

## MATERNAL NUTRITION &amp; PREGNANCY OUTCOMES

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**ABSTRACT**

Maternal nutrition is a cornerstone of a healthy pregnancy, significantly influencing both maternal well-being and fetal development. This comprehensive article delves into the vital aspects of maternal nutrition, providing expectant mothers with actionable insights for a nourishing journey through pregnancy. Covering the essential nutrients—such as folic acid, iron, calcium, and protein—we explore their roles in fostering optimal fetal growth and mitigating potential complications. All the information provided is summarised based on case studies performed and articles published in this field. Navigating the intricacies of a balanced diet for expectant mothers, we offer practical guidelines on recommended food groups, portion sizes, and meal planning. Special consideration is given to the unique needs of vegetarian or vegan mothers, ensuring they obtain the necessary nutrients for a thriving pregnancy. The article goes beyond the plate to examine the repercussions of poor maternal nutrition on pregnancy outcomes. From the risks of preterm birth to the developmental impacts on the fetus, we underscore the critical connection between a mother's dietary choices and the well-being of her child. To empower pregnant women with actionable advice, the article provides sample meal plans that exemplify a well-rounded, nutrient-rich diet. Demystifying common misconceptions about pregnancy and nutrition, we equip expectant mothers with evidence-based insights for informed decision-making. Recognizing the importance of weight gain during pregnancy, we emphasize that it's a natural and necessary component of the maternal journey. The narrative extends to the postpartum period, highlighting the enduring significance of good nutrition for recovery and breastfeeding. Throughout, we stress the importance of consulting healthcare professionals for personalized guidance. Real-life anecdotes enrich the narrative, fostering relatability and inspiring a commitment to holistic maternal well-being. In essence, this article serves as a comprehensive guide, empowering expectant mothers to make informed nutritional choices that resonate positively throughout their pregnancy journey, ensuring not only their health but also the flourishing development of the precious life they nurture.

**INTRODUCTION**

Nutrition plays a major role in maternal and child health. Poor maternal nutritional status has been related to adverse birth outcomes; however, the association between maternal nutrition and birth outcome is complex and is influenced by many biologic, socioeconomic, and demographic factors, which vary widely in different populations.<sup>[1]</sup> During pregnancy, a woman's nutritional needs change. Women need to consume extra vitamins and minerals, increase their calorie intake, and avoid certain foods and chemicals to optimize the growth and development of their baby.<sup>[2]</sup> The nutrition which is received is strongly influenced by aspects of their sociocultural and economic context, however two other important influences - discipline and willpower to achieve healthy nutrition play a major role.<sup>[3]</sup>

The adverse birth outcomes covered in this review—namely, low birth weight, preterm birth, and IUGR—can have lifelong consequences for development, quality of life, and health care costs.<sup>[4]</sup> Nutritional insult during a critical period of gestation may leave a permanent

“memory” throughout life, and some of the effects (e.g., insulin secretion and action) may be gender-specific, these aspects disturb the Molecular Mechanisms of Fetal Programming.<sup>[5]</sup> All people, whether rural or urban, have their own beliefs and practices. Some are based on centuries of trial and error and have positive values while others may be useless or harmful, these all practices lead to myths and Misconceptions about pregnancy and nutrition.<sup>[6]</sup>

Malnutrition during the critical period of pregnancy has significant health outcomes for both the mother and her offspring. Medical nutrition therapy (MNT) by a registered dietitian nutritionist (RDN) may help mitigate negative health effects, There is a good/strong evidence that MNT by an RDN decreased gestational weight gain, although there was no effect on maternal complications, caesarean section deliveries, and gestational age among women with mixed body mass index status or those who were overweight/obese. The evidence was deemed fair in support of an effect on glycemic control, infant birth weight, and infant complications.<sup>[7]</sup>

In conclusion, as we embark on this exploration of the intricate relationship between maternal nutrition and pregnancy outcomes, it becomes evident that the choices mothers make during this transformative period wield profound implications. Beyond the realm of individual health, these decisions resonate with the future of a new life, shaping the very foundation of a child's well-being. With this article, we aim not only to unravel the complexities of maternal nutrition but also to empower expectant mothers with the knowledge needed to navigate this journey with confidence. Join us on this

insightful voyage as we delve into the nuances of dietary choices, decode the nutritional needs of pregnancy, and ultimately foster a holistic approach that nurtures both mother and child.

### Nutritional needs during pregnancy

During pregnancy, a woman's nutritional needs change. Women need to consume extra vitamins and minerals, increase their calorie intake, and avoid certain foods and chemicals to optimize the growth and development of their baby.

Weight gain during pregnancy	
Weight at start of pregnancy	Recommended weight gain during pregnancy
Underweight	28 to 40 lb
Healthy weight	25 to 35 lb
Overweight	15 to 25 lb
Obese	11 to 20 lb
Twin gestation	37 to 54 lb (beginning at healthy weight)

- **Proper weight gain and caloric intake** Women carrying one fetus, who begin pregnancy at an average weight for their height, should gain a total of between 25 and 35 lb. Weight gain recommendations are adjusted when the woman is overweight or underweight at the start of pregnancy to ensure a weight gain that supports the growing fetus without placing undue strain on the woman's body. The current recommendation for women carrying one fetus is that they should consume approximately 300 to 500 additional calories per day during the last 6 months of their pregnancy.<sup>[2]</sup>

**Source: March of Dimes. Your pregnant body.**  
[http://www.marchofdimes.com/pnhec/159\\_153.asp](http://www.marchofdimes.com/pnhec/159_153.asp).

Although your patient should gain adequate weight during pregnancy, she should never try to lose weight. Inadequate and excessive weight gain during pregnancy have been associated with several adverse outcomes for both mother and child.

#### Inadequate weight gain is associated with

- Intrauterine growth retardation
- Low birth weight
- Higher incidence of preterm delivery.

#### Excessive weight gain is associated with

- long-term maternal obesity
- higher incidence of childhood obesity
- large for gestational age baby
- increased maternal morbidity

- prolonged labor
- higher incidence of perineal lacerations
- higher incidence of cesarean section deliveries
- longer hospital stays

**2. Gestational diabetes risk** Some women develop diabetes during pregnancy. Known as gestational diabetes, this condition affects up to 14% of all pregnancies. Risk factors include obesity, history of gestational diabetes, strong family history of diabetes, and being a member of an at-risk ethnic group. Gestational diabetes typically resolves within weeks of delivery; however, approximately 5% to 15% of women continue to experience signs and symptoms of diabetes after the pregnancy.<sup>[2]</sup>

Screening for gestational diabetes is done between weeks 24 and 28 of pregnancy by conducting a 1-hour oral glucose tolerance test (OGTT). The woman fasts for at least 8 hours before the test. When arriving at her practitioner's office or lab, her serum blood glucose is drawn and then she's instructed to consume a 50-g load of glucose within 5 minutes. One hour after consuming the glucose load, her serum glucose is drawn again to test her body's glucose tolerance. A glucose level above 140 mg/dL is considered abnormal; a 3-hour OGTT is then performed for a definitive diagnosis of gestational diabetes.

Gestational diabetes testing		
	1-hour OGTT	3-hour OGTT
<b>Fasting level</b>	Less than 95 mg/dL	Less than 95 mg/dL
1 hour after	Less than 140 mg/dL	Less than 180 mg/dL
2 hours after	-	Less than 155 mg/dL
3 hours after	-	Less than 140 mg/dL

**3. Important vitamins and minerals** The increased calorie and nutrient needs for these life stages should be met by consuming nutrient-dense food choices as part of a healthy dietary pattern. One way to achieve this is to follow the Healthy U.S.-Style Dietary Pattern throughout pregnancy and lactation, but adjust intake of food groups

to reflect higher calorie patterns recommended during the second and third trimesters of pregnancy and throughout lactation. In short, women should meet their increased calorie and nutrient needs with nutrient-dense foods instead of with foods high in added sugars, saturated fat, and sodium.<sup>[8]</sup>

**Healthy U.S.-Style Dietary Pattern for Women Who Are Pregnant or Lactating, With Daily or Weekly Amounts From Food Groups, Subgroups, and Components.<sup>[8]</sup>**

CALORIE LEVEL OF PATTERN	1800	2000	2200	2400	2600	2800
<b>FOOD GROUP OR SUBGROUP</b>	Daily Amount of Food from Each Group (Vegetable and protein foods subgroup amounts are per week.)					
<b>Vegetables(cup eq/day)</b>	2 ½	2 ½	3	3	3 ½	3 ½
	Vegetable Subgroups in Weekly Amounts					
Dark-Green Vegetables (cup eq/wk.)	1 ½	1 ½	2	2	2 ½	2 ½
Red & Orange Vegetables (cup eq/wk)	5 ½	5 ½	6	6	7	7
Beans, Peas, Lentils (cup eq/wk)	1 ½	1 ½	2	2	2 ½	2 ½
Starchy Vegetables (cup eq/wk)	5	5	6	6	7	7
Other Vegetables (cup eq/wk)	4	4	5	5	5 ½	5 ½
<b>Fruits (cup eq/day)</b>	1 ½	2	2	2	2	2 ½
<b>Grains (ounce eq/day)</b>	6	6	7	8	9	10
Whole Grains (ounce eq/day)	3	3	3 ½	4	4 ½	5
Refined Grains (ounce eq/day)	3	3	3 ½	4	4 ½	5
<b>Dairy (cup eq/day)</b>	3	3	3	3	3	3
<b>Protein Foods (ounce eq/day)</b>	5	5 ½	6	6 ½	6 ½	7
	Protein Foods Subgroups in Weekly Amounts					
Meats, Poultry, Eggs (ounce eq/wk)	23	26	28	31	31	33
Seafood (ounce eq/wk)c	8	8	9	10	10	10
Nuts, Seeds, Soy Products (ounce eq/wk)	4	5	5	5	5	6
<b>Oils (grams/day)</b>	24	27	29	31	34	36
<b>Limit on Calories for Other Uses (kcal/day)</b>	140	240	250	320	350	370
Limit on Calories for Other Uses (%/day)	8%	12%	11%	13%	13%	13%

During pregnancy, there are certain vitamins and minerals that women must ensure they consume plenty of. Many women don't eat right during pregnancy due to morning sickness, food aversions, or a busy schedule. Therefore, it's recommended that all pregnant women take a **folic acid** (folate) supplement, **400 mcg/day**, preferably starting before becoming pregnant but at the latest beginning with the first prenatal visit. Folic acid reduces the chance of *neural tube defects* such as *spina bifida*. If there's a family history of neural tube defects, then the woman should consume at least 4,000 mcg/day.

**Iron** and **calcium** are also recommended to be added to a woman's diet during pregnancy. A woman needs twice the amount of iron during pregnancy, approximately **30 mg/ day** as a result of increased maternal blood volume. Calcium intake should be increased to **1,200 mg/day** to maintain bone health.<sup>[2]</sup>

**Effects of poor nutrition on pregnancy outcomes**

According to *Recent Advances in Nutritional Sciences* and the *study of maternal nutrition and fetal development* published in the journal of nutrition, Nutrition is the major intrauterine environmental factor that alters expression of the fetal genome and may have lifelong consequences.<sup>[5]</sup> This phenomenon, termed "*fetal*

*programming*," has led to the recent theory of "*fetal origins of adult disease*."

Namely, alterations in fetal nutrition and endocrine status may result in developmental adaptations that permanently change the *structure*, *physiology*, and *metabolism* of the offspring, thereby predisposing individuals to metabolic, endocrine, and cardiovascular diseases in adult life. Promoting optimal nutrition will not only ensure optimal fetal development, but will also reduce the risk of chronic diseases in adults.

Animal studies show that both maternal undernutrition and overnutrition reduce placental fetal blood flows and stunt fetal growth. Impaired placental syntheses of *nitric oxide* (a major vasodilator and angiogenesis factor) and *polyamines* (key regulators of DNA and protein synthesis) may provide a unified explanation for **intrauterine growth retardation (IUGR)** in response to the 2 extremes of nutritional problems with the same pregnancy outcome.<sup>[9]</sup>

***The Intrauterine Environment as a Major Factor Contributing to IUGR***

Multiple genetic and environmental factors contribute to IUGR.<sup>[10]</sup> Although the fetal genome plays an important

role in growth potential in utero, increasing evidence suggests that the intrauterine environment is a major determinant of fetal growth. For example, embryo transfer studies show that it is the recipient mother rather than the donor mother that more strongly influences fetal growth.<sup>[11]</sup> There is also evidence that the intrauterine environment of the individual fetus may be of greater importance in the etiology of chronic diseases in adults than the genetics of the fetus. For instance, in twin pregnancies, a baby with fetal growth retardation is more likely to develop noninsulin dependent (type-II) diabetes mellitus than a sibling with normal fetal growth.<sup>[12]</sup> Among intrauterine environmental factors, nutrition plays the most critical role in influencing placental and fetal growth.<sup>[13]</sup>

Placental and fetal growth is most vulnerable to maternal nutrition status during the peri-implantation period and the period of rapid placental development (the first trimester of gestation). Maternal undernutrition or overnutrition during pregnancy can impair fetal growth. Although full enteral feeding may be potentially effective in reversing IUGR in underfed mothers, this approach is not applicable under such conditions as severe nausea and vomiting. Conversely, reducing food intake may help prevent IUGR in overfed dams, but this intervention may not be as simple as one would think due to the powerful biological mechanisms that control food intake in mammals (including humans).<sup>[14]</sup> Thus, new knowledge of the mechanisms regulating fetal growth and development will be beneficial for designing new therapeutic strategies to prevent and treat IUGR.

#### **Maternal influences on fetal brain development: The role of nutrition**

An optimal early life environment is crucial for ensuring ideal neurodevelopmental outcomes. Brain development consists of a finely tuned series of spatially and temporally constrained events, which may be affected by exposure to a sub-optimal intra-uterine environment. Evidence suggests brain development may be particularly vulnerable to factors such as maternal nutrition, infection and stress during pregnancy.<sup>[15]</sup> Both maternal under- and overnutrition may have consequences for fetal neurodevelopment. The detrimental effects of maternal undernutrition have been characterised in studies of individuals who were exposed to severe undernutrition in utero during the Dutch Hunger Winter. In early 1944, the western part of The Netherlands was under German occupation and endured severe food shortages. During this time the population, including pregnant women, had an estimated caloric intake of 400–800 per day for a 5–6 month period.<sup>[16]</sup> A subsequent study of individuals at the age of 56–59 years showed that those exposed during early gestation performed more poorly on a selective attention task, which associates with accelerated age-related cognitive decline.<sup>[17]</sup> Maternal obesity during pregnancy is associated with increased adiposity and cardiometabolic risk factors in adult offspring. Maternal obesity is also

associated with impaired neurodevelopment and executive functioning,<sup>[18]</sup> and with adverse neuropsychiatric outcomes in children,<sup>[19]</sup> including Attention Deficit Hyperactivity Disorder (ADHD),<sup>[20]</sup> and Autism Spectrum Disorder (ASD).<sup>[21]</sup>

Some of the effects of maternal obesity on the offspring may be mediated by the associated increase in inflammation. Higher levels of maternal inflammation during pregnancy are associated with an increased risk of neurodevelopmental delay during childhood and mediate the effect of prenatal environmental adversity on child neurodevelopmental delay.<sup>[22]</sup> Exposure to maternal obesity during the antenatal period may result in the fetus being more susceptible to other insults such as infection or inflammation; for example, in mice, high fat diet-induced diabetes during pregnancy can potentiate the transcriptional response to a subsequent inflammatory stimulus in the fetal brain.<sup>[23]</sup> This is in line with the multi-hit hypothesis which is commonly cited for schizophrenia but may have relevance to other neurological disorders.<sup>[24]</sup>

#### **Common Misconceptions about Pregnancy and Nutrition**

Maximum misconceptions about nutrition revolve around pregnancy; affecting a vital period in human lifecycle.<sup>[25]</sup> All people, whether rural or urban, have their own beliefs and practices. Some are based on centuries of trial and error and have positive values while others may be useless or harmful.<sup>[26]</sup> Some food items are considered good and some bad at different ages of life. Food taboos are known from virtually all human societies. Probably food taboos (as unwritten social rules) exist in one form or another in every society on Earth, for it is a fact that perhaps nowhere in the world, a people, a tribe, or an ethnic group, makes use of the full potential of edible items in its surroundings. It is the regular avoidance of a food that turns into a tradition which ends up eventually as a food taboo.<sup>[27]</sup>

One of the strong beliefs is that *papaya can cause abortion*. In a study done by Puri S and Kapoor S.<sup>[28]</sup> Papaya is considered to be a fruit which is 'hot'. Conventionally 'hot' food items are avoided during pregnancy as it is thought that it will cause abortion. Similarly 'cold' foods are avoided during lactation as it might affect the quality and quantity of milk production.<sup>[29]</sup> The main constituents of papaya latex are papain and chymopapain,<sup>[30]</sup> which are potent uterine stimulants.<sup>[31]</sup> A fully ripe papaya contains very little or a negligible quantity of the latex which will not provoke uterine contractions, so it can be eaten. On the other hand, the unripe or semiripe papaya (which contains high concentration of the latex that produces marked uterine contractions) may have an adverse effect during pregnancy and should be avoided.<sup>[31]</sup> Another common misconception was "*consumption of saffron by pregnant woman results in a fairer skin child*".<sup>[25]</sup> There was a significant difference regarding this

misconception between literates and illiterates but the difference was not significant regarding misconception about avoidance of any food/fruit in pregnancy.

The final point to conclude is that still a large proportion of population believes in old unscientific tales, though with increase in literacy the proportion of people has reduced to a certain extent. There is a need of nutrition education and awareness generation among all stratas of population. There are very less number of studies on food misconceptions about food in pregnancy, as India is a country with diverse cultural backgrounds, there is a need for more research.

### Consulting a Healthcare professional

Pregnant women may obtain nutrition information from a number of sources but evidence regarding the adequacy and extent of this information is sparse. A systematic literature review was conducted to identify sources of nutrition information accessed by pregnant women, their perceived needs for nutrition education, the perceptions of healthcare providers about nutrition education in pregnancy, and to assess the effectiveness of public health programs that aim to improve nutritional practices.<sup>[32]</sup> This study concluded that women were not receiving adequate nutrition education during pregnancy. Although healthcare practitioners perceived nutrition education to be important, barriers to providing education to clients included lack of time, lack of resources and lack of relevant training.

**Nutritional counselling:** Improving maternal nutrition during pregnancy is integral to optimising child health outcomes and protecting women's health postpartum and beyond.<sup>[33]</sup> Registered dietitians are trained experts in delivering nutritional care and are well placed to support women during pregnancy to achieve an optimal dietary intake.<sup>[34]</sup> Evidence from meta-analyses suggests that dietary interventions are more effective when delivered by dietitians.<sup>[35]</sup>

The absence of nutritional care during pregnancy has the potential to leave women reliant on other and perhaps less evidenced-based sources of information such as internet or family and friends.<sup>[36]</sup> In addition, health literacy is an important consideration in pregnancy that may influence how women engage with this health information.<sup>[37]</sup> Globally, up to 40 % of adults may have lower levels of health literacy.<sup>[38]</sup> More specifically, data from studies with pregnant women suggest that levels of health literacy are mixed in this group and that lower levels are associated with unhealthy behaviours during pregnancy.<sup>[39]</sup>

### Postpartum nutrition

During postpartum, it is critical for women to develop healthy eating patterns to adequately support breastfeeding, optimize weight, and become a good role model to their children.<sup>[40]</sup> Previous research shows that postpartum women often quit the healthy eating patterns

that they may have formed prenatally.<sup>[41]</sup> In another study, it was found that less than 30% of mothers at 6 months after birth were eating the amount of fruits and vegetables per day recommended for postpartum women.<sup>[42]</sup> Therefore, there is a need for interventions tailored to the specific nutritional needs of postpartum women that emphasize a diet based on caloric balance and rich in nutritious foods.

Recently, the Academy of Nutrition and Dietetics (formerly the American Dietetic Association) and The American Society for Nutrition have recommended that women of reproductive age receive counselling on the importance of developing healthy eating habits, including the postpartum period.<sup>[43]</sup> Studies have shown that the postpartum period can be an opportune time to provide resources and motivation for dietary changes because women are more connected to health and nutrition services due to follow-up doctor's appointments.<sup>[42]</sup> However, those opportunities are usually tempered by the challenges of motherhood such as the demands of a new infant, stress, lack of sleep, and pressure to go back to work.<sup>[44]</sup> The pilot study conducted for Nutrition Education for Postpartum Women.<sup>[45]</sup> provides evidence to support an association between a dietary intervention emphasizing vegetables and the subsequent improvements in vegetable consumption of postpartum women, thus recognizing the postpartum period an effective teachable time. This study's findings agreed with the systematic review on nutrition interventions to increase vegetable intake that resulted in an average increase of 0.39 servings of vegetables per day.<sup>[46]</sup> Importantly, when intervention mothers were compared to control mothers, a higher percentage of intervention mothers met the goals for total vegetable intake and there was a trend toward significance for dark green and deep yellow vegetable intake.<sup>[45]</sup>

### CONCLUSION

The journey through pregnancy is a transformative period where the choices made by mothers resonate beyond the immediate horizon. Maternal nutrition emerges as a linchpin in this intricate process, weaving a narrative of health for both the mother and her unborn child. Our exploration into the realm of maternal nutrition has illuminated the profound impact it wields on pregnancy outcomes. From the earliest stages of fetal development to the long-term well-being of the child, the importance of adequate and balanced nutrition cannot be overstated.

As we navigate the complexities of modern life, it becomes increasingly evident that empowering mothers with knowledge about optimal nutrition is a catalyst for positive change. While we celebrate the strides made in understanding the intricate dance between maternal nutrition and pregnancy outcomes, we must acknowledge the challenges that persist. Access to nutritious food,

lifestyle factors, and socio-economic determinants can influence the maternal nutrition landscape.

Our collective responsibility is to translate this knowledge into actionable steps, fostering an environment where mothers receive the support and resources needed for a healthy pregnancy. A call to action echoes through these insights, urging us to champion the cause of maternal well-being. By integrating this awareness into our communities, healthcare systems, and personal lives, we contribute to the narrative of healthier pregnancies, brighter futures, and generations yet to come. The journey of motherhood begins with a single, nourishing step, laying the foundation for a legacy of health and vitality.

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