

a



publication

## Adaptations of Pregnancy

Nourish your body and have a healthier baby!

To begin to understand the importance of good pregnancy nutrition you need to understand the changes that the body undergoes after conception.

The liver and kidneys play a vital role in the development of our babies and the health of our bodies. These vital organs take on new functions with pregnancy so you need to make sure you eat the right foods to nourish these organs thus you will create a very nourished environment for your baby. Yummy!

Please read the following excerpts from *Holistic Midwifery Volume I*, by Anne Frye

Adaptations of pregnancy: the liver, nutrition, and blood volume expansion:

(Note: I will use the term metabolic toxemia to discuss liver malfunction resulting from protein/calorie deficiencies. Pre-eclamptic syndrome is a bio-technical term encompassing all conditions which produce the same secondary symptoms).

Pregnancy is a normal physiological condition, and the processes associated with it have a normal function, not a pathological one. The physical changes in the body of a pregnant woman are extensive. Quite simply, everything changes! Although many of these changes are recognized in current medical practice, some of them are poorly understood.

Probably the least understood is the relationship between maternal nutrition, blood volume expansion and the increased demand on the liver. Understanding of this process is critical to understanding healthy pregnancy. Over the decades, a number of physicians (Pinard, Dodge, Frost, Mitchell, Thompkins, Wiehl, Ross, Hamlin, and others) have proven this nutritional link in their clinical practices. Unfortunately, their work has been largely ignored. The most recent of these researchers is Tom Brewer, a general practitioner who worked extensively with poor pregnant women. He has articulated this process and its link to metabolic toxemia in modern, scientific terms. For a summary of the relevant research, see [Maternal Nutrition and Child Health](#), by Douglas Shanklin. First, we will get an overview of how some of the adaptations of pregnancy interrelate to maintain the mother and baby in a healthy state. The following changes are of major significance:

### I. **The formation, implantation, and growth of the placenta.**

The placenta begins to form during the early weeks of pregnancy, with normal growth dependent upon the nutrients available from the uterine lining and the maternal bloodstream. The placenta implants into the uterine wall by eating its way into the capillary bed of the endometrium (uterine lining). Protein fibers anchor the placenta in place. Open maternal arteries deliver maternal blood into pools that form beneath the placenta. These pools are referred to as the lake of maternal blood. With each maternal heartbeat, tiny jets of maternal blood shoot up and bathe the cotyledons which are thin membranes that encase fetal capillaries. This allows exchange between the fetal and maternal blood streams permitting the transfer of maternal nutrients and oxygen to the baby and of waste products from the baby to the mother. Once waste products are exchanged for nutrients, blood repools beneath the placenta and drains into open maternal veins so it can be recirculated and replenished. This special circulatory mechanism is called an Arterial-Venous (A-V) shunt; there is no direct capillary connection. It allows maternal and fetal exchanges between blood streams with no mixing of the two in normal situations.

### II. **The expansion of the maternal blood volume by 50% to 60%**

The amount of blood in a pregnant woman's circulation increases as pregnancy advances, with peak volume occurring at 28-30 weeks. For a woman whose pre-pregnant weight was 123 lbs, blood volume

increases about 2.1 quarts (from 3.5 to a total of 5.6 quarts). This occurs because the mother's body must provide support for an increasingly larger and more complex organ: the placenta. Adequate blood volume expansion provides good perfusion of the placental surface. It is the amount of blood and the pressure of the blood which bathes the placental surface that stimulates placental growth. Gradual blood volume expansion results in continued adequate exchange of nutrients and wastes as the baby grows. Additional fluid is also a protection against shock, should the mother lose excess blood after birth.

Maintaining this dramatically expanded blood volume is made possible by the increased activity of the body's salt and water retention mechanisms, by an adequate intake of dietary salt, and by an increase in the synthesis of albumin (a protein that attracts water into the circulation) by the liver. With plasma volume expanding 50% to 60%, the red blood cells, which only increase by 30%, are correspondingly diluted. Plasma volume expansion begins as early as eight weeks and plateaus at 28-30 weeks of pregnancy (Davidson 1974; Christensen, 1958). Red cell volume begins to rise at 18 weeks of pregnancy and continues to rise until term (Norton & Kass 1968). This is the mechanism of the physiologic "anemia" of pregnancy. It is therefore normal for the hemoglobin to drop about two grams by 28 weeks (and sometimes more, especially with multiple gestations). Some women will then experience a slight rise as term approaches; others will not. The only normal exception to this basic rule is when women live at higher altitudes, where hemoglobin changes are less dramatic. The higher the altitude, the more you must rely on liver enzyme, albumin and total protein levels in lab results to monitor for any problems.

### iii. **The growth of the uterus.**

Before pregnancy, a well-nourished uterus will produce an endometrial lining that supports firm placental implantation. During pregnancy, the uterus changes from an organ weighing a few ounces to one that weighs about two pounds. Maternal nutrition influences how well this cellular hypertrophy takes place and the quality of the new tissues that develop.

### IV. **The increased demand on liver function.**

The liver performs over 500 metabolic functions. Three of these are of particular importance during pregnancy.

**Albumin synthesis:** The liver selectively combines amino acids into protein molecules. Albumin, which is similar to egg white, is the primary blood protein. It has an osmotic pressure which attracts appropriate amount of fluid into the bloodstream.

**Hormone metabolism:** The liver clears the bloodstream of hormones. In pregnancy, hormone levels rise to the equivalent of 100 birth control pills a day! The liver converts these hormones into products that are returned to the circulation and excreted by the kidneys.

**Detoxification:** The liver metabolizes toxic by-products of digestion which enter the bloodstream from the lower bowel, as well as toxins from environmental sources. Digestion slows down in normal pregnancy to enhance absorption of nutrients; therefore toxic by-products have a more favorable environment in which to develop, thus increasing the demand on the liver.

Liver-related demands increase as pregnancy advances. Maintaining liver function at peak efficiency requires a well-balanced diet with enough protein, calories, vitamins, salt, other minerals, and fluids to meet the demands of increased metabolic activity. The liver can only make albumin from dietary protein. If the diet is inadequate in any essential nutrient, the pregnancy suffers. If calories are inadequately supplied in the mother's diet, she will burn protein for her energy needs. Malnutrition due to a lack of either calories or high quality proteins can result in many complications of pregnancy, labor, birth, and postpartum.

Adequate blood volume expansion by 28 weeks serves as a foundation for adequate transport of nutrients to the baby during the last trimester, when she begins to put on more weight and store nutrients for after the birth as well as rapidly develop her brain. If the blood volume has not expanded adequately during the first 28 weeks, the mother's body is inadequately prepared to cope with the increased fetal demand and secondary symptoms of metabolic toxemia of late pregnancy become manifest during the last trimester. Increased fetal and placental demands place more stress on the

liver to increase blood volume, which it cannot do without proper nourishment. As a result, metabolism becomes increasingly deranged.

The kidneys respond to an inadequate blood volume by reabsorbing larger amounts of water and salt as they filter the blood. This reabsorbed fluid and salt is returned to the circulation. If there isn't enough albumin or sodium to hold this reabsorbed fluid within the circulatory system, much of it leaks out into the tissues through the blood vessel walls. The kidneys continue to reabsorb fluid at one end and the fluid keeps leaking out of the capillaries at the other. Pathological weight gain and edema are the result, with eventual reduction in urinary output as the body desperately tries to maintain the blood volume. (Jones, 1993)

Secondary symptoms of toxemia may present before 28 weeks in a severely compromised woman. A symptom is secondary when it may be associated with a variety of underlying causes. Some secondary symptoms are more likely to be related to inadequate blood volume expansion than others. Inadequate blood volume expansion eventually affects other metabolic processes. The symptoms of a contracted blood volume and liver compromise include:

- Intrauterine growth retardation: poor placental function produces a poorly nourished baby.
- Hypovolemia (low blood volume) threatens placental function and brings the mother into labor in a state bordering on dehydration. This is reflected in a high or rising hemoglobin and hematocrit during pregnancy.
- Nausea, tiredness insomnia and general malaise develop due to chronic hypoglycemia and liver damage.
- Pathological swelling (see above)
- High blood pressure: the mother's body tries to compensate for a contracted blood volume by attempting to adequately supply the placenta; although it doesn't have a large enough blood volume to do so properly. In response to a low or falling blood volume, the kidneys produce renin which constricts blood vessels. This is the same mechanism which raises the blood pressure in order to preserve vital organs after blood loss (such as hemorrhage) occurs. Hypertension is a late sign of toxemia. A woman's blood pressure may not rise until she is on the verge of convulsions, may not rise until after convulsions occur, or may not rise at all
- Headaches and visual disturbances due to nerve irritation resulting from excessive swelling, vasoconstriction and high blood pressure.
- Epigastric pain from liver damage (under the ribs on right side).
- Lab results reveal an elevated hemoglobin and, eventually, high liver enzymes as the liver experiences more stress. As the situation becomes more critical, low total protein and albumin levels will be noted since the liver is unable to manufacture blood proteins because it is not receiving the amino-acids necessary to do so.
- Hyperreflexes due to extreme stress and nervous system irritability
- Proteinuria (protein in the urine), a very late sign of true toxemia caused by kidney damage due to excessive filtering of thick blood and reabsorption of fluids.
- Oliguria: urine production falls off as the body desperately tries to preserve minimal blood volume. When this begins, kidney shutdown is not far behind.
- Maternal convulsions due to neurological irritation to the brain leading to coma and possibly death.
- Liver damage and rupture characteristic of toxemia.

Other complications often related to malnutrition include:

- Abruptio of the placenta: poor implantation and underlying clots cause separation before birth. Clots form easily when the blood volume is contracted because the blood volume is thicker.
- Prematurity: if blood volume reaches a critical low, the mother's body rejects the pregnancy in an effort to maintain a balance.
- Stillbirth: a weak fetus/inadequate placenta cannot maintain life either before or in conjunction with the stress of labor.
- Poor healing of the perineum or uterus.
- Infections in the mother or baby before, during, or after the birth.
- Maternal nutritional anemias.
- Post partum hemorrhage and coagulation deficiencies.

The primary disease entity in otherwise normal pregnancy is Metabolic Toxemia of Late Pregnancy (called eclamptic toxemia after the onset of convulsions). According to modern medicine, the mechanism is unknown.

Treatments vary, but all have centered on treating secondary symptoms via weight and salt restriction, rest, diuretics, antihypertensive drugs, and sedatives. These therapies increase the problem to critical proportions, since they attempt to treat only secondary symptoms and do not deal with the underlying cause.

**But what about current toxemia research which says diet is not a factor and which doesn't even mention the liver?**

Today, research is focusing on the possibility that toxemia is a recessive genetic condition. Much of the research regarding the minutia of biochemical changes ignores what is going on in the mother's external environment. The majority of studies make no attempt *at all* to ascertain the quality of the diets of the women they are researching. Often women from low socio-economic clinic populations are used for research, and many enter the study in an already compromised state, even though the study assumes them to be healthy based on a lack of recognized symptoms. While these studies may be discovering valid biochemical processes which take a pathological turn in the presence of a low blood volume, none of them are asking the right questions regarding why the blood volume is low in the first place.

There is much research to show that poor nutrition causes unhealthy pregnancies. Numerous studies, reports, and articles over the years have wholeheartedly supported this view. In an otherwise normal pregnancy, malnutrition leading to a breakdown of liver function with all its concomitant problems is the main thing that goes wrong. In pregnancies complicated by other medical conditions such as diabetes this lack of understanding only compounds the risks for both mother and baby. Enabling the liver to do its job by giving it good food is where all reasonable parental therapy needs to begin.

**A political issue:** The fact that the cause of toxemia in human pregnancy is "not known" is an enormous political issue. It is a feminist issue. While Tom Brewer's work is among the most recent in providing the value of nutrition, it has been largely ignored because he has not performed controlled studies, where one group of women would be intentionally deprived of an adequate diet, because he considers it unethical. It appears that the medical community does not want to recognize the simple truths of the nutrition/toxemia connection.

As long as the scientific community continues to focus on the results of disease, they will be running on the same old treadmill. Where would all the specialists and producers of medical technology and drugs be if it were suddenly "discovered" that when women eat well in pregnancy, eliminate drugs, and stop substance abuse, almost all complications disappear?

It's a discovery that they can't afford to make. It is one that we can't afford not to make! Pretending not to know is just another way of denying women power over their bodies, their births, and their lives.

Now that you understand how the liver, kidneys and blood volume please read about the diet developed by Dr. Tom Brewer for pregnancy called, "The Brewer's Diet."



publication