The Nutrients of Pregnancy

Some nutrients are essential for life. Vitamins, by definition, cannot be produced endogenously but are essential for life and normal metabolism. Similarly, orthomolecules are indispensable for health but may or may not be produced by the body. Minerals, antioxidants, phytonutrients, elements and macronutrients, although not always recognized as indispensable, exert a multitude of essential functions in the human body.

As metabolic requirements increase during pregnancy and lactation, so do nutritional needs. The Dietary Reference Intakes as established by the Food and Nutrition Board of the Institute of Medicine are a testament to increased nutritional requirements during pregnancy. As such, those nutrients have overt advantages throughout pregnancy because they are required for maternal metabolism, but are far more important for the support of normal fetal growth and development. Specific Dietary Recommended Intakes are shown in Tables 1a and 1b.

Clinical Trials and Prenatal Formulas

The benefits of supplementation during gestation have not always been reflected by the applied research.[7] There is a simple explanation: prenatal nutritional support tends to increase birth weight. For example, studies have demonstrated that pantothenic acid, sodium and vitamin E supplementation appear to increase birth weight.[8] Iron, iodine, calcium, folate, vitamin A, and vitamin C maternal intakes also influence offspring size.[9] Therefore, the benefits of supplementation in developing countries may be grossly underestimated simply because larger babies are more difficult to deliver (see figure 2). In countries where medical interventions for pregnancy complications are lacking, nutritional support may cause more difficult deliveries and result in an apparent lack of benefit.

Table 1a. Dietary Reference Intakes (DRIs): Vitamins

Source: Food and Nutrition Board, Institute of Medecine, National Academies

Age (years)	Vit A (μg/d)	Vit C (mg/d)	Vit D (μg/d)	Vit E (mg/d)	Vit K (mg/d)	Thiamin (mg/d)	Riboflavin (mg/d)	Niacin (mg/d)	Vit B6 (mg/d)	Folate (μg/d)	Vit B12 (μg/d)	Vit B5 (mg/d)	Biotin (μg/d)	Choline (mg/d)
Pregnancy														
14-18	750	80	5	15	75	1.4	1.4	18	1.9	600	2.6	6	30	450
19-30	770	85	5	15	90	1.4	1.4	18	1.9	600	2.6	6	30	450
31-50	770	85	5	15	90	1.4	1.4	18	1.9	600	2.6	6	30	450
Lactation														
14-18	1200	115	5	19	75	1.4	1.6	17	2	500	2.8	7	35	550
19-30	1300	120	5	19	90	1.4	1.6	17	2	500	2.8	7	35	550
31-50	1300	120	5	19	90	1.4	1.6	17	2	500	2.8	7	35	550

The situation is not the same in developed countries where medical care is readily available. Prenatal nutrient formulas are not meant to facilitate labour but designed to ensure the short and long term health of both the mother and child.

Birth weight is one of the most important outcome measures of pregnancy; since low birth weight increases the infant's risk of mortality and morbidity.[10] Low birth weight infants, although easier to deliver, are at risk for several complications and have lower rates of survival. In Canada and the United States, no factor is more significant than a low birth weight in predicting infant and fetal mortality (see Table 2).[11]

In addition, there is clear evidence showing that birth weights are also correlated to the incidence of several adult diseases such as diabetes (see Table 3) and

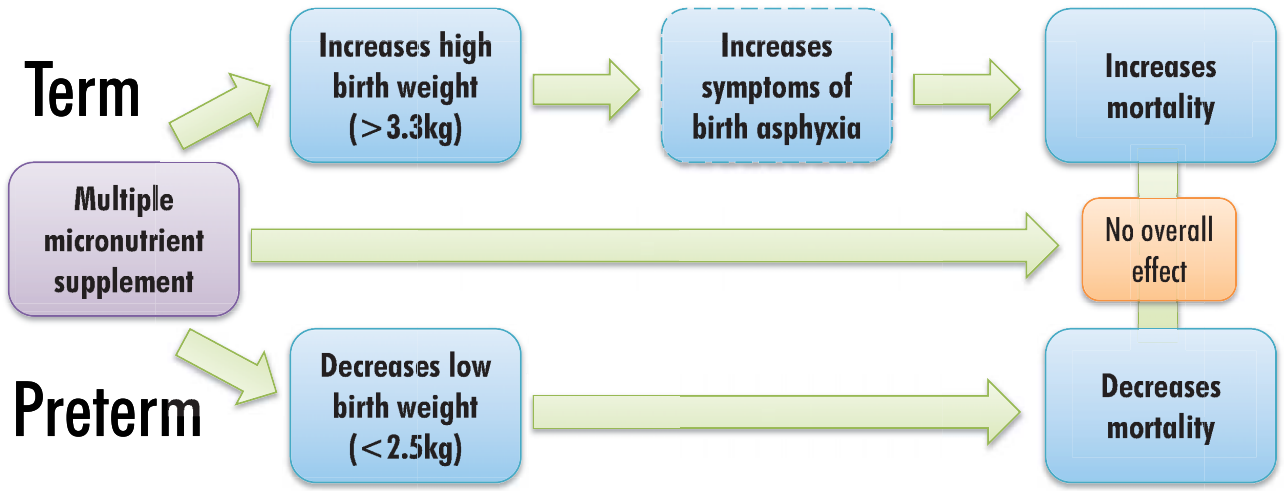


Figure 2. Possible explanation for reported lack of an overall effect of nutrient supplementation on infant mortality. Source: redrawn from Christian (2003).

Table 1b. Dietary Reference Intakes (DRIs): Minerals

Source: Food and Nutrition Board, Institute of Medecine, National Academies

Age (years)	Calcium (mg/d)	Chromium (µg/d)	Copper (µg/d)	Fluoride (mg/d)	Iodine (µg/d)	Iron (mg/d)	Magnesium (mg/d)	Manganese (mg/d)	Zinc (mg/d)	Phosphorus (mg/d)	Selenium (µg/d)	Molybdenum (µg/d)	Potassium (g/d)	Sodium (g/d)
Pregnancy														
14-18	1300	29	1000	3	220	27	400	2	12	1250	60	50	4.7	1.5
19-30	1000	30	1000	3	220	27	350	2	11	700	60	50	4.7	1.5
31-50	1000	30	1000	3	220	27	360	2	11	700	60	50	4.7	1.5
Lactation														
14-18	1300	44	1300	3	290	10	360	2.6	13	1250	70	50	5.1	1.5
19-30	1000	45	1300	3	290	9	310	2.6	12	700	70	50	5.1	1.5
31-50	1000	45	1300	3	290	9	320	2.6	12	700	70	50	5.1	1.5

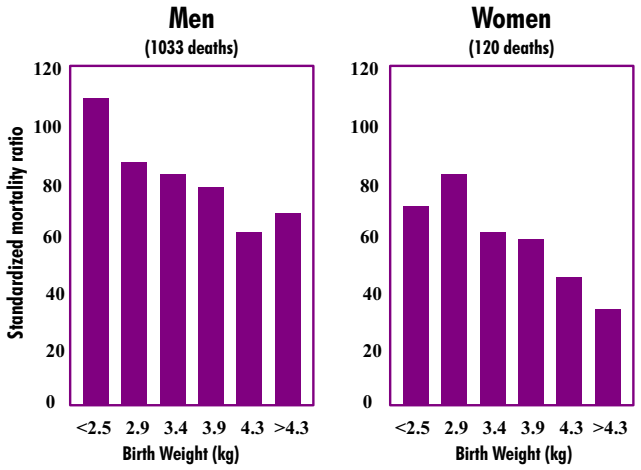
Table 2. Causes of neonatal deaths in developing countries vs. United States (1999)

Source: Rouse (2003) & CDC

Cause of neonatal death in developing countries	Proportion of all newborn deaths (%)	Cause of neonatal death in US	Proportion of all US newborn deaths (%)
Birth asphyxia	21.1	Low birth weight	23.1
Pneumonia	19.0	Congenital defects	20.8
Neonatal tetanus	14.1	Maternal complications	7.4
Congenital anomalies	11.1	Respiratory distress syndrome	5.6
Birth injuries	10.6	Complications of placenta	5.4
Prematurity	10.3	Sepsis of newborn	3.5
Sepsis and meningitis	7.2	Atelectasis	3.4
Others	5.1	Birth asphyxia	3.1
Diarrhea	1.5	Neonatal hemorrhage	2.6
		Others	25.1
Total	100	Total	100

cardiovascular conditions (see Graphs 1 & 2).[12] Most importantly, studies demonstrate that without prophylaxis, roughly 75% of pregnant women suffer from a deficit of at least one vitamin.[13]

Let us not forget that nutritional supplementation during pregnancy in developing nations remains one of the most cost effective ways to prolong life by preventing pregnancy related mortality. For instance, it is estimated that it would cost between $1.80 and $18 to save one infant through iodine supplementation. This is far less than other already established preventive interventions such as tetanus prevention at a cost of $27 to $115 per child saved.[14]



Graphs 1 & 2. Coronary heart disease death rates, according to birth weight. Source: Redrawn from Godfrey, 2000.

Table 3. Prevalence of type 2 diabetes in 370 men aged 59-70 according to birth weight

Source: Godfrey (2000)

Birth Weight (lbs)	Odds ratio of type 2 diabetes or impaired glucose tolerance
< 5.5	6.6
5.5 – 6.5	4.8
6.5 – 7.5	4.6
7.5 – 8.5	2.6
8.5 – 9.5	1.4
> 9.5	1