True vitamin A is a vitamin that occurs only in animal fats. In primitive societies, pregnant women consumed special foods rich in vitamin A--such as liver, spring butter and fish eggs--in a conscious effort to produce healthy, well-formed children. Modern research completely validates these traditions.

In a recent paper,[1] Maija H. Zile, of the Department of Food Science and Human Nutrition, Michigan State University, details the role of vitamin A in fetal development. Working with bird and mouse embryos, she and other researchers have determined that the vitamin A requirement begins at the time of formation of the primitive heart and circulation, and the development of the hindbrain, a period that corresponds to weeks 2-3 in humans. Without vitamin A, the embryo succumbs to gross abnormalities of the heart and is aborted.

Each organ system begins development during a specific window of time. Vitamin A regulates the differentiation of the primitive cells into cells specific to each organ system, in essence signaling to the genes their marching orders so they "know" where to locate themselves and what kind of tissues to become. If vitamin A is lacking during any of these windows, the organs develop abnormally or not at all.

The major target tissues of vitamin A deficiency include the heart, central nervous system, the circulatory, urogenital and respiratory systems, and the development of the skull, skeleton and limbs. Vitamin A deficiencies during the period when any of these systems begin specialization can result in abnormalities and defects.

According to Zile, even partial vitamin A deficiency affects the sensitive developing central nervous system; it plays a key role in the development of the visual system, the retina, the inner ear, the spinal cord, the craniofacial area including the pharyngeal and branchial arches and the thymus, thyroid and parathyroid glands.

During mid-gestation, vitamin A is required for fetal lung development. In vitamin A-deficient animals, congenital malformations in the urogential system occur. Most interesting is new research on the effect of vitamin A on kidney development. Vitamin A deficiency results in a reduced number of nephrons in the kidney. Lower numbers of nephrons mean the kidneys will not work at optimal levels and may doom the

individual to dialysis later in life.[2]

Another fascinating avenue of research has shown that vitamin A holds the key to what scientists call the "holy grail" puzzle of developmental biology: the existence of a mechanism that ensures that the exterior of our bodies is symmetrical while the inner organs are arranged asymmetrically. Researchers at the Salk Institute have found that vitamin A provides the signal that buffers the influences of asymmetric cues in the early stages of development, and allows these cells to develop symmetrically. In the absence of vitamin A, the exterior of our bodies would develop asymmetrically, with the result being that our right side would be shorter than the left side.[3]

After the formation of all the organ systems, vitamin A supports their growth. Chronic vitamin A deficiency during pregnancy compromises the liver, heart and kidney and impairs lung growth and development during the last weeks of gestation.[4]

Unfortunately, FDA and other agencies warn pregnant women to avoid foods like liver and cod liver oil, claiming that too much vitamin A from these foods can cause birth defects. The study usually cited in support of these warnings was carried out in 1995 at the Boston University School of Medicine and published in the New England Journal of Medicine.[5] In the study, researchers asked over 22,000 women to respond to questionnaires about their eating habits and supplement intake before and during pregnancy. Researchers found that cranial-neural crest defects increased with increased dosages of vitamin A; but neural tube defects decreased with increased vitamin A consumption, and no trend was apparent with musculoskeletal, urogenital or other defects.

This study is a poor rack on which to hang the myriad warnings that have kept pregnant women from eating liver and taking cod liver oil. Researchers made no distinction between synthetic vitamin A derived from multivitamins and processed food like margarine, and natural vitamin A from food; nor did they take blood samples to determine vitamin A status. Food recall surveys are a notoriously inaccurate method of determining nutrient intake.

Subsequent studies found that high levels of vitamin A did not increase the risk of birth defects. A 1998 study from Switzerland looked at vitamin A in pregnant women and found that a dose of 30,000 IU per day resulted in blood levels that had no association with birth defects.[6]

A 1999 study carried out in Rome, Italy found no congenital malformations among 120 infants whose mothers consumed an average of 50,000 IU of vitamin A per day.[7] Some participants consumed up to 300,000 IU vitamin A daily during pregnancy with no birth defects in the offspring. An average of 50,000 IU vitamin A per day is consistent with our recommendation of cod liver oil to supply 20,000 IU per day plus additional vitamin A in liver, butter, seafood and egg yolks.

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