

A pregnant woman is shown from the side, wearing a tan jacket and black leggings. She is gently holding her pregnant belly with both hands. The background is a blurred beach scene with waves and autumn leaves. A large yellow diagonal graphic element is on the left side of the image.

NUTRITION CONSIDERATIONS FOR THE PREGNANT ATHLETE

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INTRODUCTION

Pregnancy can be a challenging time for the female athlete. Not only are they contending with massive changes in their own physiology but they're also trying to identify an approach which supports the optimal health outcomes for both their baby and themselves.

In this guide we're going to cover various topics; from weight change and energy requirements to unique vitamin and mineral requirements for the pregnant athlete.

Bare in mind, the health of your child begins long before you've even considered pregnancy / become pregnant and your current state of health can have a significant impact on your child's genes and health state. We aren't going to cover this topic within this piece of work, nor are we going to discuss post-partum weight management.

This guide is purely to address the gestation period and how to optimally care for yourself and your child during this time.

We'd highly recommend working with your doctor and midwife too, as they will be able to support you first hand with any digestive challenges that may arise (which we'll discuss later), monitor the health of your baby as well as reaffirm and talk through your body's requirements during gestation and post-partum.

BODYWEIGHT AND PREGNANCY



BODYWEIGHT AND PREGNANCY

One of the most grossly misunderstood concepts surrounding pregnancy is change in body weight. This is especially true in the female athlete. The importance of body weight cannot be undermined when discussing the health of the baby and mother.

Overweight and obesity as well as being underweight can both have a detrimental effect on a newborn child (acutely and long term).

For instance, gestational diabetes, pre-eclampsia, gestational hypertension, depression, instrumental and caesarean birth, and surgical site infection are more likely to occur in pregnant women with obesity compared with women with a healthy weight. Maternal obesity is also linked to greater risk of preterm birth, large-for-gestational-age babies, foetal defects, congenital anomalies and perinatal death. Furthermore, breastfeeding initiation rates are lower and there is greater risk of early breastfeeding cessation in women with obesity compared with healthy weight women.

There is a reduced likelihood for the female athlete to be overweight/obese given the nature of their lifestyle (however some sports / activities may be an exception). There is however a possible risk for being underweight, being deficient in numerous important vitamins and minerals and inadequate energy intake (especially in certain sporting / performance activities which we'll cover in detail later).

BODYWEIGHT AND PREGNANCY

Whilst it could be argued being underweight during pregnancy holds less risk than being overweight / obese, it still carries some risk for significant adverse health outcomes (for both mother and child).

Depending on severity, mothers underweight at any time during gestation increase risk of low birth weight (LBW), pre-term delivery and neo-natal death. If deficient in certain nutrients and minerals, there may be additional health concerns (such as an increased risk of neural tube defects).

Additionally, excessive weight gain / loss during pregnancy can also carry a number of short and long term risks for both the mother and the child.

The goal for the individual / athlete is therefore to then achieve and or maintain a "healthy" weight (which is dependent on your body size and, arguably more important, your body composition) rather than gain excessive weight / avoid any weight gain.

BODYWEIGHT AND PREGNANCY

For most this would be a BMI of between 18.5 to 24.9 however BMI can be inaccurate and healthy weight assessment should not be predicated solely on BMI.

There is limited data on body fat percentage range recommendations for optimal health however greater body fat/weight gain during pregnancy is associated with greater risk of the child becoming obese / developing metabolic dysfunction in later years.

A general recommendation would be aiming for somewhere between 21 to 31% body fat during gestation whilst avoiding excess weight gain (we'll discuss what that looks like next!).

BODYWEIGHT AND PREGNANCY

Weight gain during pregnancy

Weight gain is to be expected in the normal weight range individual / athlete and so should be expected rather than fought against (due to concerns with body composition / aesthetics).

Understanding where the added weight comes from, to how much, when to expect it and when to make dietary changes can all get very confusing. We aim to address these issues over the coming pages.

As mentioned in the previous section, body weight can have a significant impact on the health of a new born. Whilst weight gain is to be expected, it should be controlled (as excessive weight gain during gestation carries a number of aforementioned health risks to the child and mother).

Where does the increase in weight come from?

There are a number of contributors to the increase in weight;

- **The child itself (on average 7 - 8lbs)**
- **Maternal nutrient stores (approximately 7 - 15 (+)lbs)**
- **Increased blood volume (3 - 4lbs)**
- **Amniotic Fluid (2 - 3lbs)**
- **Increased Breast tissue (1 - 2lbs)**
- **The placenta (1 - 2lbs)**
- **The uterus (1 - 2lbs)**

BODYWEIGHT AND PREGNANCY

How much weight should we expect to gain during gestation?

The American institute of medicine have outlined weight gain recommendations / expectations dependent on your weight category (see on next page)

Recommendations as of 2009

IOM Recommendations	
Pre-pregnancy Weight Status (BMI; kg/m ²)*	Gestational Weight Gain (lbs)
Underweight (< 18.5)	28–40
Normal weight (18.5–24.9)	25–35
Overweight (25.0–29.9)	15–25
Obese (≥ 30.0)	11–20

Note that, the recommendations for the obese category are in dispute as limited or no weight gain in obese women has been linked to more favorable outcomes than increasing weight gain.

BODYWEIGHT AND PREGNANCY

Expected rate of weight gain by trimester

The assumption that you can "Eat anything and everything you want! You're eating for two!" from day one of pregnancy has likely led to many expectant mothers gaining an unnecessary amount of weight in the initial stages of gestation (coupled with generally poor weight management and overall pregnancy care advice).

We know that excessive weight gain during pregnancy / being overweight pre / during pregnancy can have serious health consequences for both you and the new child so understanding the rate of weight gain across the entirety of pregnancy will help in determining whether you're gaining excessively (at a given time) or are on track (with expected / recommended weight gain).

Additionally, excessive weight gain during pregnancy has been linked to increased difficulty to returning back to a "healthy" weight / body composition; an issue of particular concern for most athletes.

Weight gain during pregnancy changes across the three trimesters, which are defined as such

- Trimester One (T1); from conception to week 13
- Trimester Two (T2); from week 13 to 26
- Trimester Three (T3); from week 26 to 40

BODYWEIGHT AND PREGNANCY

T1 expected weight gain;

Studies have shown that excessive weight gain during T1 has led to mothers retaining this weight up to (and beyond) seven years post-partum. They've also found that excessive weight gain during T1 can increase the risk of a child becoming overweight /obese in the first few years of life.

As a matter of fact, during the first 13 weeks of pregnancy very little weight gain (if it is achieved) can be contributed to fetal growth. In fact by week 13 most babies are barely 14 - 15grams in weight!

The majority of weight gain during this time is in relation to cardiac output / blood volume, growth of the uterus etc.

However, a great shift in the mother's hormonal profile begins to occur and this may trigger excessive food intake (in turn leading to excessive weight gain). Women may suffer PMS like symptoms, fatigue and extreme mood swings - all linked to increased food intake (in relation to coping mechanisms / cultural based cravings). The challenge is therefore managing this shift whilst maintaining some degree of safe activity / exercise levels.

IOM recommendations for T1 weight gain

Healthy Weight - 2 - 5lbs

Overweight - No weight gain

BODYWEIGHT AND PREGNANCY

T2 expected weight gain;

T2 is when you really start to "show". The baby has a continually maturing central nervous system but is now fully equipped with foot and fingerprints, functioning lungs and the ability to hear.

T2 may also be the "key" to future health (for both the mother and the child). The degree of weight gain during T2 is the strongest predictor of excessive weight gain during gestation. One study found that normal-weight women who stayed within the recommended guidelines for weight gain during the second trimester had a 77 percent chance of staying on track to gain the appropriate amount of weight at the end of pregnancy.

Excessive weight gain during T2 has also been linked to increased macrosomia (highest percentile of large for gestational age (LGA) babies) and LGA babies. Macrosomia and LGA babies both carry increased risk of birth complications and metabolic dysfunction for the mother as well as being at greater risk in later of developing some kind of metabolic dysfunction.

IOM recommendations for T2 weight gain

Healthy Weight - approximately a lb a week

Overweight - 0 to 0.5lbs a week from week 20 onwards

BODYWEIGHT AND PREGNANCY

T3 expected weight gain;

T3 is when the most weight gain is to be expected and mother's may start experiencing some digestive issues (constipation, increased peeing frequency, indigestion etc.).

In T3, excessive weight gain carries an increased risk of pre-term birth and cesarean delivery. It can also increase the chance of macrosomia birth. Excessive T3 weight gain may also increase the risk of the child becoming overweight/ obese in early years.

Conversely inadequate weight gain may lead to low birth weight children who carry similar risks of increased susceptibility and likelihood of developing metabolic dysfunction and or becoming overweight / obese.

Of note, excessive weight gain during T3, particularly in overweight / obese mothers, may increase the risk of post-partum depression.

IOM recommendations for T3 weight gain

Healthy Weight - approximately a lb a week

Overweight - 0 to 0.5lbs a week from week 20 onwards

BODYWEIGHT AND PREGNANCY

In Summary;

The goal for the individual should be to achieve a "healthy" weight / body composition before becoming pregnant however this may not always be an option.

If not applicable, the individual should then aim to maintain a rate of weight gain in accordance with these recommendations to avoid any deleterious outcomes for both themselves or their newborn child.

Being both underweight and carrying excessive weight both carry certain risks, as does gaining / losing excessive amounts of weight during gestation.

1st Trimester <i>Conception – 13 weeks</i>	2nd Trimester <i>13 – 26 weeks</i>	3rd Trimester <i>26 to 40 weeks</i>
<i>Pattern of weight gain through pregnancy</i>		
Note that, the goal for the individual should be to aim to achieve a "healthy" weight / body composition prior to starting pregnancy and throughout for optimal outcomes.		
Healthy weight individual; 2 – 5lbs	Healthy weight individual; Approx. 1lb a week	Healthy weight individual; Approx. 1lb a week
Overweight / Obese individual; Maintain weight	Overweight / Obese individual; 0 to 0.5lbs a week from week 20 onwards	Overweight / Obese individual; 0 to 0.5lbs a week from week 20 onwards
Excessive and inadequate weight gain are both associated with negative health outcomes for both the mother and the child. The goal should be to aim for the prescribed recommendations. These recommendations may change for twin births, more than twin births and if the mother has had health issues in the past / currently (and should be discussed with their GP/ midwife)		

ENERGY REQUIREMENTS DURING PREGNANCY



ENERGY REQUIREMENTS & PREGNANCY

Just as misunderstood as a mother's change in body weight across pregnancy is her change in energy requirements.

Sports involving some degree of aesthetics (dance, gymnastics, bodybuilding etc.), weight restriction (weightlifting, combat sports etc.) and or extended endurance activities (marathon running etc.) are associated with athletes who exhibit lean bodies and a reduced body weight. These athletes often present an inadequate energy intake in accordance with their exercise energy expenditure which can compromise physiological functions as well as daily and exercise performance.

Notably, these athletes, as a byproduct of their sport / activity, have increased needs for energy and nutrients in pre-pregnancy, during pregnancy, and post-pregnancy in relation to non-athletic pregnant women.

I'm hoping that, as someone who works with me and or has followed me in whatever social media platform you understand that energy intake directly (and solely) effects body weight. That is, any change in weight is solely predicated on a lack of, or excess of, energy intake.

ENERGY REQUIREMENTS & PREGNANCY

Pregnancy itself is extremely energy demanding, and the energy cost of a typical pregnancy is somewhere in around the 80,000kcal mark (divided across the 9 month gestation period) and that's before we take into consideration physical activity.

However, the goal remains the same; you don't want to gain too much weight nor do you want to be underweight for pregnancy and this will be determined on your calorie intake.

So, how many calories?

Or, more precisely, how many calories *extra* should you have during pregnancy (on top of your intake that would facilitate weight maintenance)?

How many calories extra you require is obviously dependent on the kind of activity you do, the duration, frequency, intensity etc. i.e. what you likely already know if you work and or follow me.

So, what are the specific recommendations for athletes?

Well, there are none so to speak, however experts will recommend both recreational and elite athletes aim to plan their dietary intake so that their weight coincides with the IOM recommendations (which we outlined earlier).

ENERGY REQUIREMENTS & PREGNANCY

An extremely well done study investigated energy demands of healthy underweight, normal-weight, and overweight pregnant women and to explore energetic adaptations to pregnancy.

The women in the study aren't exactly elite athletes however would be described as moderately active (20–30 min of moderate exercise ≥ 3 times/wk).

They found that BMR increased over pre-pregnancy values by 5%, 11%, and 24% in the first, second, and third trimesters, which was similar to what was observed among women in low- and normal-BMI groups. In high-BMI group, the increase was greater; 7%, 16%, and 38% in the first, second, and third trimesters, respectively. They cited that the increase in BMR was linked to an increase in tissue mass. It is likely the metabolic demand of pregnancy and fetal development also contributes.

On the basis of the women in the normal-BMI group, the incremental needs during pregnancy were negligible in the first trimester, 350 kcal/d in the second trimester, and 500 kcal/d in the third trimester over nonpregnant values. It should be noted however that in this study, although BMR increased, energy expenditure attributed to exercise decreased. Therefore, recommendations for athletes may be greater and require careful monitoring on the part of the individual (to ensure they're in line with IOM recommendations).

ENERGY REQUIREMENTS & PREGNANCY

Baring in mind these women were only moderately active, these recommendations are likely insufficient (however provide a nice starting point to work around with).

Baring in mind physical activity has been frequently found to reduce as pregnancy progresses these figures may actual be more applicable for some more relaxed athletes than those who engage in more "high level to elite" level athletic training / programming.

It would be advisable to use some kind of weight monitoring and dietary tracking system (MyFitnessPal for example) to ensure accuracy when aiming to stay within IOM recommendations.

In Summary

There is little in the way of recommendations designed for athletes and energy intake. Let your pre-pregnancy maintenance numbers form your basis and make adjustments based on changes in BMR for each trimester (as outlined in the aforementioned study) and recommended rate of weight gain.

Change in energy requirements by trimester		
Trimester One	Trimester Two	Trimester Three
<i>Negligible</i> increase from baseline	350kcal increase from maintenance	500kcal increase from maintenance
Note that, for athletes, these recommendations may be higher. This depends entirely on the type, duration, frequency and intensity of the exercise they perform. Athletes should still aim to follow IOM recommendations for rate of weight gain and modify their energy intake to support this goal as well as their own personal performance.		

MACRONUTRIENT REQUIREMENTS DURING PREGNANCY



MACRONUTRIENT REQUIREMENTS & PREGNANCY

Common sense would dictate that as energy requirements increase macronutrient numbers are obviously going to increase as well (as this is where the energy comes from after all).

As we discussed energy intake only really needs to be adapted moving into T2 and T3 (and of course if you're in a calorie deficit pre-pregnancy the goal would then be to bring that back to maintenance for T1).

However, macronutrient demands alter across the entire timeline of pregnancy, and certain types of nutrient may be more healthful than others (in relation to the baby's health).

In this section we're going to look at;

- ***Protein***
- ***Carbohydrates***
- ***Fats***

And cover;

- ***Changes in target intakes***
- ***Timing***
- ***The importance of quality / forms of nutrient ingested***

PROTEIN REQUIREMENTS & PREGNANCY

Everyone's favourite; Protein. Protein forms an essential component of a healthy diet in humans to support both growth and maintenance. Protein in the body plays structural (skeletal muscle, keratin, collagen) and functional (enzymes, transport proteins, hormones) roles.

Within several weeks of conception, adjustments in protein metabolism occur to support fetal growth and development while maintaining maternal homeostasis and preparing for lactation.

Protein utilization from foods and deposition as new tissues are energy dependent at stages of absorption, amino acid transport, protein synthesis, and proteolysis. So, dietary intake during pregnancy must have sufficient energy and protein to ensure the full-term delivery of a healthy infant.

The amount of protein deposited in maternal and fetal tissues varies during pregnancy, with non-significant deposition during the first trimester, gradually increasing during the second trimester, and with most occurring in the third trimester.

PROTEIN REQUIREMENTS & PREGNANCY

So, what does this mean? Simply put it means, just like our energy intake, protein intake recommendations during pregnancy should be gestational stage-specific (with adequate energy to ensure all needs are met).

So, how much do I need per trimester?

Previously, recommendations for moderately active (around 30 mins moderate intensity exercise 3 x a week) mothers were between 0.88 to 1.1g / kg per day. The single recommendation does not take into account the changing needs during different stages of pregnancy.

A 2016 study however reevaluated these recommendations with the use of a minimally invasive indicator amino acid oxidation method (which essentially allows us to determine protein requirements).

Using this method they found requirements to be, on average, 1.2 and 1.52 g/ kg per day during early (~16 wk) and late (~36 wk) stages of pregnancy (which they alternatively stated was ~14–18% of total energy intake).

PROTEIN REQUIREMENTS & PREGNANCY

Athletic populations are recommended to consume between 1.2 to 2.2g / kg per day (depending on sport, energy availability, level of performance etc.). Somewhere between 1.2 to 2.2g / kg per day would therefore be advisable and fall between the protein recommendations set out in the 2016 study and athletic population recommendations however athletes should aim to remain within the recommended Acceptable Macronutrient Distribution Range of 10–35% for energy from protein.

One study found that increasing beyond the 35% threshold may negatively affect fetal growth and, in relation to athletes, likely poses no greater benefit for performance / recovery outcomes. There may be some minor benefit when in a calorie deficit (in relation to further fat loss and retention of lean body mass) but that is not the goal in this instance (but something to consider post-partum).

It is the opinion of this author(i.e.) me that an intake between 1.2 to 2.2g / kg a day would be more optimal than current recommendations and mothers should aim to achieve at least 1.2g / kg per day by week 16 and look to scale that to at least 1.5g / kg per day by week 36 (whilst ensuring protein intake never exceeds 35% of total energy intake)

CARBOHYDRATE REQUIREMENTS & PREGNANCY

Carbohydrates are the body's main energy source. We break down and or use carbohydrate into / as glucose. Glucose is then further metabolized to produce ATP or "adenosine triphosphate" which is essentially the body's unit of currency. e.g. it takes x amount of ATP to jump, throw, sprint, break down food, create new muscle tissue etc.

Glucose is the main energy substrate for fetal growth in pregnancy and so the mother's carbohydrate intake plays an important role.

How much carbohydrate?

Whilst the quantity of carbohydrate in the diet does not appear to have any real effect on gestation related outcomes (both for the mother and new born) the quality does appear to be important.

In general carbohydrate quantity, at least in relation to pregnancy, should constitute between 50 - 60% of total energy intake (as outlined by the World Health Organization).

CARBOHYDRATE REQUIREMENTS & PREGNANCY

The importance of quality of carbohydrate

Dietary glycaemic index (GI) and glycaemic load (GL) are markers of dietary carbohydrate quality (with lower scores associated with higher quality carbohydrate sources).

Higher dietary carbohydrate quality intake (over lower quality intake) has been associated with reduced cardiovascular risk in the newborn child as well as a reduced likelihood of a child being born larger for gestational age (a strong predictor of chronic disease in later life).

For mothers a lower quality carbohydrate intake has been associated with greater (and possibly excessive) gestational weight gain and increased weight retention post-partum.

Higher fibre intake (a marker of improved carbohydrate quality) has also been associated with a reduced risk of developing gestational diabetes mellitus.

CARBOHYDRATE REQUIREMENTS & PREGNANCY

Gestational diabetes mellitus (GDM) is one of the most common metabolic complications during pregnancy, and its prevalence has continued to increase worldwide.

GDM is characterised by an impaired ability of the body to respond to increases in postprandial blood glucose.

Pregnancy hormones and other factors are thought to interfere with the action of insulin as it binds to the insulin receptor. Since insulin promotes the entry of glucose into most cells, insulin resistance prevents glucose from entering the cells properly.

As a result, glucose remains in the bloodstream, where glucose levels rise. More insulin is needed to overcome this resistance (eventually leading to GDM).

GDM is associated with short-term adverse perinatal and pregnancy outcomes such as increased risk of macrosomia, poor mental health, caesarean section and neonatal hyperglycaemia (high blood sugar).

Mothers with GDM and their offspring are also at an increased risk of developing type 2 diabetes.

CARBOHYDRATE REQUIREMENTS & PREGNANCY

Aside from carbohydrate quality, the likelihood of developing GDM is increased if you are overweight / obese/ carrying excess adipose (fat) tissue pre-pregnancy and or gain excessive amounts of weight throughout pregnancy.

Additionally, maintaining exercise levels is an important tool to combat the condition. Virtually all athletic populations should be at low risk as a product of their lifestyles however it is important to be mindful of this condition as a possible risk to lesser dietary and lifestyle choices.

In Summary;

The quantity of carbohydrate does not appear to be a risk factor for any negative gestational outcomes (for both mother and child) however the quality of carbohydrate does appear to matter. Higher quality carbohydrate is associated with improved short and long term outcomes for both mother and child.

Carbohydrate recommendations should constitute between 40 - 60% of dietary intake and be predominantly from fruit, vegetables and whole grains. Those with digestive issues should first explore a low FODMAP option and consult with their respective dietician / GP / other healthcare provider to determine agreeable dietary choices.

DIETARY FAT REQUIREMENTS & PREGNANCY

Fats are an integral part of the diet and a source of energy; they are also required for numerous metabolic processes, absorption of certain vitamins and components of certain structures within the body.

The World Health Organization and IOM recommends adults aim to keep their dietary fat contribution to around 30 - 35% of total energy intake (personally, I believe anywhere between 20 - 30% is fine and is based more so on personal preference and energy intake itself).

Whilst fats are important, over consumption can contribute to excessive weight gain given the energy density of fat (around 9 kcals per gram compared to around 4kcals per gram for both protein and carbohydrate respectively).

Why fat quantity may be important in pregnancy

High fat intake (in excess of 35% dietary intake and or causing excessive weight gain) has been linked to a number of undesirable health outcomes (both perinatal and post-partum);

- **Increased risk of GDM**
- **Increased risk of metabolic dysfunction (in both mother and child)**
- **Increased neonatal fat mass**
- **Compromised neonatal gut microbiome**
- **May also impair cognitive development, function and mental health in offspring**

DIETARY FAT REQUIREMENTS & PREGNANCY

These are just a few of the negative health outcomes faced by both mother and child when dietary fat exceeds the aforementioned threshold. For the athlete of course, excessive weight gain can elongate the return to "normality" after pregnancy.

Why quality matters when it comes to dietary fat intake

Both omega-3 fatty acids - EPA & DHA - are required for the development of the fetal brain and retina, and they reduce the risk for premature birth, cerebral palsy, the child's future risk for developing allergies, cardiovascular diseases and the risk of the mother for perinatal depression.

The omega-3s are especially important coming into T2 and T3 and DHA recommendations scale to between 200 - 300mg a day.

These targets can be achieved via diet or supplementation. Two servings (150–300 g) of fish a week, of which one should be oily fish (e.g. herring, trout, salmon, sardines). Alternatively, supplementation is an option. We'd advise being wary of fish oil supplements (typically cod liver oils) containing vitamin A. Excess vitamin A intake may be potentially harmful for the unborn child (this will be discussed in more detail later on).

DIETARY FAT REQUIREMENTS & PREGNANCY

In terms of saturated and trans fats, the "bad" fats (I'd go back and look at the dietary fat learning materials from the fundamentals course) the recommendation is to minimize intake of these during pregnancy.

Increased intake of saturated fats has been linked to neonatal obesity and increases in waist circumference. They have also been associated with increased risk of developing future metabolic dysfunction and, if consumed in place of adequate omega-3 intake, impede cognitive structuring.

in addition, increased intake of trans and saturated fat over unsaturated and polyunsaturated fats has been associated with greater adipose gain during a weight gain phase in athletes (note that these athletes were however not pregnant).

In Summary;

Fat intake should not exceed 35% of total energy intake during pregnancy however should be enough that the mother is able to meet her greater requirements for omega 3 fatty acids (particularly during T2 and T3). Supplementation may be beneficial but mothers should avoid supplements containing added vitamin A as excessive intake can be harmful to the unborn child.

MACRONUTRIENT REQUIREMENTS & PREGNANCY

Change in macronutrient requirements by trimester			
	Trimester One	Trimester Two	Trimester Three
Protein	Minimum 1.2g/kg a day for general athletic recommendations (however intakes up to 2.2g/kg per day may be required depending on activity type, frequency, duration and intensity).	Minimum 1.2g/kg a day by week 16 for expectant mothers (however intakes up to 2.2g/kg per day may be required for athletes depending on activity type, frequency, duration and intensity).	Minimum 1.5g/kg a day by week 36 for expectant mothers (however intakes up to 2.2g/kg per day may be required for athletes depending on activity type, frequency, duration and intensity).
<i>Generally speaking between 18 – 25% contribution to total energy intake will be fine for most.</i>			
Carbohydrates	Quantity depends on mother's activity however quality is important. Higher quality options should be the preference in most cases (low GL / GI scores) and mothers should aim for between 25 – 35g of fibre a day.	Quantity depends on mother's activity however quality is important. Higher quality options should be the preference in most cases (low GL / GI scores) and mothers should aim for between 25 – 35g of fibre a day.	Quantity depends on mother's activity however quality is important. Higher quality options should be the preference in most cases (low GL / GI scores) and mothers should aim for between 25 – 35g of fibre a day.
<i>Generally speaking between 40 – 60% contribution to total energy intake will be fine for most.</i>			
Fat	Quantity and quality appear to be important when it comes to fat intake. Mother should aim to keep total fat intake below 35% of energy intake (personally, I feel between 20 – 30% will be fine for most athletes). Minimizing intakes of saturated and trans fats is recommended. Aiming for at least 300mg EPA & DHA is advised.	Quantity and quality appear to be important when it comes to fat intake. Mother should aim to keep total fat intake below 35% of energy intake (personally, I feel between 20 – 30% will be fine for most athletes). Minimizing intakes of saturated and trans fats is recommended. Aiming for at least 300mg EPA & DHA is advised (200mg DHA during T2)	Quantity and quality appear to be important when it comes to fat intake. Mother should aim to keep total fat intake below 35% of energy intake (personally, I feel between 20 – 30% will be fine for most athletes). Minimizing intakes of saturated and trans fats is recommended. Aiming for at least 300mg EPA & DHA is advised (200mg DHA during T3)
<i>Generally speaking between 20 – 30% contribution to total energy intake will be fine for most (aiming to keep below 35%)</i>			

MICRONUTRIENT & MINERAL REQUIREMENTS DURING PREGNANCY



MICRO & MINERAL REQUIREMENTS & PREGNANCY

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 of 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.

On the next page there will be a table outlining the changes between non-pregnant and pregnant recommendations.

We will cover all the key micronutrient and minerals on the next page however won't be discussing them all in depth.

If you'd like to find out more about a specific micronutrient and or mineral I'd advise checking out work done by the World Health Organization and or [examine.com](https://www.examine.com) (more so for athletes to see if additional intakes will elicit any further benefit).

MICRO & MINERAL REQUIREMENTS & PREGNANCY

	Micronutrient and Mineral Requirements in Women	
	Non-Pregnant 19 + (per day)	Pregnant (per day)
Vitamin A	500 µg	800 µg
Thiamine (Vitamin B1)	1.1 mg	1.4 mg
Riboflavin (Vitamin B2)	1.1 mg	1.4 mg
Niacin (Vitamin B3)	14 mg	18 mg
Vitamin B6	1.3 – 1.5mg	1.9 mg
Vitamin B12	2.4 µg	2.6 µg
Vitamin D	500 µg	800 µg
Vitamin E	15 mg	15 mg
Folic Acid (Vitamin B9)	400 µg	600 µg
Iron	18 mg	27 mg
Zinc (*)	3 to 9.8 mg	T1 – 3.4 – 11mg T2 – 4.2 – 14mg T3 – 6 - 20mg
Copper	1.3 mg	1.5 mg
Selenium	26 mg	T2 – 28mg T3 – 30 mg
Iodine	2 µg/kg per day	3.5 µg/kg per day
Calcium	1.2 g	1.5 – 2g
Magnesium	220 mg	220 mg

*Zinc recommendations range from intakes suited to those with low and high bioavailability of the mineral based on the given dietary strategy they follow (i.e. vegan, pescetarian etc.)

As mentioned we're now going to cover several of the vitamins and minerals which may be more prominent for health (for both mother and child), however would state that **ALL** vitamins and minerals are critical for health (and just because they aren't featured shouldn't diminish their value).

MICRO & MINERAL REQUIREMENTS & PREGNANCY

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 behavioural 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.

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 µg or 10 000 IU of vitamin A) may be teratogenic (an agent that can disturb the development of the embryo or fetus.)** 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

MICRO & MINERAL REQUIREMENTS & PREGNANCY

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.

An intake of 400 µg/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, coeliac disease, use of anticonvulsants) should be 4 mg/day.

MICRO & MINERAL REQUIREMENTS & PREGNANCY

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)

MICRO & MINERAL REQUIREMENTS & PREGNANCY

Iron-containing supplements should be used if the iron reserves are insufficient, which may result in reduced haemoglobin production; anaemia, 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 anaemia 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 behaviour and possibly be linked with disease later in life.

Copper

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

MICRO & MINERAL REQUIREMENTS & PREGNANCY

Vitamin B12

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.

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.

Zinc

As a deficit of zinc does not immediately trigger mobilization of zinc from the maternal skeletal system, **zinc deficit 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.

OTHER CONSIDERATIONS FOR THE MOTHER DURING PREGNANCY



MEAL FREQUENCY DURING PREGNANCY

Meal patterning during pregnancy may be important because pregnant women who sustain prolonged periods of time without food by skipping meals and/or snacks may be inducing a physiologic stress upon their pregnancy.

Prolonged periods of time without food can cause hypoglycemia (low blood sugar), which stimulates a cascade of neuroendocrine events that may ultimately affect the health of the developing baby.

Whilst we can't test this in a randomized control trial (for ethical reasons) **a 2013 observational study has found that "women with high adherence to a "main meal" frequency pattern, implying a regular intake of breakfast, lunch, and dinner, had a significantly lower risk of preterm delivery compared with women with low adherence to this pattern**, even after adjustment for fiber as a proxy for a healthy diet." (Note that this study reinforced similar previous findings on the matter).

This involved a meal pattern of at least four meals a day and appears that overweight / obese women and or those with compromised glycaemic control may find most benefit to addressing meal frequency. Those who "fast" or have reduced meal frequency may want to amend their practices during gestation based on these findings.

DIETARY CHOICE AND PREGNANCY

We're all aware of the abundance of popular diet fads and principles these days. This section aims to cover those outside of the "fad" realm but which appear most commonly and may be followed by many expectant mothers. Note that, these are objective overviews aimed at best possible outcomes for the child, not based on any form of pre-existing bias. Your's and your child's health means more to me than my opinions (which ultimately aren't against any of these dietary practices anyway).

Veganism

Although plant-based diets are at risk of nutritional deficiencies such as proteins, iron, vitamin D, calcium, iodine, omega-3, and vitamin B12, the available evidence shows that well planned vegetarian and vegan diets may be considered safe during pregnancy and lactation, but they require a strong awareness for a balanced intake of key nutrients.

This means that the individual in question and or whoever is helping them coordinate their nutrition during gestation is aware of; protein quality, bioavailability of certain minerals, lack of dietary exposure towards certain vitamins, the importance of DHA, inadequacy of plant sources in this regard and why it may have to be supplemented etc. **There is nothing inherently wrong with being vegan whilst pregnant, we must however be conscientious that it does require more awareness, education, planning and balance.**

DIETARY CHOICE AND PREGNANCY

Ketogenic Diets

Similar to plant based diets, ketogenic diets run the risk of specific nutrition deficiencies such as folic acid (B9), biotin (B7), selenium, choline, vitamins A, E, D, chromium, iodine, magnesium, and molybdenum. Several of these dietary components have critical roles in optimal pregnancy outcomes.

These diet may however be an effective tool in addressing epilepsy in the mother (and the hazards that come along with that condition) and may be an alternative method to treat GDM.

There is nothing inherently wrong with following a ketogenic diet whilst pregnant, however, just as you would if you were following a vegan approach, you must be conscientious that it does require more awareness, education, planning and balance.

Intermittent Fasting

Intermittent fasting may be an effective approach for treating certain metabolic dysfunction conditions, as a weight management tool and as an approach which may effect longevity.

However, we do not believe it should be advised during gestation and would recommend returning to the "meal frequency" section to better understand why.

ALCOHOL AND PREGNANCY

Consumption of alcohol during pregnancy is harmful for the fetus. Children heavily exposed to alcohol antenatally may suffer from a number of physical and mental disorders before and after delivery and during their life course. They have a higher risk for impaired growth and may have neural disorders, resulting in serious learning and behavioural problems. Children exposed to smaller quantities of alcohol may develop similar but milder symptoms.

Although it has been demonstrated that heavy consumption of alcohol is associated with a high risk for the fetus, the “safe” dose of alcohol, which would not harm the child, has not been determined or standardized.

There is evidence that consumption of more than one alcoholic drink per day during pregnancy increases the risk for premature birth and low birth weight. Therefore, the only “safe” level is complete abstinence during pregnancy and lactation.

The consequences of alcohol consumption depend on the period of the pregnancy. **During the first 3 months, the risk for structural malformations is increased, whereas later, the risks for stunting and abnormal brain development increase.**

ALCOHOL AND PREGNANCY

Reduced IQ has been observed in genetically susceptible descendants even after consumption of small quantities of alcohol during pregnancy. Women who assume that small amounts of alcohol will not harm their child may tend to conceal their drinking, which may result in excessive consumption. Healthcare professionals should address this problem and clarify the patterns of use.

For the athlete there is no additional benefit to consuming alcohol during gestation. Alcohol can impair the response to exercise and prolong recovery whilst worsening body composition and performance.

In Summary

It'd be completely inadvisable to consume alcohol during pregnancy based on the potential harmful effects it may have on the developing child.

There is also no benefit to athletic performance, recovery and or body composition for the athlete.

Some mothers may use alcohol as a coping tool for perinatal depression and healthcare professionals should monitor this and be mindful of how to best manage these situations.

SPORTS SUPPLEMENTS AND PREGNANCY

The use of sports supplements / ergogenic aids is poorly understood in general and complications only further arise when we ponder their "safety for use" in the pregnant athlete.

We're going to briefly cover the safety of the most widely used and extensively researched performance aids (in relation to use during pregnancy).

Caffeine

Caffeine is an effective performance aid and is the most widely used psychoactive compound in the world. **Mothers should aim to limit their intake to less than 200mg a day** (2 coffees or 4 tears for reference). Minimal intakes may be best advised as any caffeine intake has been associated with significant (albeit modest) increases in risk for various undesirable gestational outcomes.

Creatine

Creatine appears to be relatively safe for use during gestation and may actually provide some unique benefits. There has been recent interest in use of creatine during pregnancy to promote neural development and reduce complications resulting from birth asphyxia. It has been postulated that **there may be additional benefit to creatine supplementation during pregnancy on fetal growth, development, and health.**

SPORTS SUPPLEMENTS AND PREGNANCY

Beta Alanine

In adults (≥ 18 years), the specified doses 1000, 1500 and 2000 mg/day of beta alanine in food supplements are unlikely to cause adverse health effects provided that beta-alanine is consumed with maximum 5 mg/kg bw per intake and a minimum of 2 hours between the intakes.

No studies have investigated the effects of beta-alanine in potentially vulnerable groups (e.g. the elderly, pregnant and lactating women). Use of the supplement is up to the discretion of the athlete in this instance, however caution is advised (as is weighing up potential benefit to risk ratio and the duration of time in which you'll be abstaining from supplementation)

L-Citrulline / L-Arginine

Despite evidence that co-administration of citrulline and arginine may be a more effective strategy to increase bioavailable arginine and improve pregnancy outcomes in preclinical models, **no published human studies to date have examined the impact of supplementation with citrulline or a combination of arginine and citrulline on birth outcomes.**

Arginine supplementation has been associated with reduced risk of pre-eclampsia, gestational hypertension, FGR, and preterm labor. The observed safe amount for arginine supplementation in adults is currently 30 g/d for 90 days

ADDRESSING STRETCH MARKS

Striae gravidarum, or stretch marks of pregnancy, are a common cutaneous physiological change occurring during pregnancy.

Women of all racial groups are at risk. Rates of occurrence vary, with reported rates ranging between 50 and 90 %. Stretch marks usually first appear around the sixth and seventh month of pregnancy but have been reported prior to 24 weeks gestation.

They occur most commonly during a first pregnancy but have been known to occur for the first time in a second pregnancy. Stretch marks vary in quantity and severity, frequently affecting the abdomen, breasts and thighs where there is greatest stretching of the skin.

Can you prevent and or reduce the development of stretch marks?

There is limited evidence that centella, and possibly massage with bitter almond oil, may prevent stretch marks and/or reduce their severity. There is weak evidence that hyaluronic acid prevents stretch marks.

Bio-Oil is the most commonly reported product of use in preventing stretch marks. Trials have showed promise following use however these studies were ran by the company and findings have to be taken with a pinch of salt.

ADDRESSING STRETCH MARKS

Anecdotally, we have seen mother's have great results using Bio-oil and so may be a worthwhile option.

Ultimately, any of the mentioned strategies, regardless of level of support, may be worth trialing as the effectiveness of that given strategy may not be truly reflected by the data.

The manifestation of stretch marks (in terms of severity and when they appear) differs significantly from person to person, and those with more severe manifestations may skew results.

Ultimately, they can't hurt and for some athletes it may be desirable to mitigate stretch mark formation for aesthetic purposes.

It should be noted that **we at OUTWRK do not support the notion that stretch marks are unaesthetic. They are part of you and something to be proud of, arguably more so when they are a product of bringing a child into the world.**

DIGESTIVE ISSUES WHEN PREGNANT

Many expectant mothers suffer with pregnancy related gastrointestinal issues. From nausea and vomiting, to constipation to even exacerbating pre-existing digestion related issues (namely irritable bowel syndrome and irritable bowel disease - which should be discussed with your doctor / health care provider).

In this section we aim to cover the range of these issues briefly, explaining the mechanisms and things you can do to manage them (from a dietary perspective).

Nausea & Vomiting

Nausea and vomiting are the most frequent medical conditions during pregnancy, *affecting 50-80% of women*. These symptoms begin between the 4th and 6th week, peak at the 8th to 12th, and often cease by the 20th.

It is not fully understood as to why these issues develop however it has been speculated that changes in certain hormones can influence gastric motility and emptying. Psychological factors may also play a role. Anxiety, depression, undesired pregnancies and negative relationships with family members have been linked to a higher prevalence of nausea and vomiting.

DIGESTIVE ISSUES WHEN PREGNANT

Addressing the issue;

Most women do not require pharmacological treatment and can be managed with alternative options and dietary modifications.

Diet recommendations include smaller meals and avoidance of fatty foods and fresh vegetables that can delay gastric emptying.

Daily consumption of 1.5 L of water or drinks containing glucose, salt and potassium are recommended. Both thiamine (vitamin B1) and pyridoxine (vitamin B6) have proven their efficacy and are indicated as routine supplements in patients with protracted vomiting.

A 2010 Cochrane review evaluated nine randomized trials involving ginger. Based on expert experience, ginger can be considered a non-pharmacologic option during pregnancy.

Gastroesophageal reflux disease (G.E.R.D)

GERD is reported by 40-85% of pregnant women, usually beginning at the end of the first trimester, and can profoundly impair the quality of life.

DIGESTIVE ISSUES WHEN PREGNANT

Addressing the issue;

Conservative measures include avoiding eating late at night, elevating the head of the bed by 10-15 cm and lying on the left side.

If symptoms persist, medication may be necessary. First-line treatment is based on antacids. Antacids containing calcium, and magnesium are considered safe in pregnancy.

Furthermore, patients prefer to use this medication because it relieves the symptoms promptly and can be taken on demand. No teratogenic effects of these drugs (notably these have been observed in animal studies).

Bicarbonate-containing agents, such as sodium bicarbonate, should be avoided as they can be potentially harmful to the mother and the fetus.

Constipation

Constipation usually occurs in the first and second trimester, affecting 35% and 39% of women, respectively. The risk of constipation seems to be higher if documented in previous pregnancies and is associated with iron intake.

DIGESTIVE ISSUES WHEN PREGNANT

Once again the sex hormones and their effect on motility may be to blame. Additionally, it has been proposed that pregnant women have increased absorption of colonic water (which may impact transit times through the gut).

Iron intake can worsen symptoms. A "gentle" iron supplementary alternative may be of benefit in this scenario.

Mechanical changes in the G.I tract which occur during pregnancy may also contribute (and may worsen as pregnancy progress and the child becomes larger).

Addressing the issue

Dietary management of constipation includes adequate water intake and a high-fiber diet. Food volume may exacerbate the symptoms, especially in the second trimester, and smaller, more energy dense meals may be an alternative.

Additionally, adequate exercise may also be of benefit as may limited use of stimulants (coffee, green tea etc. however please review the previous statements on caffeine made in this book and why use of the substance should be limited).

IN SUMMARY



IN SUMMARY

We'd just like to take this time to say thanks for the support and interest in our guide and overall services.

It means a lot to us and we do sincerely hope it has helped and revealed the complexities of nutrition surrounding pregnancy and performance.

This guide is by no means exhaustive and we implore you to go and investigate further the themes discussed within.

I truly believe we grow by learning and learning is a product of curiosity!

Once again, thank you so much for the support and look forward to hearing how this guide has helped you!

Cheers,

Jamie

Tag us @jamiesdietguide if this has helped!