



GUIDANCE BOOK: NUTRITION IN PREGNANCY

PORT SUDAN
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PRESENTATION OF THE GUIDELINE

The importance of good nutrition in the early development of infants and children has been recognized for many decades. Moreover, it has been accepted that a pregnant woman should prioritize the needs of the fetus and sacrifice her own nutrient reserves to ensure its optimum development.

Household food insecurity is one of the primary underlying causes of malnutrition in Sudan. One out of three Sudanese suffers food deprivation and over 46 per cent are classified as poor. In 2014, the number of persons experiencing food insecurity went from 4.2 million in July to 5.7 million in August.

Inadequate food intake and poor dietary diversity in many households are linked to the high prices of food and basic commodities, poor harvests and limited knowledge of nutrition. Recently, food prices are 150 per cent higher than the average of the last five years. Additionally, Sudan is the fifth most food insecure country in the world – ranking 74th out of 78 countries (in the 2013 Global Hunger Index).

The high levels of maternal undernutrition across the country are contributing to the high levels of child stunting. The nutritional status of the mother has intergenerational effects, not only affecting her pregnancy and birth outcomes, but also the growth and development of her child. Micronutrient deficiencies during the critical window of opportunity – the first 1,000 days, starting from pregnancy through to a child's second birthday – can have long-lasting implications for the growth and development of a child.

In Sudan, the highest level of maternal undernutrition is in Red Sea State, where one in every three mothers is malnourished. This is followed by North Darfur (26 per cent). In Haia locality (Red Sea State) up to 62 per cent of mothers are undernourished. A prevalence of maternal undernutrition greater than 50 per cent is classified as extreme. Yet, strong interventions to improve maternal nutrition are not to be seen in Sudan (UNICEF 2014).

Furthermore, the uptake of antenatal care (ANC) services is correspondingly low. At the state level, only three states reported four or more ANC visits to more than 50 per cent of pregnant women. The lowest coverage reported was in two localities in Red Sea State (0 and 2 per cent coverage).

Moreover, 10 per cent of Sudanese girls are married before reaching the age of 15 and 38 per cent are married before the age of 18, which has detrimental consequences for health and nutrition. Maximum adult height can be reached as early as 16 years or – particularly for populations such as Sudan with high rates of undernutrition – as late as 23 years. Thus, undernourished adolescent girls may not have

finished growing before their first pregnancy, predisposing them to deliver low birth weight (LBW) babies. In Sudan, the prevalence of LBW babies is 31 per cent.

This guideline has been prepared to help doctors, registrars and consultants on prevention, diagnosis and treatment of the most common nutritional problems occurred in pregnant and lactating mothers at the Teaching Referral Obstetric Hospital of Port Sudan. The guideline is based on the most recent national and international references of nutrition in pregnancy.

I would like to thank all the people that worked on and revised the guideline, especially Dr. Mohamed Aladin Ali and Dr. Ahmed Ibrahim Abusin, registrar and Medical Director of the Teaching Obstetric Hospital. Finally, I would like to thank A.I.S.P.O. organization and the Italian Agency for Development Cooperation for the great effort in support of maternal health and their contribution on reduction of maternal mortality, providing an appropriate working environment in our Hospital and promoting high performance of health workers.

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INTRODUCTION

The importance of good nutrition in the early development of children has been recognized for many decades. While it has been generally accepted that a pregnant woman would prioritize the needs of the fetus and sacrifice her own nutrient reserves to ensure its optimum development, it is also known that poor nutritional conditions before and during pregnancy can induce short-term and lasting changes in the size, composition and metabolic responsiveness of the offspring.

Epidemiological analyses and animal studies have shown that these nutritional influences early in life can influence the responsiveness of the body to the nutritional environment much later in life. The nutritional well-being of women as they conceive affects not only the development of the fetus but also the genetic organization of the future metabolic responsiveness of the child and, later, the adult. This area of epigenetics has become one of the fastest growing and most complex areas of biological science.

Women who are overweight when entering pregnancy or who gain excess weight during pregnancy may well be establishing an intergenerational amplification of the obesity epidemic. There is no doubt that a mother's nutritional status affects her child as an infant; it also affects that child's risk of obesity and related chronic disease as an adult.

This important development in the understanding of the intergenerational impact of nutrition leads to new policy challenges. The present report raises critical questions for protecting and promoting public health through maternal and infant nutrition. The current epidemics of obesity, diabetes and related chronic diseases are of increasing concern for national health authorities and for WHO, with international agreement to arrest and then reduce the prevalence of obesity and diabetes across the globe. With the establishment of WHO's Commission to End Childhood Obesity, it is particularly timely for the WHO European Region to review current practices and promote policies to improve maternal and childhood nutrition across the Region. The World Obesity Federation fully supports this initiative and the work of WHO in confronting this important public health challenge.

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ACRONYMS

LBW: low birth weight

ANC: antenatal care

PNC: postnatal care

BMI: body mass index

RBC: red blood cell

PTH: plasma parathyroid hormone

SGA: small-for-gestational-age

GDM: gestational diabetes mellitus

WHO: world health organization of the United Nations

FAO: food and agriculture organization of the United Nations

WFP: world food program of the United Nations

MCV: mean cell volume

MCHC: mean corpuscular hemoglobin concentration

HB: Hemoglobin

IV: intravenous

IM: intramuscular

PPH: postpartum haemorrhage

CEMOC: Comprehensive emergency obstetric care

BEMOC: basic emergency obstetric care

IOL: induction of labour

CS: cesarean section

LMWH: low molecular weight heparin

INDICE

1. GUIDELINES FOR GOOD NUTRITION PREPARING FOR A HEALTHY PREGNANCY (PRECONCEPTION)	8
2. NUTRITION DURING PREGNANCY.....	12
3. VITAMIN D IN PREGNANCY.....	22
4. CALCIUM SUPPLEMENTATION IN PREGNANT WOMEN ...	28
5. GUIDELINE FOR THE MANAGEMENT OF ANAEMIA IN PREGNANCY AND POSTNATALLY	30
6. GESTATIONAL DIABETES NUTRITION GUIDELINES.....	37
7. MANAGEMENT OF WOMEN WITH OBESITY IN PREGNANCY	44
MAIN RESOURCES	50

1. GUIDELINES FOR GOOD NUTRITION PREPARING FOR A HEALTHY PREGNANCY (PRECONCEPTION)

INTRODUCTION

Good nutritional status before conception is important for the future health of both mother and baby so that the body is in a positive nutritional state at conception (vital brain and organ development occurs during the very first few weeks of pregnancy) and can deal well with the additional demands of pregnancy.

A diet providing appropriate amounts and types of energy, protein, vitamins, minerals and fluid will:

- minimize the risk of maternal and fetal deficiencies.
- improve the chance of a healthy and successful pregnancy for mother and baby.
- prepare for breastfeeding by increasing body stores of some nutrients.

In addition, there is increasing evidence that maternal nutritional status and dietary intake at conception and during pregnancy can affect the child's future development and health throughout life.

Additional food and dietary considerations for girls and women who may become pregnant are outlined below and include:

- healthy weight (under/overweight)
- folic Acid
- iron
- vitamin D
- vitamin A supplements and liver
- fish
- medicines and supplements.

HEALTHY WEIGHT

Fertility and the ability to conceive and successful pregnancy outcome can be affected by underweight, overweight or obesity, eating disorders and excessive alcohol consumption.

UNDERWEIGHT

Women who are underweight (Body Mass Index /BMI < 18.5) may find it more difficult to conceive, are more likely to produce low birth weight infants and are at a greater risk of miscarriage, stillbirth and disability.

Body mass index (BMI)= body weight in (kg) x (body height)² in meters

Ideally conception should be delayed until:

- a healthy weight is achieved (BMI 18.5-24.9)
- the woman has had a balanced and varied dietary intake for a few months
- any underlying nutrient deficiencies have been corrected or stabilized.

OVERWEIGHT AND OBESITY

Fertility is reduced with increasing BMI above the healthy weight range and the health risks to mother and baby during pregnancy and birth also increase (eg fetal malformation, complications during pregnancy, hypertension, preeclampsia, infections, gestational diabetes, complications during labour and birth).

- Ideally women who are overweight (BMI over 24.9) should reduce weight within the healthy range (BMI 18.5-24.9) prior to conception;
- Women with a BMI of 30 or more should be made aware that losing 5-10% of their weight would have significant health benefits and would increase their chances of becoming pregnant and of a healthy pregnancy and baby;
- Further weight loss to achieve a BMI within the healthy range (18.5-24.9)
- should also be encouraged using evidence – based weight management programmes and advice that follow the principles of good practice laid down by NICE (2010);
- Extreme and fad diets for weight loss may result in nutrient deficiencies and should be avoided;
- Ideally weight should have stabilized prior to conception and women should be aware that continuing with a weight loss programme when pregnant is not recommended.

FOLIC ACID (FOLATE)

Folic acid is an important vitamin for brain development during the first 3 months of pregnancy and helps protect against spina bifida and other neural tube defects. Women considering pregnancy are advised to take 400mcg of folic acid daily (as a supplement) at least 3 months before conception to optimise folic acid in the body. Consumption of foods rich in folic acid should also be encouraged (e.g. beans, vegetables, breakfast cereal fortified with folic acid).

Some women need a higher dose folic acid supplement (5mg). Women who have a history of neural tube defects or spina bifida in their family, or who have diabetes, take anti-convulsion medicines, celiac condition, Crohn's disease or other malabsorption conditions are advised to take a folic acid supplement of 5mg daily until the end of the 12th week of pregnancy.

IRON

Pregnant women can become deficient in iron, so it is recommended that women should try to build up their body iron stores before pregnancy by eating foods rich in iron. These include meat, poultry, pulses, green leafy vegetables, soya products, eggs, nuts, wholegrains, dried fruit and iron-fortified breakfast cereals. Iron absorption is improved by eating vitamin C at the same time e.g. fruit juice, fruit, vitamin C-fortified squashes, vegetables and salads.

VITAMIN D

A significant proportion of the population have low vitamin D levels which has resulted in a rising number of cases of rickets and other disorders caused by vitamin D deficiency. Mothers-to-be need good vitamin D levels to ensure there is enough for the developing baby's needs, and to prevent disorders related to vitamin D deficiency in both the baby and themselves.

The body relies on sunlight exposure to meet its vitamin D requirements, in Sudan all seasons of the year are sunny so vitamin D deficiency due to lack of sunlight exposure is rare.

Foods containing vitamin D naturally (e.g. fortified margarine, egg yolk, fortified breakfast cereal, oily fish and evaporated milk) should be encouraged but be aware that it is difficult to obtain enough vitamin D from diet alone. If adequate sunlight exposure is not possible a supplement (10ug) may be considered prior to pregnancy. Women who are at increased risk of low vitamin D levels include:

- from black and minority ethnic backgrounds who have darker pigmented skin
- housebound
- teenagers
- those with poor nutritional status and diet restricted to certain food groups (e.g. vegans and vegetarians)
- women who have closely spaced pregnancies
- breastfeeding mothers
- those whose skin is covered /strict sunscreen use
- women taking certain drug therapies e.g. anti-convulsant or with liver/kidney disease.

VITAMIN A (RETINOL)

Very high intakes of vitamin A in the diet can increase the risk of birth defects in the fetus. Women planning a pregnancy are advised to avoid liver and liver products (pate, sausage), and supplements containing vitamin A including fish and fish liver oil supplements, except on the advice of a dietitian, doctor or pharmacist.

MEDICINES AND SUPPLEMENTS

Women planning a pregnancy should be advised to seek advice from their doctor or pharmacist about suitability of any prescribed medication and before taking any 'over the counter' medicines/ supplements or herbal remedies.

2. NUTRITION DURING PREGNANCY

WEIGHT GAIN

Pregnant Women require only a slight increase in energy, from 100 Kcal per day during the first Trimester to 300 kcal during these second and third trimesters. Pregnant women require 10–15% more kilocalories than before pregnancy, especially during the last months of pregnancy. This amount of energy can be provided by only a small quantity of food and expectant mothers frequently overestimate their need for additional energy. The recommended increase depends on the basal metabolic rate, lifestyle and physical activity.

Educational Outreach and health promotion help in achieving a normal pre-pregnancy weight, which is important for fertility, a successful pregnancy and delivery and the future health of the offspring.

PROTEINS

During pregnancy, it is important to consume the required amount of protein, the basic building block of maternal and fetal tissues. The Amount of protein required during the first half of pregnancy is the same as that for non-pregnant women, 0.8–1.0 g/kg per day or 10–15% of the energy required, and that during the second half of the pregnancy is 1.1 g/kg per day, based on the diet in developed economies. Pregnant Adolescents require 1.5 g/kg of protein a day. The recommended sources of protein are dairy products with a reduced fat content, fish and lean meat; proteins of plant origin, e.g. legumes, nuts and seeds, are other sources, although their protein content is lower than that of animal products. For example, 100 g of cooked meat contain 25–35 g of protein, 120 g of fish contain 25–30 g protein, one egg has 6 g of protein, while 150 g of beans contain only 15 g of protein.

CARBOHYDRATES

Carbohydrates are a source of energy for both the mother and the fetus. The Amounts required are the same as those recommended for the general population (50–60% of energy). Appropriate amounts of suitable carbohydrates help to control blood glucose levels and provide protection against ketosis. The recommended sources of carbohydrates are wholegrain products and potatoes, which should be boiled or baked and not deep-fried or fried. Consumption of sugar should be limited and should not exceed 5% of energy intake or 25 g (five teaspoons). Excess Sugar increases the risk

for obesity. Expectant Mothers should avoid sweetened soft drinks, which increase the risks for pre-eclampsia and premature birth.

FATS

Fats are an integral part of the diet and a source of energy; they are also required for numerous metabolic processes. Expectant Mothers need not change their intake of fats. The recommended amount is 30% of the total energy consumption. The choice of fats, however, is vital. Both Triacylglyceride Eicosapentaenoic and docosahexaenoic acids are required for the development of the fetal brain and retina, and they reduce the risk for premature birth, the child's future risk for cardiovascular diseases and the risk of the mother for perinatal depression. Triacylglyceride are especially important during the second and third trimesters. The recommended amount of docosahexaenoic acid is 200–300 mg/day, which can be ensured by two servings (150–300 g) of fish a week, of which one should be oily fish. Attention should be paid to the choice of fish and the way it is cooked, fish should be broiled, steamed or oven-baked, and salty, pickled, cured or smoked fish is not recommended. Overconsumption of fish may lead to excessive intake of mercury, which can damage the child's nervous system. Fish Oil supplements are not recommended because of their high vitamin A content, and foods that contain Triacylglyceride, such as eggs and milk, are recommended. The amount of saturated fats consumed in butter, cream, fat meat and palm oil should be restricted, and trans-fatty acids, which are frequently contained in partially hydrogenated vegetable fats often used in dairy and confectionery products, should be excluded.

FIBRE

The required intake of fibre in Latvia is 30–35 g. Fibre is required to prevent constipation and thus reduce the risk for hemorrhoidal vein disease; it also reduces the risks for gestational diabetes and pre-eclampsia. Furthermore, fibre rich products contain minerals, vitamins and other biologically active substances. The main sources of fibre are wholegrain products (e.g. wholegrain bread, porridge or pasta), legumes, dried and fresh fruit, vegetables, nuts and seeds. Cereal products are the main source of fibre, the most common one being rye bread. Additional bran should be taken only on professional advice, as it tends to decrease the uptake of iron, calcium and other minerals and contributes to intestinal obstruction. The required quantity can be absorbed in a balanced diet.

VITAMINS AND MINERALS

The requirements for vitamins and minerals in pregnancy are much higher than that for extra energy; therefore, expectant mothers should pay attention to the quality of the food they eat and balance their diet. Most women require additional nutrients only after the fourth month of pregnancy, but the intake of certain micronutrients, such as folic acid, iodine and iron, is vital before conception and during early pregnancy.

WHO-recommended quantities of minerals and vitamins per day during pregnancy and lactation

Micronutrient	WHO recommendation
Vitamin A, µg	800.0 µg
Thiamine (vitamin B1), mg	1.4mg
Riboflavin (vitamin B2), mg	1.4mg
Niacin (vitamin B3), mg	18.0mg
Vitamin B6, mg	1.9mg
Vitamin B12, µg	2.6 µg
Vitamin C, mg	55.0mg
Vitamin D, µg	5.0 µg
Vitamin E, mg	15.0mg
Folic acid, µg	600.0 µg
Iron, mg	27.0mg
Zinc, mg	10.0mg
Copper, mg	1.15mg
Selenium, µg	30.0 µg
Iodine, µg	250.0 µg
Calcium, g	1.5-2.0g

FOLIC ACID

Folic Acid is required for maternal erythropoiesis, DNA synthesis, growth of the placenta and the development of the fetal spinal cord during the first month of pregnancy. Notably, the neural tube closes during weeks 3–4 of pregnancy when women are often unaware that they are pregnant. In most cases, the required amounts of folates cannot be supplied from food alone. (Folic Acid and folates have a similar chemical structure; “folic acid” refers to synthetic supplements, while food products contain “folates”.) An intake of 400 g/day of folic acid reduces the risk for neural tube defects; therefore, women of reproductive age should make sure that their daily intake is at this level. Women who are planning pregnancy should start taking folic acid supplements before pregnancy in order to reach a stable level by the time of pregnancy, and they should continue supplementing their diet at least until the end of week 12 of gestation. It is recommended that the intake of women at high risk (a history of spina bifida, diabetes mellitus, malabsorption syndrome, celiac disease, use of anticonvulsants) should be 4 mg/day. Smokers, alcohol abusers and women who have regularly taken oral contraceptives or triamterene and trimethoprim as diuretics are at higher risk for folic acid deficiency or deficit. Women who take multi-vitamin supplements should check the folic acid content. The Foods eaten should be rich in folates. The Main dietary sources of folic acid are green-leaf vegetables (spinach, salad leaves), bovine liver, legumes (lentils, Beans and peas), beetroot, oranges and tomatoes. Fresh, uncooked vegetables should be eaten daily, as folic acid is unstable to heat.

IRON

The requirement for iron increases during pregnancy, especially during the second half, when the volumes of blood and erythrocytes increase, and the fetus and placenta require more iron. Furthermore, absorption of iron increases considerably during pregnancy, as there is no loss of blood through menstruation. It is important to ensure that the intake of iron from food is sufficient during pregnancy. The capacity for iron absorption depends significantly on the type of food, other foods eaten at the same time and physiological requirements. Haem iron is the form that is best absorbed, and lean red meat and fish should be eaten regularly. Although foods of plant origin, including wholegrain products and vegetables, also contain large quantities of iron, its bioavailability is much lower. Vitamin C significantly increases the uptake of iron (from e.g. citrus fruit juice), while fermented and non-fermented tea, coffee, wholegrain products and products rich in calcium decrease uptake. Therefore, it is important to avoid eating food containing iron at the same time as food that delays

iron absorption; a 2-hour Interval should be observed. Plasma Ferritin levels should be normal before conception and during pregnancy. Supplements containing iron should be used if the iron reserves are insufficient, which may result in reduced hemoglobin production; anemia, in turn, is associated with lower immunity and higher risks for infectious diseases, less productivity, cognitive disorders and emotional stress in the postnatal period, higher risks for maternal mortality, premature delivery and low birth weight, as well as placental abruption and blood loss after delivery. The Fetus is relatively well protected against iron deficiency due to transporter proteins in the placenta. Nevertheless, maternal iron deficiency is associated with a greater frequency of iron deficit anemia in the newborn by the age of 3 months, with delayed psychomotor and/or mental development. This may have a negative effect on social and emotional behavior and can possibly be linked with disease later in life. In Sudan iron supplements should be given for all pregnant women after the first trimester unless obvious contraindication.

IODINE

Iodine is vitally important; it is required for the synthesis of maternal thyroid hormones, which, in turn, are essential for the development of the fetal central nervous system. An adequate intake of iodine should thus be assured before conception and during pregnancy and lactation. Thyroid hormones are necessary for programmed, coordinated development of the child's central nervous system and cognitive and behavioral development; therefore, iodine deficit is one of the preventable causes of developmental and mental disorders. The fetus is most susceptible to iodine deficit during the early stages of pregnancy. If iodine supplementation is given only after the first antenatal visit (ninth week), it is too late to ensure the best possible outcome of the pregnancy. To ensure an adequate intake of iodine before conception, women of reproductive age should have a sufficient daily intake. The daily intake of iodine before conception and during pregnancy and lactation should be 150–250 g, which can be supplied by vitamin formulations with potassium iodide as the active ingredient. The maximum dosage allowed for pregnant and lactating women is 600 g/day; a dosage > 1100 g/day is deemed unsafe. The dosage should be adjusted for women with a thyroid disorder, in consultation with an endocrinologist. Intake of iodine with food depends on the iodine levels in food and soil, the use of iodine disinfectants in the food industry and use of iodine containing fertilizers in agriculture. The main sources of iodine in the diet are fish, seafood and dairy products. Use of iodized salt in cooking food at home is important, as it is added to only a small proportion of processed foods. For most pregnant women, the intake of iodine from food is insufficient: iodized salt, consumption of seafood twice a week

and dairy products generally provide up to 100 g/day; therefore, an additional 100-150µg of iodine are required, which should be taken as supplements. Complex supplements containing folic acid and iodine are available for use when planning a pregnancy. An expectant mother who is already taking multivitamin supplements that contain the required amounts of iodine does not require additional supplementation. Exclusively breastfed children receive an adequate supply of iodine if the mother's intake is adequate.

VITAMIN B6 (PYRIDOXINE)

Vitamin B6 participates in amino acid metabolism and is also a catalyst in reactions such as the production of neurotransmitters. Vitamin B6 helps to reduce nausea and vomiting. The main dietary sources are meat (beef, pork and chicken), fish (tuna, salmon), legumes, oats, bananas, plums, avocado and potatoes. No supplementation is required during pregnancy.

VITAMIN B12 (CYANOCOBALAMIN)

Vitamin B12 is involved in various enzymatic reactions and is required for the synthesis of methionine and tetrahydrofolate. It is found only in products of animal origin: meat, especially beef (also liver, which is not recommended during pregnancy), milk, dairy products and fish (mackerel, herring and tuna). Mussels and oysters contain especially large quantities of this vitamin. Vitamin B12 and folic acid are required for both the cognitive and motor development of the fetus. Vegans and expectant mothers who have undergone gastrointestinal surgery may suffer from vitamin B12 deficit and should take supplements; otherwise, no supplementation is required during pregnancy.

CHOLINE

Choline is required for the integrity of cell membranes, nerve impulse transmission and methyl group synthesis. The main dietary sources of choline are pork, chicken, turkey, egg yolk and soya lecithin. The recommended dose of choline during pregnancy is 450 mg/day.

VITAMIN C (ASCORBIC ACID)

Vitamin C is an antioxidant and is required for the synthesis of collagen and for prevention of pre-eclamptic toxemia. During pregnancy, vitamin C is required at an additional amount of 10 mg/day, which should be supplied from the diet. Good sources of vitamin C are cabbage, tomatoes, paprika, broccoli, strawberries, pineapple, citrus fruit.

VITAMIN A

Vitamin A is required for the development of the skin, mucous membranes (including those of the gastrointestinal and respiratory systems), skeletal system and teeth and for visual and immune functions. While vitamin A deficit is undesirable, excessive amounts (3000 g or 10 000 IU of vitamin A) may be teratogenic. Women who take medicine or food supplements containing vitamin A or retinol, such as fish oil supplements, should discontinue them before conception and throughout pregnancy. Vitamin A is found in foods of animal origin, e.g. fish, seafood, eggs, milk and dairy products, especially cheese. Liver contains particularly high quantities of vitamin A and is therefore not advised during pregnancy. Certain foods of plant origin, such as pumpkin, carrots, red peppers, spinach, salad leaves and apricots, contain carotenes, which are pro-vitamins of vitamin A they pose no risk during pregnancy.

VITAMIN E (TOCOPHEROL)

Vitamin E is an antioxidant that ensures the formation and development of healthy cells in the fetus and protects pregnant women from toxins. Vitamin E enters the fetal circulation from maternal blood during the twelfth week of pregnancy. The recommended daily amount during pregnancy is 15 mg. Some premature newborns may have a deficit of vitamin E, although this is very rare, and the potential toxicity of vitamin E during pregnancy is a more frequent concern, as it has been reported that intake of vitamin E above recommended levels is associated with complications during delivery and a risk for cardiovascular disease in the child. Vitamin E is found in plant oils (olive, sunflower and rapeseed), wholegrain products, egg yolk, nuts and seeds (pumpkin, sunflower, sesame).

VITAMIN K

Vitamin K is required for bone health and coagulation homoeostasis. A deficiency of vitamin K during pregnancy may result in severe vomiting and Crohn disease, especially in women who have undergone gastrointestinal procedures. Dark-green leafy vegetables such as broccoli, various salads and spinach are rich in vitamin K; lesser quantities are contained in animal products, cheese and eggs.

COPPER

Copper deficiency may be teratogenic for the fetus, and a diet poor in minerals may increase the risk for anemia. Seafood, wholegrain products, beans, nuts and animal offal contain large quantities of copper. Dark-green leafy vegetables and dried fruit are other sources.

MAGNESIUM

During gestation, the fetus accumulates 1 g/day of magnesium, and pregnant women should have sufficient quantities of magnesium to prevent leg cramps and Pre-eclampsia. Nuts, wholegrain products and dark-green leafy vegetables are sources of magnesium.

SODIUM

During pregnancy, the maternal blood volume increases, resulting in a higher glomerular filtration rate, in which the water and electrolyte balance is maintained by compensatory mechanisms. Strict reduction of sodium in the diet during pregnancy is not recommended, nor is use of diuretic agents. It is advisable to cut down on salt in the diet and to use iodized salt. The recommended quantity is 1.5–2.3 g of sodium per day, equivalent to 4–5 g of cooking salt. This quantity of salt and an adequate volume of liquids ensure a sufficient blood volume for preventing dehydration and premature contractions. Most people consume significantly more salt than recommended, most of which is in food (added salt constitutes only a small part); therefore, it is recommended that the use of cooking salt during pregnancy be restricted.

ZINC

As a deficit of zinc does not immediately trigger mobilization of zinc from the maternal skeletal system, zinc deficiency sets in rapidly. This can result in congenital malformations and impaired brain development. Red meat, seafood and unrefined cereal products are dietary sources of zinc.

WATER

The volume of liquid required per day is 2–2.5 L, mostly in the form of water. (NB: In Sudan this amount should be increased as weather is hot), the volume should be increased gradually as the pregnancy progresses and the expectant mother gains weight. During the last months of pregnancy, the volume required increases by 300 mL/day. The volume depends on the body mass of the woman: the recommended amount of water (from both food and drink) is 35 mL/kg body weight per day and in no case lower than 1.5 L/day. More water is required in hot weather and during strenuous physical work. An adequate volume of water not only ensures the vital functions but also reduces the risks for urinary infections, urinary calculi and constipation.

CAFFEINE

Large quantities of caffeine (as widely consumed in east of Sudan) restrict fetal development, and it is recommended that pregnant women not exceed 200 mg/day. The amount of caffeine in foods and drinks varies; however, two cups of coffee or four small mugs of tea contain 200 Mg caffeine. Caffeine-containing energy drinks should be avoided during pregnancy.

UNHEALTHY AND POTENTIALLY DANGEROUS SUBSTANCES IN THE DIET DURING PREGNANCY

Food may contain substances that have no nutritional value and adversely affect health.

Artificial sweeteners

A number of sweeteners are available, including saccharin, acesulfame potassium, sucralose and aspartame. Acesulfame potassium and saccharin cross the placental barrier and appear in breast milk, but both sweeteners and sucralose have been found to be safe for mothers and fetuses. Aspartame Should be avoided by women with

phenylketonuria, as it is metabolized into phenylalanine, which is toxic to the fetal brain. Stevia, a sweetener of plant origin, appears to have no effect on fetal development.

Bisphenol A

Bisphenol A is reported to adversely affect the endocrine system. It is similar to the estrogen molecule and may affect the hormone dependent tissues of the fetus, such as thyroid function, or increase the mother's risk for spontaneous abortion. Bisphenol is contained in polycarbonate plastics (so called "hard plastics"). Preference should be given to containers that do not contain bisphenol A, which migrates into food upon contact. Infant feeding bottles containing bisphenol A have been banned in most European countries and the USA.

Polychlorinated Biphenyls and dioxins

These are lipophilic substances that accumulate in fats. The main dietary sources are oily fish (salmon, trout, carp, herring) and fish liver. Expectant mothers should not, however, discontinue eating fish; it is recommended that oily fish be eaten at least once a week.

Lead

If exposure is high, lead may cross the placental barrier and enter the fetus. Intake of lead is associated with increased risks for hypertension and spontaneous abortion in the mother and low birth weight and impaired neural development in the infant. Lead can be absorbed from low-quality enamel vessels, lead containing glass crockery or obsolete Teflon-coated cookware.

Vitamin A

Pregnant women should avoid liver or liver products and formulations containing retinol, including fish oil. Products of plant origin that contain carotenes (pro-vitamins of vitamin A) are red and orange vegetables and fruit; they are not teratogenic to the fetus and are safe for consumption during pregnancy.

Mercury

Mercury accumulates in large ocean fish, such as shark, marlin, tuna, swordfish and king mackerel. As the Baltic Sea is exceedingly polluted, it is not advisable to consume fish from the Sea during pregnancy. Furthermore, mercury accumulates in pike and other large freshwater fish (perch, pikeperch and freshwater cod); however, only pike should be avoided, and such fish should not be eaten more often than once a week. No more than 140 g of tuna should be eaten per week.

3. VITAMIN D IN PREGNANCY

INTRODUCTION

Vitamin D has an increasingly recognized repertoire of non-classical actions, such as promoting insulin action and secretion, immune modulation and lung development. It therefore has the potential to influence many factors in the developing fetus. This paper investigates the effects of vitamin D on the placenta-fetal unit and the mother, in terms of calcium metabolism (classical actions) and non-calcium effects (non-classical actions). There is little information on vitamin D intake in pregnancy and lactation and few studies on clinical outcomes. Some have suggested that the requirement for vitamin D in these women may be up to 6000 iu/day¹ and the ideal vitamin D regimen to prevent and treat vitamin D insufficiency in utero is unknown.

VITAMIN D DEFICIENCY

Vitamin D and its active metabolite 1,25-dihydroxyvitamin D (1,25(OH)₂D) have classical actions on calcium balance and bone metabolism. Without sufficient 1,25(OH)₂D, the intestine cannot absorb calcium and phosphate adequately, which leads to secondary hyperparathyroidism and a lack of new bone mineralisation (rickets in children and osteomalacia in adults). Rickets is a childhood vitamin D insufficiency and usually develops many months after delivery. However, the neonate is at risk of hypocalcaemic tetany consequent on maternal hypovitaminosis D. Calcium levels are normal in utero when maternal vitamin D is insufficient. However, when maternal calcium delivery is interrupted at birth, the neonate may develop hypocalcaemia. While the developing fetus requires approximately 30 g of calcium, the maternal gut adapts and can overcome some vitamin D insufficiency with increased calcium transport.

In the general adult population, reduced vitamin D concentrations are found in obese subjects. Pre-pregnancy obesity has been associated with lower levels of vitamin D in both pregnant women and their neonates; 61% of women who were obese (body mass index [BMI] ≥ 30) prior to pregnancy were found to be vitamin D deficient, compared to 36% of women with a pre-pregnancy BMI of less than 25.4.

PHYSIOLOGY

There are two forms of vitamin D. Vitamin D₃ (cholecalciferol) is produced from the conversion of 7-dehydrocholesterol in skin and vitamin D₂ (ergocalciferol) is produced in mushrooms and yeast. The biologically active form of vitamin D is

1,25(OH)₂D. This requires hydroxylation of vitamin D in the liver to 25(OH)D (25-hydroxyvitamin D), which then undergoes renal hydroxylation to form 1,25(OH)₂D. Although 25(OH)D has low biological activity, it is the major form of circulating vitamin D. Serum 25(OH)D concentrations are generally thought to reflect nutritional status. Production of 1,25(OH)₂D in the kidney is tightly regulated by plasma parathyroid hormone (PTH) as well as serum calcium and phosphate levels.

The interaction of 1,25(OH)₂D with nuclear vitamin D receptors influences gene transcription. Nuclear receptors for 1,25(OH)₂D are present in a range of tissues including bone, intestine, kidney, lung, muscle and skin. Similar to steroid hormones, 1,25(OH)₂D acts via signal transduction pathways linked to vitamin D receptors on cell membranes. Major sites of action include intestine, bone, parathyroid, liver and pancreatic beta cells. Its biological actions include increases in intestinal calcium absorption, transcellular calcium flux and opening gated calcium channels allowing calcium uptake into cells such as osteoblasts and skeletal muscle. The biological effects of 1,25(OH)₂D are diverse. It inhibits PTH secretion and adaptive immunity, while promoting insulin secretion and innate immunity. It also inhibits cell proliferation and stimulates their differentiation.

The largest source of vitamin D in adults is synthesis from solar radiation; half an hour of sun light delivers 50000iu of vitamin D with white-complexioned skin. Dietary intake of vitamin D makes a relatively small contribution to overall vitamin D status as there is little vitamin D that occurs naturally in the food supply. Melanin absorbs ultraviolet B (UVB) from sunlight and diminishes cholecalciferol production by at least 90%. Dietary vitamin D is absorbed from the intestine and circulates in plasma bound to a vitamin D binding protein.

Pre-eclampsia and neonatal hypocalcaemia are the most prevalent complications of maternal hypocalcaemia and are clearly associated with substantial morbidity. A statistical association of glucose intolerance and hypovitaminosis D has been demonstrated. Maternal vitamin D is important to fetal bone development. 6,7 Fetal lung development and neonatal immune conditions such as asthma may relate in part to maternal vitamin D levels. Although it is not clear whether maternal vitamin D supplementation will prevent these conditions, a strategy for supplementation and treatment of maternal vitamin D deficiency is proposed.

MATERNAL AND FETAL COMPLICATIONS

Pre-eclampsia

There is conflicting evidence whether hypovitaminosis D in pregnancy is associated with hypertension and pre-eclampsia. In three studies, women who developed pre-eclampsia were found to have lower levels of vitamin D than women who did not with levels less than 50 nmol/l associated with a five-fold increased risk of severe

pre-eclampsia. Low levels in the first half of pregnancy were related to the risk of developing pre-eclampsia and the neonates of these mothers had a two-fold increased risk of having vitamin D levels < 37.5 nmol/l (vitamin D deficient). In a case-control study, women with severe pre-eclampsia before 34 weeks of gestation had reduced levels of vitamin D compared to control women.¹¹ Furthermore, women with early-onset severe pre-eclampsia and a small-for-gestational-age (SGA) infant had significantly lower vitamin D levels than those with early-onset severe pre-eclampsia but non-SGA infants. However, many studies have shown a weak or no relationship between vitamin D and hypertensive disorders in pregnancy.

Low birthweight

Maternal vitamin D levels have been shown to positively correlate with birthweight centile. In a study from Holland, women with vitamin D deficiency had a 2-fold increased risk of having an SGA baby. Another study found that maternal vitamin D levels of < 37.5 nmol/l in the first half of pregnancy were associated with an adjusted odds ratio of 7.5 for SGA infants in white women, but not in black women.

Australian researchers found that mean birthweight was 200 g lower ($P < 0.001$) in babies of vitamin D deficient mothers. However, other studies demonstrated no relationship between maternal vitamin D levels in the first trimester and birthweight but did demonstrate that low vitamin D levels in late pregnancy were associated with reduced intrauterine long bone growth and lower gestational age at delivery.

Impaired glucose tolerance in pregnancy:

Hypovitaminosis D is associated with impaired glucose tolerance and diabetes in the general population.

However, the evidence for an association between low vitamin D levels and gestational diabetes mellitus (GDM) is conflicting.

Low concentrations of 25(OH)D have been related to the risk of developing type II diabetes mellitus (T2DM) through effects on insulin secretion and insulin sensitivity. However, not all studies support these findings. The Third National Health and Nutrition Examination Survey (NHANES III) did not demonstrate an association between 25(OH)D levels and diabetes or insulin resistance. Depending on the diagnostic criteria used, it has been suggested that GDM complicates up to 16% of pregnancies, although the true occurrence can be much greater in some ethnic groups.

Other complications

Vitamin D deficiency (< 37.5 nmol/l) has been associated with a four-fold increased risk of primary caesarean section (caesarean section performed for the first time), although this has not been demonstrated in all studies. Vitamin D deficiency is also

associated with bacterial vaginosis in pregnant women. In conclusion, hypovitaminosis D may be associated with hypertension, pre-eclampsia and increased caesarean section rates. There are no randomized trials showing that vitamin D supplementation alters these putative risks.

Neonatal hypocalcaemic seizures

Neonatal vitamin D levels are correlated with those of their mother, with maternal vitamin D deficiency increasing the risk of neonatal vitamin D deficiency. In an Australian study, hypovitaminosis D was found in 15% of pregnant women and 11% of neonates.²⁰ Vitamin D deficiency is a major cause of hypocalcaemic seizures in neonates and infants. Hypocalcaemia is not uncommon in neonates and is a potentially severe problem. Mothers of babies who suffer hypocalcaemic seizures are more likely to be vitamin D deficient (85%) than mothers of babies who do not (50%). In another study from Egypt, all mothers of babies with hypocalcaemic seizures had severe vitamin D deficiency. Maternal vitamin D deficiency is a common, and potentially preventable, cause of neonatal hypocalcaemia.

Skeletal development and growth

Hypovitaminosis D is associated with impaired growth and bone development in the fetus. Evidence is accruing to show that less profound maternal 25(OH)D insufficiency may lead to suboptimal bone size and density after birth without overt rachitic change. This is likely to lead to an increased risk of osteoporotic fracture in later life. A retrospective cohort study showed that children who had received supplements with vitamin D in the first year of life had a significant increase in femoral neck bone density at the age of 8 years compared to the group that did not receive supplements.

Fetal lung development and childhood immune disorders

Low maternal vitamin D intake in pregnancy is associated with wheezing and asthma in the offspring. Low cord blood 25(OH)D concentrations have been associated with respiratory syncytial virus bronchiolitis and respiratory infections. There are plausible physiological mechanisms for an association between prenatal vitamin D status and immune development. The metabolite 1,25(OH)₂D has been shown in animal and in vitro models to have an immune-modulatory role and low levels of neonatal vitamin D have been linked to childhood asthma. Maternal vitamin D supplementation is associated with cord blood gene expression of tolerogenic immunoglobulin such as immunoglobulin-like transcripts 3 and 4 (ILT3 and ILT4). Cord blood 25(OH)D is correlated with mononuclear cell release of IFN and hence Th1 cell development. More research is needed on the potential association between maternal vitamin D in

fetal lung development and childhood allergy; there are ongoing studies investigating long-term neonatal putative benefits of adequate maternal vitamin D.

SUPPLEMENTATION AND TREATMENT IN PREGNANCY

Daily vitamin D supplementation with oral cholecalciferol or ergocalciferol is safe in pregnancy. The 2012 recommendation from UK Chief Medical Officers and NICE guidance state that all pregnant and breastfeeding women should be informed about the importance of vitamin D and should take 10 micrograms of vitamin D supplements daily. Particular care should be taken over high-risk women. The recommendations are based on the classical actions of vitamin D, although many of the non-classical actions of vitamin D may be beneficial. As mentioned above, the review and meta-analysis found associations between vitamin D insufficiency and risk of gestational diabetes, pre-eclampsia, bacterial vaginosis and SGA infants. Of course, this does not necessarily demonstrate that correction during pregnancy will reduce these risks. Three categories of vitamin D supplementation are recommended:

1. ***In general***, vitamin D 10 micrograms (400 units) a day is recommended for all pregnant women in accord with the national guidance. This should be available through the Healthy Start program.
2. ***High-risk*** women are advised to take at least 1000 units a day (women with increased skin pigmentation, reduced exposure to sunlight, or those who are socially excluded or obese). The RCOG has highlighted the importance of addressing suitable advice to these women. Women at high risk of pre-eclampsia are advised to take at least 800 units a day combined with calcium. Vitamin D may be inappropriate in sarcoidosis (where there may be vitamin D sensitivity) or ineffective in renal disease. Deficient renal 1-hydroxylation necessitates the use of active vitamin D metabolites, such as 1-hydroxycholecalciferol or 1,25-dihydroxycholecalciferol. Specialist medical advice should be sought in such cases. The limitation to therapy compliance mostly relates to the calcium which has a side effect of tasting of chalk, rather than the vitamin D element of oral therapy. It is often more appropriate to give vitamin D alone for patient acceptability. However, this is limited by the availability of suitable agents; vitamin D cannot be prescribed at low doses without calcium. 800-unit formulations of cholecalciferol without calcium are available. There may be particular benefits of vitamin D/calcium supplementation in women at risk of pre-eclampsia.

3. **Treatment.** For the majority of women who are deficient in vitamin D, treatment for 4–6 weeks, either with cholecalciferol 20000iu a week or ergocalciferol 10000iu twice a week, followed by standard supplementation, is appropriate. For women who require short-term repletion, 20000iu weekly appears to be an effective and safe treatment of vitamin D deficiency. A daily dose is likely to be appropriate to maintain subsequent repletion (1000iu daily). In adults, very high doses of vitamin D (300000–500000 iu intramuscular [IM] bolus) may be associated with an increased risk of fractures and such high doses are not recommended in pregnancy. A 2011 study demonstrated that supplemental doses of 4000 iu cholecalciferol a day were safe in pregnant women and most effective compared to the lower doses.

Supplementation and treatment recommendations		
Supplementation		
	Daily units	Combined with
Vitamin D	400 ¹	N/A
	800 ²	Calcium
	1000 ³	N/A
Treatment		
Cholecalciferol	2800	20 000 iu a week
Ergocalcifero	2800 ⁴	10 000 iu 2x week

¹ Recommended for all pregnant women

² Recommended for women with high risk of pre-eclampsia

³ Recommended for women at high risk of vitamin D deficiency

⁴ To be taken through and after the high-dose supplementation

4. CALCIUM SUPPLEMENTATION IN PREGNANT WOMEN

Calcium is the most abundant mineral in the body and is essential for many diverse processes, including bone formation, muscle contraction, and enzyme and hormone functioning. Most of the body's calcium is found in the bones and teeth; approximately 1% is present in the intracellular structures, cell membrane and extracellular fluids. Calcium absorption increases during pregnancy and a dietary intake of 1200 mg/day of calcium for pregnant women is recommended by WHO and the Food and Agriculture Organization of the United Nations (FAO). Inadequate consumption of this nutrient by pregnant women can lead to adverse effects in both the mother and the fetus, including osteopenia, tremor, paresthesia, muscle cramping, tetanus, delayed fetal growth, low birth weight and poor fetal mineralization. Serum calcium concentrations are maintained within narrow limits in the body and thus have limited use for the assessment of calcium nutritional status at both the individual and the population levels. Calcium intake could be a useful indicator of status at the population level. The main dietary sources of this nutrient are milk, dairy products, calcium-set tofu and fortified foods.

AVAILABLE EVIDENCE

Two Cochrane systematic reviews investigated whether calcium supplementation on a daily basis during pregnancy safely improved maternal and infant outcomes. The findings revealed that this intervention significantly reduced the risk of pre-eclampsia and high blood pressure (with or without proteinuria). Women who received calcium supplements had a significantly higher risk of developing HELLP (haemolysis, elevated liver enzymes, and low platelet count) syndrome, a rare adverse event associated with severe pre-eclampsia. Calcium supplementation had no effects on the risk of developing eclampsia or maternal death or maternal admission to the intensive care unit. In regard to infant outcomes, there was no effect of calcium supplementation on preterm birth (born before 37 weeks' gestation) overall. However, a subgroup analysis suggested that there were fewer preterm births among pregnant women who received between 1.5 g and 2 g of elemental calcium per day than among those women with a lower calcium intake. Calcium supplementation did not have a detectable effect on the risk of low birth weight, admission to a neonatal intensive care unit, stillbirth and neonatal death before hospital discharge.

Suggested scheme for calcium supplementation in pregnant women

Dosage	1.5–2.0 g elemental calcium/day ⁵
Frequency	Daily, with the total daily dosage divided into three doses (preferably taken at mealtimes)
Duration	From 20 weeks' gestation until the end of pregnancy
Target group	All pregnant women, particularly those at higher risk of gestational hypertension ⁶
Settings	Areas with low calcium intake

⁵ 1 g of elemental calcium equals 2.5 g of calcium carbonate or 4 g of calcium citrate.

⁶ Women are regarded as being at high risk of developing gestational hypertension and pre-eclampsia if they have one or more of the following risk factors: obesity, previous pre-eclampsia, diabetes, chronic hypertension, renal disease, autoimmune disease, nulliparity, advanced maternal age, adolescent pregnancy and conditions leading to hyperplacentation and large placentas (e.g. twin pregnancy). This is not an exhaustive list, but can be adapted/complemented based on the local epidemiology of preeclampsia.

5. GUIDELINE FOR THE MANAGEMENT OF ANAEMIA IN PREGNANCY AND POSTNATALLY

INTRODUCTION

Anaemia is the most common medical disorder in pregnancy. Pregnancy causes 2-3-fold increase in requirement of iron and 10-20 fold increase in folate requirement.

In iron deficiency anaemia, there is a shortage of iron stores (low ferritin), reduced transport and functional iron (low transferrin) limiting red cell production (low Hb).

In pregnant women who are anaemic in the UK, 90% of them are iron deficient. Iron deficiency causes maternal morbidity due to increased susceptibility to infections, physical weakness, preterm labour, increased risk of postpartum hemorrhage, low birth weight babies and postnatal depression. Maternal iron depletion also increases the risk of iron deficiency in the neonate. Managing anaemia in pregnancy will therefore help to prevent adverse fetal and maternal outcomes as well as reduce the need for allogeneic red blood cell transfusion.

DEFINITION

Anaemia is defined as Hb value less than 2 standard deviations below the mean value for a healthy matched population.

The definition of anaemia in pregnancy is Hb levels of:

<11g/dl in the first trimester

<10.5 g/dl in the second and third trimesters

<10 g/dl in the postpartum period.

(ref: British Committee for Standards in Haematology 2011)

CLINICAL SIGNS AND SYMPTOMS

Pregnancy anaemia can be asymptomatic and may be diagnosed following routine screening. The signs and symptoms are often non-specific with tiredness being the most common. Women may also complain of weakness, headaches, palpitations, dizziness, dyspnea and hair loss. Signs of anaemia can occur in the absence of a low Hb. In this instance it would be diagnosed by a full blood count with a reduced MCV (Mean Cell Volume) and MCHC (Mean Corpuscular Hemoglobin Concentration). In these patients, a ferritin needs to be checked and if it is <30µl iron therapy should be commenced.

DIAGNOSIS

A trial of oral iron therapy can be both diagnostic and therapeutic. If haemoglobinopathy status is unknown, then it is reasonable to start oral iron therapy whilst screening is carried out. A trial of oral iron should demonstrate a rise in Hb within 2 to 3 weeks. If there is a rise then this confirms the diagnosis of iron deficiency. If there is no rise, further tests must be carried out.

In patients with a known haemoglobinopathy serum ferritin should be checked first. Ferritin levels below 30 μ l should prompt treatment and levels below 15 μ l are diagnostic of established iron deficiency.

MANAGEMENT

NICE guidelines recommend that women are screened for anaemia at booking and again at 28 weeks gestation.

All women should be given advice regarding diet in pregnancy with details of foods rich in iron along with factors that may promote or inhibit the absorption of iron. This should be backed up with written information. Dietary changes alone are not sufficient to correct an existing iron deficiency in pregnancy and iron supplements are necessary.

Antenatal

If at booking Hb <11.0 g/dl: Start on a trial of oral iron. The necessary dose is 100-200mg of elemental iron daily.

Dose and elemental iron content per tablet

Preparation	Dose per tablet	Elemental Iron	No of tablets per day
Pregaday		100 mg	2
Ferrous Sulphate	200 mg	65 mg	3
Ferrous Gluconate	300 mg	35 mg	6
Ferrous Fumarate	210 mg	68 mg	3

Women should be counselled as to how to take oral iron supplementation correctly. This should be on an empty stomach, 1 hour before meals, with a source of vitamin C to maximise absorption. Other medications or antacids, tea or coffee should not be taken at the same time.

Women with a normal Hb but a low MCV should have their ferritin checked and if ferritin is $<30\mu\text{l}$, oral iron should be commenced.

Repeat Hb levels 3 weeks after commencement of iron therapy (this should fit in with 15-16 week antenatal appointment) and a rise in Hb should be demonstrated. If there is no rise in Hb despite compliance with therapy, serum ferritin should be checked and concomitant causes of the anaemia need to be excluded. Referral to consultant obstetrician is required.

If at Booking Hb $<9.0\text{ g/dl}$ Oral iron - 200mg elemental iron in divided doses/day should be commenced and follow up as above. Referral to consultant obstetrician if symptomatic.

If at Booking Hb $<7.0\text{g/dl}$ send an urgent referral to joint obstetric/hematology clinic to investigate further and make management plan. Do not offer blood transfusion unless symptomatic or currently actively bleeding. Consider total dose IV iron infusion.

200mg of elemental iron / day (N.B. if 200mg ferrous sulphate used, need 3-4 tablets/day) if taken correctly will give a rise in Hb of 2.0g/dl every 3 weeks.

Once Hb is within the normal range, treatment should be continued for a further 3 months.

At 28 weeks. All women should have their Hb re-checked (NICE 2008)

If at 28 weeks Hb $< 10.5\text{g/dl}$ Trial of oral iron as above. Re-check Hb in 3 weeks. If no response, check serum ferritin and refer to consultant obstetrician to consider total dose iron infusion.

If at 28 weeks Hb $<9.0\text{g/dl}$ Start oral iron - 200mg elemental iron in divided doses/day, as above. Consultant Obstetrician referral if symptomatic.

If at 28 weeks Hb <7.0g/dl Urgent referral to joint obstetric/hematology clinic to investigate and make management plan. Do not offer blood transfusion unless symptomatic or currently actively bleeding. Consider total dose IV iron infusion.

NB Gastrointestinal toxicity affects 35-59% of patients and can result in nonadherence to treatment with oral preparations (Auerbach and Ballard 2010) These effects can be reduced by taking oral iron with food or taking a reduced dose.

Management of Labour and Delivery

With effective management of anaemia antenatally, anaemia at delivery is usually avoided. If this occurs, all measures must be taken to avoid blood loss at delivery:

- Deliver in consultant unit
- IV access and Group and screen on admission
- Active management of third stage of labour
- In the event of a PPH prompt active management is required to stop bleeding.
- Consider the use of prophylactic syntocinon infusion.
- Postnatal FBC and serum ferritin on day 1 and iron replacement as below.

Postnatal

- Hb <10.0g/dl in postnatal period.
- Haemoglobin measurement is not required following an uncomplicated, normal birth Check FBC and serum ferritin on day 1 post-delivery in the following cases:
- PPH of >500mls
- Uncorrected antenatal anaemia
- Known iron deficiency anaemia
- Any woman with signs or symptoms of anaemia

Clinical assessment alongside Hb concentration is necessary postpartum to make a decision on the best method of iron replacement. In fit, healthy asymptomatic women there is little evidence to support blood transfusion.

Hb 8.0-10.0g\dl if asymptomatic and haemodynamically stable, offer 200mg elemental iron per day for 3 months. FBC and ferritin should be checked after 3 weeks to ensure that Hb and iron stores are replete.

Hb<8.0g/dl Consider total dose intravenous iron. Repeat FBC and ferritin at 10 days to ensure response and at 3 months in community to ensure Hb and iron stores are replete.

Hb<7.0g/dl Consider and discuss alternatives with the woman . Consider transfusion and/or total dose IV iron.

Minimum transfusion volumes should be considered; Review after 1 unit.

Women who are symptomatic of anaemia, haemodynamically unstable or continuing to bleed heavily will need a full senior obstetric review to investigate the origin of the blood loss and decide further treatment.

Management of maternal anemia with intravenous Iron Sucrose

1. Intravenous Iron sucrose

Chemistry

Iron sucrose injection, USP is a sterile, aqueous, complex of polynuclear iron (III)-hydroxide in sucrose for intravenous use. Its molecular weight (MW) is approximately ~ < 60,000 Daltons.

Availability

IV iron sucrose is available as 2.5 ml & 5ml single dose ampoules. One ampoule of 2.5 ml contains 50 mg and one ampoule of 5 ml contains 100 mg of elemental iron.

Safety Profile

Rarely, minor adverse effects¹

Lower dose of Iron sucrose (100mg Fe/kg) produced less or almost no adverse effects.

Allergic reactions: 3.3 cases/million/year

Dosage Calculation:

Administration of IV Iron sucrose is based on total Iron deficit.

Total dose in mg = Body Wt. X (Target Hb - Actual Hb) X 2.4

This is followed by 10 mg/ Kg body weight to replenish the Iron stores.

Administration:

IV Iron sucrose is administered by intravenous Infusion:

The infusion is administered as every 2.5 ml Iron Sucrose diluted exclusively in a maximum of 100 ml of 0.9% NaCl, immediately prior to infusion. The rate should be of 100 ml/30 minutes.

Example: To give 100 mg of elemental iron, two ampoules of 2.5 ml or one ampoule of 5 ml should be diluted in 100 ml NS and this should be infused over the period of 30 minutes.

Unused diluted solution must be discarded.

Maximum dose: A maximum of 200mg of elemental iron can be given in one dose (in 100 ml NS). This should be infused over 30 minutes, can be given 1-3 times per week or on alternate days.

A total dose of 1.0 gm can be given in 4-10 sittings (over a period of 1 month).

Patient Selection

IV iron sucrose should be considered only when Hb levels are above 7 gm %. In case of 7 gm % and below, blood transfusion should be considered. Gestation Period				
Hb level (gm%)	14-16 wks	20-24 wks	26-30 wks	30-34 wks
< 7	Blood Transfusion at CEmOC	Blood Transfusion at CEmOC	Blood Transfusion at CEmOC	Blood Transfusion at CEmOC
7.1 - 8.9	IFA therapeutic/ supplemental dose	Consider IV iron sucrose	First time IV iron sucrose and top up doses if given earlier	First time IV iron sucrose and top up doses if given earlier / Blood transfusion
9 to 10.9	IFA therapeutic/ supplemental dose	IFA therapeutic/ supplemental dose	IFA therapeutic/ supplemental dose	IV iron sucrose first time or top up doses if given earleir
11 and above	IFA therapeutic/ supplemental dose	IFA preventive dose	IFA preventive dose	IFA preventive dose

Contraindications to IV iron therapy

- First trimester of pregnancy
- Previous hypersensitivity to IV iron
- Anaemia not attributable to iron deficiency
- Iron Overload
- Acute infection/inflammation
- Clinical or biomedical evidence of liver damage
- Asthma
- Acute renal failure
- Active Rheumatoid Arthritis

6. GESTATIONAL DIABETES NUTRITION GUIDELINES

INTRODUCTION

Gestational diabetes mellitus (GDM) is glucose intolerance identified for the first time during pregnancy. As a pregnancy progresses, women become insulin resistant due to the increased production of certain placental hormones which are necessary to shunt nutrients to the growing fetus. If the pancreas is unable to meet the increasing insulin demands, the outcome is glucose intolerance resulting in hyperglycemia (high blood glucose).

Good nutrition and controlling both carbohydrate and caloric intake will help control blood glucose levels. Optimally, a registered dietitian and/or certified diabetes educator will provide Medical Nutrition Therapy. Medical Nutrition Therapy is a nutritional treatment for a specific condition, in this case gestational diabetes, based on a detailed assessment of individual factors such as pre-pregnancy weight, physical activity level, pregnancy weight gain to date and diet history.

The primary goal is to control blood glucose levels by controlling intake of carbohydrates and saturated fats while ensuring adequate nutrition without excessive weight gain. If a registered dietitian or certified diabetes educator is not available in the community to provide Medical Nutrition Therapy, a registered nurse or community health worker may educate on the nutrition principles of gestational diabetes mellitus.

ASSESSMENT

Gather information on weight history, pre-pregnancy weight, pregnancy weight gain to date, rate of weight gain, physical activity level, and dietary habits. Determine appropriate educational materials based on ability to understand written and spoken information, cultural diversity and individual needs.

Weight History

- Identify total weight gain in previous pregnancies, significant weight fluctuations (gain or loss) during pregnancy and/or prior to pregnancy, and dieting habits including a history of or current anorexia or bulimia.

Weight Gain and Calorie Intake Recommendations during Pregnancy

Determine Body Mass Index (BMI) using pre-pregnancy weight (PPW) and height (no shoes) on a BMI chart or wheel, or by calculating kg/m².

- Identify weight gain and calorie intake recommendations according to BMI category.
- Plot weight on a prenatal weight gain grid to obtain an accurate assessment of total pregnancy weight gain and rate of weight gain. Determine if weight gain is above, at or below the recommended range. If weight gain is within the recommended range, rate of weight gain should be no more than $\sim \frac{1}{2}$ - 1 pound/week in the second and third trimester. If weight gain has already exceeded the recommended range, monitor that the woman slows weight gain in order to prevent further excess gain.
- Individualize calorie needs based on BMI, rate of weight gain and physical activity level. The calorie range will determine the quantity of food that can be eaten each day. Intake may be adjusted as the pregnancy progresses based on weight gain and blood glucose levels.

Weight Gain and Calorie Intake Recommendations for Women with GDM *

BMI (kg/m²)	Recommended weight gain (lbs.)	Estimated calorie intake kcal/kg/day PPW
Underweight (< 19.8)	28 – 40	36 - 40
Normal weight (19.8 – 26)	25 – 35	30
Overweight (26.1 – 29)	15 – 25	24
Obese (>29)	15	12 - 18
Twin Gestation	35 - 45	Add an extra 500 kcal/day to the above recommendations.

* Adopted from National Academy of Sciences Institute of Medicine Guidelines for Pregnancy

Physical Activity Assessment

- Ask about current physical activity. If not currently physically active, assess willingness to change. Consult with the medical provider before developing an activity plan to check for contraindications.
- Moderate activity (30 minutes, five days/week) can help maintain normal blood glucose levels and control weight gain.

Diet Assessment

- Ask about prenatal multivitamin intake or intake of any herbs and other supplements. If not currently taking a prenatal multivitamin, encourage one daily or at least 1 mg of folic acid if unable to tolerate a prenatal vitamin due to nausea. Woman should use iodized salt to meet the increasing iodide needs in pregnancy (250 ug/day) given most prenatal vitamins do not contain iodine. Ask about food allergies or intolerances, nausea, vomiting, constipation or heartburn, which may affect intake.
- Use a diet assessment tool (24-hour recall, 3- to 5-day food diary, food frequency questionnaire) to determine meal trends, food preferences and nutritional adequacy.
- Find out who prepares the meals, or if she knows how to cook. Ask about meal preparation facilities, as well as financial resources for groceries and supplies.

Meal Plan Components

- Maintain a minimum of 175 grams of carbohydrate or 12 carbohydrate choices per day (approximately 700 kcals from carbohydrates).
- Use diet history to create a meal plan that will ensure blood glucose control at each meal. Smaller meals should contain no more than one or two carbohydrate choices (15-30 grams of carbohydrate) and larger meals no more than three to four carbohydrate choices (45-60 grams of carbohydrate).
- Distribute carbohydrate-containing foods into smaller, frequent meals evenly spaced throughout the day. When total calories are divided into smaller, more frequent meals, the pancreas is often able to secrete adequate amounts of insulin and this may prevent the need for medications and minimize hunger, ketones in the urine, heartburn and nausea.
- Schedule at least two hours between meals to allow for two-hour postprandial blood glucose levels.
- It is best not to allow more than 10-12 hours between the last evening meal and the next morning meal.
- Consider including a small snack at bedtime (one carbohydrate choice and one protein choice) to help prevent ketone formation, especially if dinner and breakfast are separated by more than 10-12 hours.
- Use a food and beverage record to track intake. Include type and amount (cups, etc.) of food eaten, meal times, and fasting and postprandial blood glucose levels (one or two hours after the start of the meal).

Understanding Facts

Saturated fats contribute to higher levels of maternal triglycerides, which have been associated with macrosomia (large for gestational age) in the baby. Choose foods lower in saturated fat. If weight gain is excessive, a lower-fat diet overall can help slow the rate of weight gain since fats have more than twice as many calories per gram as carbohydrate or protein.

- Saturated Fat is usually solid at room temperature and comes from meat and animal products such as hamburger, eggs, cheese, bacon and butter. Saturated fat should be limited to less than 10 percent of calories and trans fats should be avoided.
- Unsaturated fat is usually liquid at room temperature and is found in most vegetable oils (ex: canola and olive oil), peanuts, almonds, sunflower seeds, olives, avocados, and cold-water fish such as salmon and albacore tuna. Unsaturated fat should be eaten in moderation.

Practical Tips for Decreasing Fat Intake

- Remove the skin and fat from chicken and turkey. Trim all visible fat from meat.
- Bake, roast, broil, grill or boil meats instead of frying or adding fat.
- Cook with small amounts of oil if needed, and choose vegetable oils such as canola or olive oil.
- Choose low-fat or nonfat cheeses. They contain less saturated fat.
- Choose low-fat or nonfat milk and yogurt.
- Use minimal amounts of butter or margarine.
- Avoid adding sauces or gravies to meats, vegetables, pasta and other foods. Try flavoring with herbs and spices instead.
- Replace chips and cookies with whole grain pretzels or low-fat crackers.
- Check food labels for processed foods that contain high amounts of fat and refined sugar.

High-Fiber Foods

- High-fiber foods can help control blood glucose levels because they slow digestion and absorption of nutrients.
- Whole-grain foods are high in nutrients and fiber. Food labels should state, “made with 100% whole grain” for bread, crackers, tortillas and pasta. Try bran cereal, brown rice or bulgur. Use whole wheat or other whole grain flours in cooking and baking. Choose corn tortillas over flour tortillas.

- Fresh fruits are high in nutrients and fiber, but also are carbohydrates. Choose them over fruit juices. Oranges, grapefruit and tangerines are high in Vitamin A and Vitamin C, important nutrients for pregnancy.
- Dark green, deep red, orange and deep yellow vegetables, such as spinach, broccoli, romaine, carrots, chilies and peppers are high in nutrients needed for pregnancy.
- Beans, peas and other legumes are a good source of fiber.

Protein Foods

- Protein foods do not increase blood glucose levels. Include three servings daily.
- Poultry and lean cuts of beef or pork (90 percent or leaner) contain less saturated fat.
- Nuts and seeds are good sources of protein that are low in saturated fat.
- Eggs (fully cooked) are a good source of protein and can easily be added to many meal plans.
- Fish is usually low in saturated fat. However, amount and type of fish must be monitored due to health risks of mercury levels found in various fish, described under Additional Nutrition Tips.
- Cheese is a good source of protein.

Vitamins

- Take a prenatal multivitamin every day. Choose one that contains folic acid, calcium and iron. Mother and baby need the extra nutrients.

Fluids

- Drink 8-10, 8-oz. glasses of water every day to stay well hydrated.
- Limit fruit juice to ½ cup of 100 percent juice per day, depending on blood glucose response.
- Avoid soda and other sugared drinks such as fruit punch or Kool-Aid.

Calcium Foods

- Include four servings of milk and/or dairy foods daily; adolescents should aim for five servings.
- Milk is an excellent source of calcium, and low-fat milk will provide fewer calories. Milk also contains protein and carbohydrate.
- Other sources of calcium include cheese, yogurt, fortified cereals and other grains, spinach, collard greens, soybeans, rhubarb, and fortified orange juice.

- If milk and/or other dairy foods are not tolerated or accepted, include other nondairy sources of calcium in the diet and consider an additional calcium supplement.

Physical Activity Recommendations

In addition to making healthy food choices and monitoring portion sizes, exercise helps maintain blood glucose levels and controls weight gain. Since muscles require glucose for energy, exercise is the body's natural way of taking glucose out of the blood. Instruct the woman on physical activity guidelines for pregnancy and the benefits of exercise in controlling blood glucose levels.

- Encourage moderate activity (i.e., 30 minutes of walking) within one to two hours after a meal to lower postprandial blood glucose levels. This is especially effective following the largest meal of the day.
- Develop an individualized exercise plan based on a physical assessment by the provider.
- Regular physical activity (30 minutes/day, five days/week) can help to reduce insulin resistance and prevent excessive weight gain.
- Actual heart rate should not exceed 140 beats/minute.
- Ensure adequate hydration and avoid overheating during all physical activity.
- Contraindications to physical activity include: preeclampsia, intrauterine growth restriction, abruption, placenta previa or vaginal bleeding.

Evaluation

TARGET BLOOD GLUCOSE LEVELS

Fasting Blood Glucose: < 95 mg/dl
 1 hour postprandial: < 130 – 140 mg/dl
 2 hour postprandial: < 120 mg/dl

Food and Blood Glucose Record

- Assess blood glucose response to food choices and meal timing to determine if normal blood glucose levels have been maintained.
- Monitor patterns in blood glucose levels to determine areas where food choices need to be adjusted.
- Allow up to two weeks for blood glucose levels to optimize in response to nutrition therapy.
- Use caution when portioning foods. These foods may raise blood glucose levels more than expected. Try eating smaller amounts and testing blood glucose two

hours after the start of the meal to determine if blood glucose levels remained in the target range.

- Monitor the response if blood glucose levels increase after consuming a certain food. The woman may need to avoid that food or decrease the portion size. Consider testing blood glucose levels pre-meal to determine whether the response is related to the food eaten. High fat foods
- may worsen insulin resistance and cause an increase in blood glucose levels.
- Assess that the woman does not restrict food intake to less than 12-18 kcal/kg/day pre-pregnancy weight in an attempt to avoid medication therapy.
- If medication therapy is begun, modify the meal plan to meet the medication regimen. Women taking short acting insulin analogues with each meal (such as actrapid) may not need to have smaller meals between their regular meals due to the rapid peak and short duration of insulin action. In contrast, women using Regular insulin or glyburide with meals may need to include smaller, more frequent meals to avoid low blood sugar levels due to the delayed peak and longer duration of these agents.

Follow-Up After Delivery

It is crucial that women return to their provider to receive the appropriate postpartum counseling, testing and follow-up after delivery. About half of all women with gestational diabetes mellitus will develop type 2 diabetes within the next five- 10 years.

- Encourage women to aim for their prepregnancy weight six to 12 months after the baby is born. If overweight, work to lose at least 5 to 7 percent (10 to 14 pounds for someone who weighs 200 pounds) of body weight over time, and keep it off in order to improve insulin sensitivity and reduce the risk of developing diabetes.
- Encourage breastfeeding, emphasizing the following benefits:
 - promotes weight loss for the mother
 - may decrease maternal progression to type 2 diabetes
 - reduces insulin resistance in mothers
 - may decrease obesity in the child
- Educate on continued lifestyle modifications, including healthy food choices and daily physical activity, to lessen insulin resistance and prevent or delay the onset of type 2 diabetes.
- Be sure the woman returns for a follow-up glucose tolerance test at six to 12 weeks postpartum.

7. MANAGEMENT OF WOMEN WITH OBESITY IN PREGNANCY

Obesity in pregnancy defined as a Body Mass Index (BMI) of 30 kg/m or more at booking.

CLASSES OF OBESITY:

Class I; BMI 30.0–34.9

Class 2; BMI 35.0–39.9

Class 3 or morbid obesity: BMI 40 and over

Background and Introduction

The prevalence of obesity in pregnancy rising from 9–10% in 1990s to 16–19% in the 2000s.

Obesity in pregnancy is associated with an increased risk of:

- miscarriage,
- prematurity,
- congenital anomalies,
- stillbirth .
- macrosomia
- neonatal death.
- lower breastfeeding
- obesity and metabolic disorders in childhood
- thromboembolism,
- gestational diabetes,
- pre-eclampsia,
- induced labour,
- dysfunctional labour,
- caesarean section,
- anaesthetic complications
- postpartum haemorrhage,
- wound infections,
- maternal death: the CEMACH report one maternal deaths in the 2003–2005

Pre-Pregnancy Care

- Women with a BMI >30 should receive information and advice about the risks of obesity during pregnancy and childbirth and supported to lose weight before conception.
- Loss of at least 4.5 kg in obese women before pregnancy reduced the risk of developing GDM by 40%.
- Some weight loss regimens during the first trimester may increase the risk of fetal NTD.
- Women with a BMI >30 wishing to become pregnant should take 5mg folic acid supplementation daily, starting at least one month before conception and continuing during the first trimester of pregnancy.
- Women with a booking BMI >30 are advised to take 10micrograms Vitamin D daily during pregnancy because they are at increased risk of vitamin D deficiency.

Measuring Weight, Height and BMI

- Pregnant women should have their weight, height measured and their body mass index calculated at booking.

Information-Giving During Pregnancy

What information should be provided to women with maternal obesity?

- Women with a BMI >30 should receive information and advice about the risks of obesity during pregnancy and childbirth and how they may be minimized. including:

1) Obesity in pregnancy is associated with an increased risk of:

- Miscarriage
- Prematurity
- congenital anomalies
- stillbirth
- macrosomia
- neonatal death.
- lower breastfeeding
- Obesity and metabolic disorders in childhood
- thromboembolism,
- gestational diabetes,
- pre-eclampsia,
- induced labour,

- dysfunctional labour,
- caesarean section,
- anaesthetic complications
- postpartum haemorrhage,
- wound infections,
- maternal death.

2) increased maternal and fetal monitoring;

3) difficulties in fetal surveillance and screening for anomalies due to poor ultrasound visualization;

4) difficulties in anaesthesia and CS requiring senior obstetric anaesthetist and antenatal anaesthetic assessment

* in order to prevent weight gain and GDM, women should be aware about healthy eating and exercise provided by trained professional early in the pregnancy.

Risk Assessment During Pregnancy

Pregnant women with a booking BMI >40 should have an antenatal consultation with an obstetric anaesthetist, to anticipate:

- Difficulties with venous access,
- Difficulties with regional (Epidural re-site and failure of epidural cannulation)
- Difficulties with general anaesthesia (aspiration, difficult intubation and postoperative atelectasis).
- Co-morbidities such as hypertension and ischaemic heart disease.

An anaesthetic management plan for labour should be discussed and documented in the medical records.

Women with a booking BMI >40 should have a documented assessment in the third trimester by professional to determine manual handling requirements including safe working loads of beds and theatre tables.

THROMBO PROPHYLAXIS

- Women with BMI >30 should be assessed at booking and throughout pregnancy for the risk of thromboembolism.
- If BMI >30 + two or more additional risk factors for thromboembolism, should LMWH antenatally.
- Women receiving LMWH antenatally should usually continue until six weeks postpartum, but a postnatal risk assessment should be made.

Weight (kg)	Dose
91 – 130	60mg Enoxaparin, 7500 units Dalteparin, 7000 units tinzaparin daily
131 – 170	80mg Enoxaparin, 10000 units Dalteparin, 9000 units tinzaparin daily
>170	0.6mg/kg/day Enoxaparin, 75 units/kg/day Dalteparin, 75 units/kg/day tinzaparin daily

If BMI >30 should be encouraged to mobilise as early as possible following childbirth.

-If BMI >40 should receive postnatal LMWH for a minimum of 1 week regardless the mode of delivery.

-If BMI >30 + one or more additional persisting risk factors for thromboembolism should receive LMWH for 7 days after delivery.

-If BMI >30 + two or more additional persisting risk factors should receive TED stockings in addition to LMWH.

Maternal Surveillance and Screening

What specific considerations should be given to maternal surveillance for women with obesity?

- Appropriate cuff should be used for BP measurements: the cuff size should be documented in the records.
- Incidence of pre-eclampsia 1.4% in women with a BMI 19.8–26 and 3.5% in those with morbid obesity BMI >40.
- Women with booking BMI >35 have increased risk of preeclampsia and should have surveillance during pregnancy
- Women with a booking BMI >35 and at least one additional risk factor for preeclampsia should have referral early in pregnancy for specialist care.

Additional risk factors include:

- first pregnancy or > 10 years inter pregnancy interval
- previous or family history of pre-eclampsia,
- booking diastolic BP >80mmHg,
- booking proteinuria >1+ on more than one occasion or >0.3g/24 hours,
- multiple pregnancy,
- 6.medical conditions such as antiphospholipid antibodies or hypertension, renal disease or DM.

Women with booking BMI >35 and no additional risk factor can have community monitoring for preeclampsia at a minimum of 3 weekly intervals between 24 and 32 weeks gestation, and 2 weekly intervals from 32 weeks.

*All pregnant women with a booking BMI >30 should be screened for gestational diabetes

Planning Labour and Delivery

Women with a booking BMI >30 should have an informed discussion antenatally about intrapartum complications associated with a high BMI, and management plan which documented in the notes.

There is an increased risk of:

- Slow labour progression,
- Shoulder dystocia
- Emergency CS.
- PPH.
- Difficult CS
- Higher risk of anesthetic complications
- Difficulties with intravenous access, regional anesthesia and fetal surveillance in labour

VBAC in women with a booking BMI >30 should have an individualized decision because:

Obesity is a risk factor for unsuccessful VBAC, uterine rupture and neonatal injury during VBAC.

Emergency CS in women with obesity is associated with an increased maternal morbidity.

Care During Childbirth

Where should the birth place be?

- Women with a BMI >35 should give birth in a consultant-led obstetric unit with neonatal services,
- Babies born to mothers with obesity are 1.5 times more likely to be admitted to a NICU

Indication for induction of labour

* In absence of other obstetric or medical indications, obesity alone is not an indication for IOL.

* IOL carries the risk of failed induction and emergency caesarean section with high maternal morbidity.

Lines of communication

* If a woman with a BMI >40 is admitted to the labour:

- Inform the duty anaesthetist if delivery or operative intervention is anticipated.
- Alerted operating theatre staff.
- An obstetrician and an anaesthetist at Specialty Trainee year 6 and above.

Midwifery Support

Women with a BMI >40 who are in established labour should receive continuous midwifery care.

Specific Interventions Required during Labour

- Women with a BMI >40 should have venous access established early in labour.
- Women with a BMI >30 should be recommended to have active management of the third stage of labour.
- Women with a BMI >30 having CS should receive prophylactic antibiotics at the time of surgery.
- Women undergoing CS who have more than 2cm subcutaneous fat, should have suturing.

Postnatal Care and Follow-up After Pregnancy

Initiation and maintenance of breastfeeding in women with maternal obesity

- Obesity is associated with low breastfeeding initiation and maintenance rates.
- Women with a booking BMI >30 should receive advice and support antenatally and postnatally for breastfeeding.

Ongoing care provided to women with maternal obesity following pregnancy

- Women with a booking BMI >30 should continue to receive nutritional and weight reduction advice after birth.
- All women with a booking BMI >30 and GDM should have:
 1. GTT 6 weeks after birth
 2. regular follow up with the GP to screen for the development of type 2 diabetes.
 3. annual screening for cardio-metabolic risk factors,
 4. lifestyle and weight management advice.

MAIN RESOURCES

1. Guidelines for good Nutrition Preparing for a healthy pregnancy (preconception)
National Health service of United Kingdom (NHS .UK) references 2018.
2. Nutrition in pregnancy topics
“Proper maternal nutrition during pregnancy planning and pregnancy: a healthy start in life”
recommendations for health care professionals the experience for Latvia & WHO, 2017.
3. Vitamin D supplementation in pregnancy
“Royal college for obstetrician and gynecologist”, reference guidelines 2014.
4. Calcium supplementation in pregnancy
WHO recommendation, 2013.
5. Guideline for the management of anaemia in pregnancy and postnatally.
National Health service of United Kingdom (NHS .UK) references, south west regional
transfusion committee 2014.
6. Gestational Diabetes Nutrition Guidelines
Colorado department of public health & environment, 2007.
7. Management of Women with Obesity in Pregnancy
“Royal college for obstetrician and gynecologist”, reference guidelines 2017.

For the preparation of this guideline the following have been involved:

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