07.pdf

SACN (Scientific Advisory Committee on Nutrition) (2009). SACN Energy Requirements Working Group Draft Report. Available at: www.sacn.gov.uk/pdfs/5nov_sacn_energy_drafting_group_draft.pdf

Sayed AR, Bourne P, Pattinson R *et al.* (2008) Decline in the prevalence of neural tube defects following folic acid fortification and its cost-benefit in South Africa. *Birth Defects Research* (PrtA): *Clinical and Molecular Teratology*. 82: 211-216.

The NHS Information Centre (2010) Health Survey for England – 2009: trend tables. Available at: www.ic.nhs.uk (accessed 11 March 2011).

Thompson R, Miles L, Lunn J *et al.* (2010) Peanut sensitisation and allergy: influence of early life exposure to peanuts. *The British Journal of Nutrition* 26: 1–9.

WHO (World Health Organization (2001) Healthy eating during pregnancy and breastfeeding. Available at: www.euro.who.int/__data/assets/pdf_file/0020/120296/E73182.pdf

Williamson, C. S. (2006). Nutrition in pregnancy. *Nutrition Bulletin* 31(1): 28-59.

Wyness L (2011) Diet during pregnancy can lead to obesity in offspring. *Nutrition Bulletin* 36(3)(in press).