Nutrition in Pregnancy and Lactation: A Report to the Children'S Bureau (1967)

Pages
80

Size
7 x 10

ISBN
030929150X

Committee on Maternal Nutrition; Food and Nutrition Board; National Research Council

NUTRITION IN PREGNANCY AND LACTATION

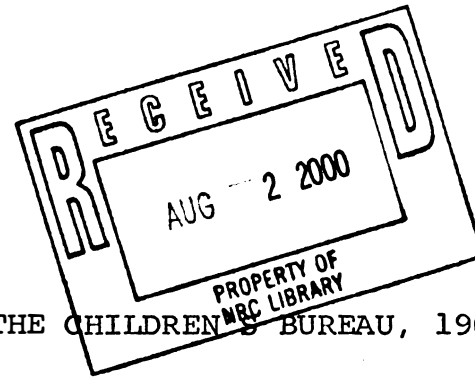
A REPORT TO THE CHILDREN'S BUREAU

BY

THE COMMITTEE ON MATERNAL NUTRITION

FOOD AND NUTRITION BOARD

NATIONAL ACADEMY OF SCIENCES-NATIONAL RESEARCH COUNCIL



FOR TRANSMITTAL TO THE CHILDREN'S BUREAU, 1967

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PREFACE

The Committee on Maternal Nutrition of the Food and Nutrition Board of the National Research Council was appointed in 1966 with the purpose of reviewing and interpreting the current state of knowledge of the relationships between nutrition in pregnancy and the outcome of pregnancy for mother and infant. Such an undertaking is particularly pertinent at this time in the United States since public health statistics indicate that neonatal and infant mortality experience in this country has not been as favorable in the most recent two decades as in some countries of Western Europe. The Children's Bureau of the Department of Health, Education, and Welfare has developed new programs in maternal and infant care and services for "Children and Youth" to which nutrition services must contribute. Therefore, the Committee accepted as its first responsibility the development of a report based on current nutrition concepts which may serve as a basis for the development of authoritative guidelines for the nutrition component of maternal and child health programs. This report has been prepared without the advantage of a complete review and synthesis of the world

literature on the subject, a task to be undertaken by the Committee in a later monograph.

This report represents the views of the Committee drawn from its experience in the fields of obstetrics, pediatrics, and nutrition. It is submitted to the Children's Bureau with the hope that it may assist the staff of that agency in developing nutrition service in its programs concerned with maternal and infant health. The Committee considers the recommendations contained in this report as tentative and anticipates that certain of these will be modified when a more detailed evaluation of the world literature is made. An eventual objective of the Committee is to designate fields of research which should receive increased attention in order to gain the knowledge necessary to make nutrition service more fully effective in the management of pregnancy, thus offering the greatest opportunity to the new-born for health, without impediment to physical and mental development.

CHAPTER I

THE ROLE OF NUTRITION IN REPRODUCTIVE EFFICIENCY

Reproductive efficiency is a term referring to all aspects of the process and outcome of pregnancy in a qualitative sense. It means productivity without waste. In the United States the majority of babies are born healthy and at full term to healthy young women after normal pregnancies. There is a high degree of reproductive efficiency among women who themselves were born and reared in an environment which favored normal growth and development and provided for their nutritional, emotional, and educational needs.

The children of families in these favorable environments have adequate diets, develop good eating and health habits which carry over into their adult lives, have few serious illnesses, obtain good medical care, have a good education, tend to marry and bear and rear their children under under similar favorable conditions. Good health and nutrition favor growth and development to full genetic potential. In general the resultant tallness is accompanied by a high level of biological efficiency and is associated with successful

reproductive performance.

There are, however, many women in the United States whose pregnancies are complicated or tend to repeatedly result in weak, poorly developed, or defective infants unable to survive the full term of pregnancy or the first days after birth. Fetal and neonatal death rates, the incidence of prematurity, low birth weight, and congenital defects are measures of reproductive inefficiency. This pregnancy wastage is great. Each year in this country at least 65,000 babies die during the last half of pregnancy. Of the approximately four million born alive, 67,000 fail to survive as long as one week. In a large proportion of deaths occurring in the first month, a contributing factor is low birth weight. Of the approximately 350,000 small, weak, and premature infants born each year, there are many whose survival depends upon special skilled care after birth, and many of the survivors continue to have health problems and retarded physical and mental development. Nearly 250,000 babies are born annually with congenital malformations. It is necessary to consider, in addition to infant morbidity and mortality, the maternal depletion and ill health which may be produced because of pregnancy.

Eight developed countries currently report significantly lower late fetal and neonatal mortality rates than does the

United States, indicating that our losses are needlessly high, and our recent rate of improvement is the smallest of any comparable country. Possible reasons may be the increase in the proportion of births to low income, non-white families in large city public hospitals; the increased incidence of low birth-weight infants; and a slow rate of decline in mortality rates among non-white infants.

The women whose pregnancies contribute most to these poor pregnancy outcomes have characteristics opposite to those of reproductively efficient women. They tend to be women of lower family income who have grown up in large families with inadequate means to provide good medical care, education, and nutrition. During pregnancy, these women have more chronic illnesses, more nutritional deficits, and more obstetrical complications. Toxemia of pregnancy is one of the most prevalent of these complications. Although a number of factors have been implicated in toxemia, an important one may be poor nutrition. In the United States, reproductively inefficient women are likely to be of Negro, American Indian, or Spanish American origin, ethnic groups which make up a substantial proportion of the lower socio-economic strata. But also included are many women who have not grown up in poverty who, for various reasons, arrive at childbearing age with poor health habits and with associated health, nutritional, and

Definitions of Diet and Nutrition

Diet is the daily fare of food and drink. It is sometimes defined as a manner of living with special reference to eating practices. The diet furnishes nutrients which may or may not be sufficient to adequately meet the nutritive needs of the individual depending on age, size, activity, state of health, environment, and genetic pattern. Unfortunately the word is often used to mean something restrictive such as weight control regimen. Actually everyone is on a "diet" of some kind whether he lives in a developing country, a slum, or an elite suburb.

Human Nutrition is the sum of the processes by which an organism absorbs and utilizes essential nutrients for the support of metabolism within the cell, stores for future use, or uses immediately for energy. It is also the sum of the influences which the intrinsic and extrinsic environment exerts upon these processes.

Nutritional Status of the individual reflects both past and present dietary intake and its utilization by the body.

Nutritional Counseling is a technique of communication and education by which dietary practices may be evaluated and changes for nutritive improvement indicated. Dietary counseling

necessitates knowledge of nutrition science and food values as well as of those psychological, socio-economic, and cultural factors which affect dietary practices.

CHAPTER II

RECOMMENDED NUTRIENT ALLOWANCES FOR PREGNANCY AND LACTATION

The objectives of effective programs of prenatal care are to create conditions most favorable for a normal, healthy pregnancy for the mother and birth at term of a healthy, fully-developed infant. The nutritional components concerned with the outcome of pregnancy (both maternal and fetal) must aim at provision of diets which provide calories and essential nutrients in amounts sufficient to meet all the needs for formation, growth, and development of the fetus as well as the extra-fetal tissues and the metabolic and physiologic requirements of the mother, which may include repletion of maternal stores.

The time continuum for adequate nutrition extends throughout all of life, but it is of utmost importance throughout all of pregnancy and lactation in order to meet the different demands during this period. It begins with the needs during the first trimester, the critical period of initial cellular growth, multiplication, and differentiation and continues through the second and third trimesters. During the first trimester, the

formation of definitive embryonic structure is most susceptible to the teratogenic effects of intrinsic and extrinsic environmental factors and to potentiation of genetic tendencies that may produce irreversible abnormalities. This is also the period of nausea and vomiting and bizarre appetites which, if not corrected, may lead to irreversible complications in the last two trimesters of pregnancy. Since the first trimester is the formative period for the embryo and the time when definitive maternal patterns are established, every effort should be made to correct the problems of early pregnancy and establish a satisfactory nutritional intake. This will provide for the molecular integrity of developing embryonic structures, including the placenta, and their subsequent growth, for the nutrient stores in the newly-born infant, and for adequate lactation.

To achieve effective nutritional management during pregnancy, it is necessary to individualize food plans to meet the needs of each patient. Physicians planning a diet for a pregnant woman must make dietary adjustments after considering the patient's nutritional status, age, body size, genetic pattern, physical activity, economic status, cultural and environmental background, food preferences, and existing medical complications. It is also necessary to determine the

Calories

Recommended allowances for a woman with a prepregnant weight of 58 kg (128 lb).

Prepregnancy	2100 Calories
Pregnancy	2300 Calories
Lactation	3100 Calories

An increased intake of calories are needed to meet the energy costs of the pregnant woman. These include calories for the building of new tissue in the fetus and placenta, the increased physical work load associated with normal activities of the mother, and the increased basal energy requirements during pregnancy. The increase in weight associated with pregnancy accelerates, beginning with small increments during the early weeks and increasing in the latter months before term, with an average gain between 0.5-0.8 pounds per week over the entire period. (Figure I, Appendix page 55) The intake should allow a gain in weight totaling approximately 24 pounds. Weight gain is one measure of the adequacy of caloric intake. Rapid gain in weight which is not related to caloric intake may indicate water retention. (27)

The usual caloric intakes of some pregnant women may require little change. Other women may need either more or less than the 200 additional calories per day recommended on the average during pregnancy. Adjustments in caloric allowances need to be made after considering weight, height, age,

and activity level. Some women may so reduce physical activity during the third trimester that the extra demands for calories may be largely met without additional caloric intake.

Allowances for women of body-size and age different from that of the reference woman may be estimated from data recorded in Table I, page 12.

The diets of some women with poor eating habits commonly include large quantities of sweets, sodas, and starchy foods which are proportionately high in calories, but which may lack essential nutrients. An important function of nutritional management in these cases is to help such women adjust their eating habits to include the essential nutrients within the calories allowed.

The additional energy requirements of lactation are proportional to the quantity of milk produced. The basic diet must be supplemented by approximately 120 calories for every 100 ml of milk produced. An appropriate caloric intake for the lactating woman is one on which the woman's weight remains constant.

A diet which provides generous amounts of all of the essential nutrients, to be described, along with the additional items commonly used in preparing meals will usually provide adequate calories necessary for successful pregnancy.

TABLE I

Calorie Allowances for Pregnant Women*

Body Weight	AGE 13 Yrs.	16 Yrs.	25 Yrs.	35 Yrs.	45 Yrs.
58 kg (Reference)	3100	2700	2300	2200	2100
40	2400	2100	1800	1725	1650
45	2600	2250	1950	1875	1800
50	2800	2400	2100	2000	1900
55	3000	2600	2200	2100	2000
60	3200	2800	2350	2250	2150
65	3400	2950	2500	2375	2250
70	3600	3100	2600	2500	2400

*Activity is an important determinant of caloric need. Calorie allowances, therefore, should be adjusted to meet varying levels of energy expenditure. Calorie allowances for women who are lactating may be derived by the addition of approximately 800 calories to the allowances in the Table. However, calorie allowances during lactation should be adapted to the quantities of milk produced.

Protein

Recommended allowances for a woman with a prepregnant weight of 58 kg (128 lb).

Pregnancy	78 grams daily
Lactation	98 grams daily

During pregnancy the growth of the fetus and accessory tissues increases protein needs. Adequate protein is required throughout pregnancy, but large additional demands are made during the last two trimesters. These requirements are greatest if the woman entered pregnancy in poor nutritive status and for the pregnant adolescent. Protein allowances for women who are lactating may be derived by addition of 20 grams protein daily to pregnancy allowances, on the assumption that 850 ml breast milk is produced daily. However, protein allowances during lactation must be adapted to the quantities of milk produced.

Meats, milk products, eggs, and fish supply the essential amino acids in proportions similar to body needs and have high nutritive value. Proteins from fruits, vegetables, grains, and nuts supply important amounts of many amino acids, but do not supply as complete an assortment as animal proteins, so the nutritive value is lower. Therefore, to insure a diet with a high nutritive value of protein, some portion of the protein intake should come from animal sources. Some animal

protein should be included in each meal since it is necessary to have both essential and non-essential amino acids available simultaneously for efficient protein bio-synthesis. Nitrogen balance studies (24) have shown that when the diet of the pregnant woman does not contain sufficient calories from carbohydrates and fats, protein is used for energy, and the body becomes depleted in the protein reserve necessary for the building of new tissue.

Milk and milk products are protein-rich foods and are also good sources of calcium, phosphate, B vitamins and minerals. Meats and eggs are also protein-rich and good sources of iron and B vitamins. If the protein content of the diet is low, these other nutrients are also apt to be inadequate.

Table II shows representative examples of food selections which supply the recommended amounts of protein. Many other food combinations will yield a similar amount of protein.

GOOD AND FAIR SOURCES OF PROTEIN (3, 33)

GOOD SOURCES

Food	Amount	Protein (grams)	Calories
Pork, cooked lean	3 oz.	25	220
Chicken, drumsticks	2 medium	24	180
Beef, stewed	3 oz.	23	245
Liver	3 oz.	22	195
Hamburger, cooked	¼ lb.	21	245
Cheese, cheddar type	3 oz.	21	315
Fish, canned	½ cup	19	160
Chile con carne (with beans)	1 cup	19	335
Cottage cheese	½ cup	19	100
Milk, nonfat dry	3/4 cup	19	190
Chicken, stewed	3 oz.	18	170
Milk, nonfat or whole	2 cups	18	180-320
Eggs	3	18	240
Pork and beans, canned	1 cup	16	320
Frankfurters	2½	15	390

FAIR SOURCES

Food	Amount	Protein (grams)	Calories
Beans, dried, cooked	1 cup	15	230
Peas, blackeyed, cooked	1 cup	13	190
Peanut butter	3 tbsp.	12	285
Tortillas, corn	6	9	380
Bread, enriched whole grain	4 slices	8	240
Rice, cooked	1 cup	4	185

Calcium

Recommended allowances for a woman with a prepregnant weight of 58 kg (128 lb).

Pregnancy	1.3 grams (1300 mg) daily
Lactation	1.3 grams (1300 mg) daily

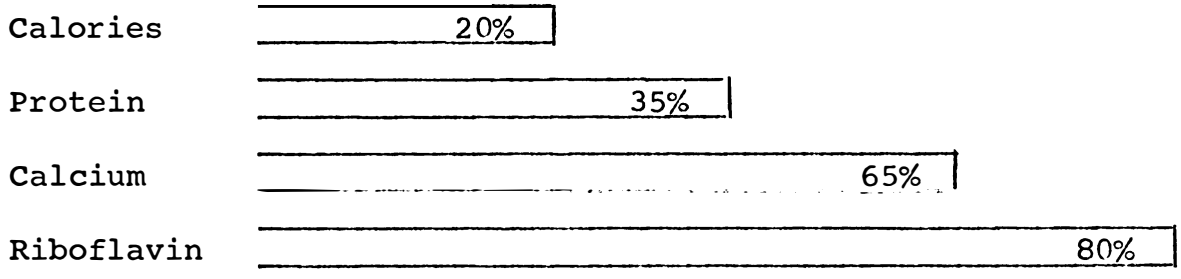
For the adolescent girl who is pregnant or lactating, the calcium allowance is 1.8 grams daily.

During pregnancy and lactation, the demand for calcium is increased to provide for the skeletal structures of the fetus and for the production of milk during the lactation period. Calcium is also important to maintain systems of blood coagulation, neuromuscular conduction, and muscle contractility. When dietary calcium is insufficient, the most readily mobilized calcium is found in the trabecular portion of bones of the mother.

Milk and milk products are the richest food sources of calcium. To provide enough calcium for the infant's bone and tooth development without depleting the expectant mother's supply, three cups of milk daily or its equivalent are recommended. One quart or more daily is advised during lactation. Part of the milk may be offered as cheese or in prepared dishes. Skim milk is as acceptable a source of calcium, protein, and riboflavin as is whole milk, and provides about half of the calories.

Calcium tablets are not acceptable substitutes for food sources of calcium because they do not supply the protein and vitamins found in food, may not be as readily utilized, and are a more expensive source of calcium than that found in foods. The use of non-food calcium is not recommended.

Approximate Contribution to Recommended Daily Dietary Allowances for a Pregnant Woman 18-35 Years of WHOLE MILK, 3 cups (1½ pints)



Iron

Recommended allowances for a woman with a prepregnant weight of 58 kg (128 lb).

Pregnancy	20 mg daily
Lactation	20 mg daily

Similar allowances are recommended for adolescent girls who are pregnant or lactating.

During pregnancy there is an increased need for iron in the diet in order to: maintain the mother's stores of iron and her hemoglobin level, furnish iron for feto-placental development, and furnish the infant with iron stores needed for blood formation during the neonatal period before iron-rich foods are added to the diet.

Iron balance in women of child bearing age is apt to be precarious because of the regular loss of menstrual blood and because of poor food practices. Women entering pregnancy with iron deficiency anemia need prescribed medicinal iron in addition to food sources of iron. In fact, it is not unreasonable to provide supplemental iron to all pregnant women. (See page 47 for recommended dosage.)

To insure intake of the recommended amounts of iron careful food planning is necessary. The iron in meat, eggs, and poultry is absorbed more readily than that from vegetable sources. (9)

GOOD AND FAIR SOURCES OF IRON (3, 33)

GOOD SOURCES

Food	Amount	Iron (mg)	Calories
Liver, pork	3 oz.	19.0	210
Kidney	3 oz.	9.5	170
Liver, beef	3 oz.	7.5	195
Liverwurst	3 oz.	5.1	240
Heart	3 oz.	5.0	160
Beans (cooked, dried)	1 cup	4.6	230
Pork, lean	3 oz.	3.2	220
Beef, lean	3 oz.	3.2	170

FAIR SOURCES

Food	Amount	Iron (mg)	Calories
Raisins	1/2 cup	2.8	230
Prunes	1/2 cup	2.2	190
Greens, cooked	3/4 cup	2.0	30
Sardines	2 oz.	1.8	120
Bread, enriched whole grain	3 slices	1.8	180

Ascorbic Acid, (Vitamin C)

Recommended allowances for a woman with a prepregnant weight of 58 kg (128 lb).

Pregnancy	100 mg daily
Lactation	100 mg daily

Ascorbic acid is essential for the maintenance of normal connective tissue; it is important for the health of gums and teeth; and it facilitates the absorption of iron. Food sources of ascorbic acid include fruits, especially citrus fruits, vegetables, and liver.

Vitamin A

Recommended allowances for a woman with a prepregnant weight of 58 kg (128 lb).

Pregnancy	6000 IU daily
Lactation	8000 IU daily

Vitamin A is essential in cell development, in tooth formation, in normal bone growth, and for healthy skin. It also has an important role in the chemistry of vision, enabling the eye to adapt to dark and light. The most abundant food sources of vitamin A are milk, butter, egg yolk, liver and the carotenoid pigments of green leafy vegetables, tubers, and fruits. Vitamin A in large amounts may produce toxic effects, however, this is not a hazard at usual levels of intake.

Vitamin D

Recommended allowances for a woman with a prepregnant

weight of 58 kg (128 lb).

Pregnancy	400 IU daily
Lactation	400 IU daily

Vitamin D provides for the absorption and retention of calcium and phosphorus and is required for skeletal growth. Food sources of vitamin D include whole milk fortified with 400 IU per quart, butter, fish oil, egg yolk, and liver. Other foods may have vitamin D added.

Excessive quantities of vitamin D are toxic. In the adult, doses in the order of 2000 to 3000 IU per day may lead to minimal toxicity. A newly recognized infantile hypercalcemia syndrome with developmental cardiac abnormalities suggests that smaller excesses in pregnancy may be toxic to the fetus.

GOOD AND FAIR SOURCES OF ASCORBIC ACID (3, 33)

GOOD SOURCES

Food	Amount	Ascorbic Acid (mg)	Calories
Orange	1 medium	75	60
Strawberries, raw	3/4 cup	66	40
Green pepper, cooked	1 whole	64	20
Cantaloupe	1/2 (5 inches dia.)	63	60
Brussel sprouts	1/2 cup	57	20
Orange juice (frozen, diluted)	1/2 cup	56	55
Grapefruit, raw	1/2	52	55
Grapefruit juice (canned)	3/4 cup	50	60
Greens, cooked turnip, mustard, collard*	3/4 cup	50	30

FAIR SOURCES

Food	Amount	Ascorbic Acid (mg)	Calories
Spinach, cooked	3/4 cup	40	30
Pepper, green and red, raw	1/2	40	10
Tomato, fresh	1 wedge 2" x 7"	34	50
Cauliflower, cooked	1/2 cup	33	12
Sweet potato, baked	1 medium	24	80
Cabbage, raw	1/2 cup	24	24
Tomato (canned, cooked or juice)	1/2 cup	23	23
Asparagus, cooked	1/2 cup	23	20
White potato (boiled in jacket or baked)	1 medium	22	90
Liver	3 oz.	22	195

*Servings of greens are given as 3/4 cup since this is an amount apt to be eaten by persons who like cooked greens.

FOOD SOURCES OF VITAMIN A (3, 33)

Food	Amount	Vitamin A (International Units)	Calories
Liver	3 oz.	45,420	195
Greens, cooked	3/4 cup	6,000 - 11,000	20 - 40
Potato, sweet	1	8,910	155
Carrots	1/2 cup	7,610	20
Pumpkin	1/2 cup	7,295	40
Cantaloupe	1/2	6,540	60
Winter squash	1/2 cup	4,305	65
Apricots	3	2,890	55
Egg yolk	1	580	60
Butter or fortified margarine	1 tbsp.	460	100
Milk, whole	1 cup	350	160
Milk, half & half	1/4 cup	290	80

Thiamine

Recommended allowances for a woman with a prepregnant weight of 58 kg (128 lb).

Pregnancy	1.0 mg daily
Lactation	1.2 mg daily

Thiamine helps to maintain appetite and normal cardiac and neurologic functions and is necessary in systems of carbohydrate metabolism.

Thiamine is sparingly stored in the body. Although widely distributed in plant and animal foods, thiamine occurs in small amounts. A varied diet helps to insure an adequate thiamine intake. Good sources include organ meats, milk, lean pork, dried beans, nuts, whole grain and enriched breads, and cereals.

Riboflavin

Recommended allowances for a woman with a prepregnant weight of 58 kg (128 lb).

Pregnancy	1.6 mg daily
Lactation	1.9 mg daily

Riboflavin functions in a number of important enzyme systems in tissues and respiration. It assists in the metabolism of carbohydrate and amino acids. Good sources of riboflavin are milk, milk products, and organ meats. Fair sources include meats, poultry, dark green leafy vegetables, and enriched or

whole grain bread and cereal. Eighty percent of the recommended riboflavin allowance for pregnancy is supplied by 3 cups of milk per day.

Niacin

Recommended allowances for a woman with a prepregnant weight of 58 kg (128 lb).

Pregnancy	17 mg equivalents daily
Lactation	21 mg equivalents daily

Niacin is needed for the vital processes of translating sources of energy into usable form. If the protein in the diet is of good quality and of sufficient amount, niacin intake will be adequate.

Folacin

Pregnancy	approximately 400 µg

Folacin (folic acid) requirements are increased during pregnancy, particularly during the 2nd and 3rd trimesters because of the demands of the growing fetus. The normal adult requirement is approximately 50 micrograms daily. Although precise information is not available, the minimum requirement during pregnancy is probably 400 micrograms.

Folacin deficiency results in megaloblastic maturation arrest of the bone marrow and anemia. Ascorbic acid is necessary for the maintenance of folacin in its active form. Folacin occurs in a wide variety of foods of animal and vegetable origin.

and cystic fibrosis; and of sickle cell anemia, and hemophilia.

C. Past History of Patient:

1. Feeding practices and problems during woman's infancy childhood, and adolescence.
2. The patient's recollection of her growth and development in relation to other family members and to peers.
3. Past history of illnesses or defects.
4. Weight history.

D. Present Pregnancy:

1. Immediate prepregnant weight and patient's concept of her desirable weight.
2. Change in weight during present pregnancy.
3. Pica
4. Major food likes and dislikes including major categories of foods rarely or never eaten.
5. Use of pharmaceutical preparations including vitamins and/or minerals.
6. Medically prescribed or self-imposed dietary restrictions.

This dietary information may be obtained by the physician or by a nutritionist, nurse, or midwife. To further determine general eating patterns, including food preparation and buying habits, a questionnaire such as that outlined in the Appendix (page 56) may be helpful, and may serve as a basis for meaningful dietary instruction.

E. Physical Examination:

1. Height is probably the most important single indicator of lifetime nutritional experience and should be accurately determined. Readings should be made without shoes to the nearest quarter-inch (or one centimeter).

2. Weight should be recorded in the nude, or with an appropriate correction if clothing is worn. This correction should be made at the time of the measurement. Weight should be recorded to the nearest pound (or 0.5 kilogram), then should be compared to a standard to give a general idea of the individual's weight to height status. (See Appendix, page 58)

3. Physical signs frequently associated with nutritional deficiencies are:

a. General
   - apathy
   - pallor
   - irritability
   - chronic fatigue

b. Gums
   - swollen
   - bleeding on pressure

c. Teeth
   - number decayed, missing or filled

d. Tongue
   - red
   - fissured
   - swollen
   - papillary atrophy

e. Thyroid
   - visible enlargement

f. Skin
   - unusual dryness of skin and hair
   - petechiae
   - dermatitis
   - brittle nails

g. Abdomen
   enlarged liver
   enlarged spleen

h. Lower Extremities
   edema
   absence of ankle jerks

i. Skeletal
   enlarged joints
   costochondral beading

F. Laboratory:

1. Hemoglobin. If the level is below the standard for pregnant women, a hematocrit should be done and a thin blood film studied for cell morphology. If these are not sufficient to establish a diagnosis, special investigations such as determination of serum levels of iron[1], folic acid[2], vitamin B_{12}[3] or bone marrow biopsy may be indicated.

2. There is not sufficient information on which to base a nutritional profile in pregnancy. Ordinary adult standards must be used for laboratory determinations which may be made.

3. PKU screen on mother's blood. A recommendation that all pregnant women be tested routinely for elevated serum phenylalanine levels to identify progeny presumably at risk of mental retardation may be premature at this time. It is, however, reasonable to perform such tests on blood taken from retarded women who are pregnant. For those who wish to assess nutritional status in

greater detail, the following biochemical tests are suggested:

Total protein[4], albumin[5], iron-binding capacity[1], ascorbic acid[6], vitamin A + beta-carotene[7], and transketolase[8]. Urine determinations[9] include creatinine[a)], total nitrogen or urea[b)], and thiamine[d)].

G. References:

1. Woodruff, C.W.: "A Micromethod for Serum Iron Determination." J. Lab. & Clin. Med. 53:955, 1959.

2. Herbert, V., et. al.: "The Measurement of Folic Acid Activity in Serum, a Diagnostic Aid in the Differentiation of Megaloblastic Anemias," Blood 15:228, 1960.

3. Spray, G.H.: "An Improved Method for the Rapid Estimation of Vitamin B_{12} in Serum." Clin. Sci. 14:661, 1955.

4. Interdepartmental Committee on Nutrition for National Defense: Manual for Nutrition Surveys, 2nd ed., Washington, D.C.: U.S. Government Printing Office, 1963, p. 134.

5. Beckman Methods Manual, Technical Bulletin #6095A. Spinco Division, Beckman Instrument, Inc., Palo Alto, 1961.

6. Bessey, O.A., Lowry, O.H., & Brock, M.J.: "The Quantitative Determination of Ascorbic Acid in Small Amounts

The major identifiable components of the weight gained by term are in Table III.

TABLE III

IDENTIFIABLE COMPONENTS OF WEIGHT GAINED AT 40 WEEKS GESTATION

Tissues or Fluid	Weight (grams)	Weight (pounds)	Reference
Fetus	3,500	7.7	10
Placenta	650	1.4	15
Amniotic fluid	800	1.8	15
Uterus	900	2.0	15
Breasts	405	0.9	15
Blood	1,800	4.0	27
Interstitial fluid	1,200	2.7	15
TOTAL	9,255	20.5	
Total weight gained during pregnancy	10,896	24.0	
Weight gain not accounted for	1,641	3.5	

In these averaged figures, shown in Table III, about 3.5 pounds of the total are unaccounted for. This discrepancy can be taken as a measure of maternal storage of nutrients, principally fat. (15)

Planning a weight control program aimed at limiting gain to less than 24 pounds assumes knowledge of a woman's body stores and dietary intake which is generally not available. The danger exists of interfering with the normal physiological processes of both the mother and the fetus. Thus, a rational program for a healthy pregnant woman should provide a diet

which contains all of the required nutrients with sufficient calories to support a steady gain in weight of 0.5 to 0.8 pounds per week to a total of approximately 24 pounds. A gain of less than this amount is likely to be at the expense of either the mother or the fetus or both.

It is important, however, to emphasize that normal gain in weight and rate of gain by themselves give no assurance that the patient's nutrition is necessarily optimal. For such assurance, the dietary intake of the patient must frequently be assessed and evaluated in the context of her "total status". Furthermore, every effort must be made to distinguish between the normal steady gain in weight of 0.5 to 0.8 pounds per week and that due to edema, usually evidenced by the sudden gains characteristic of water retention.

The Underweight Pregnant Woman: Although it was pointed out by Tompkins, et. al. (31) that patients who were 15 per cent or more underweight at the onset of pregnancy had an increased incidence of severe toxemia and an increased number of low birth weight infants, this subject has received relatively little attention in recent years. (29) Burke (5) noted that underweight women made the largest average gains in weight during pregnancy; they retained the most weight post partum; and they had the smallest babies. It

would seem justifiable, therefore, to design a weight control program for underweight women to include sufficient nutrients, particularly protein, to provide for the needs of the fetus and to support the gain in weight characteristic of a normal pregnancy. (Figure 1, Appendix page 55)

The Overweight Pregnant Woman: Obese women tend to have more complications during pregnancy (toxemia, diabetes), labor (uterine inertia), and delivery (dystocia, cesarean section), and give birth to large babies. On the other hand, they tend to have a low incidence of low birth weight infants. (17)

In the management of the obese pregnant woman, it is necessary to bear in mind that the existing body-weight usually represents a weight accumulation of many years and does not necessarily reflect her current caloric intake. During pregnancy the optimum management is an adjustment of food intake, if required, to improve the quality of the diet.

Whether an obese woman should attempt to lose weight during pregnancy depends on her individual circumstances. Under close supervision, weight reduction programs have been successful, but the question remains whether weight reduction during pregnancy is either necessary or desirable.

The emphasis in nutritional management of obese women, as in all women, must be placed on provision of the

recommended daily allowances of all nutrients. Weight reduction *per se* should be handled as a separate problem *post partum*. The most important aspect of a weight control program for obese pregnant women may well be that of developing attitudes, knowledge, self-understanding, and improved dietary habits that will make her post partum weight control program more satisfying and effective.

Maternal Nutrition and Toxemia of Pregnancy

Perhaps no aspect of maternal nutrition has excited so much interest or aroused so much controversy as the role of nutrition in the etiology and management of toxemia (pre-eclampsia and eclampsia) of pregnancy. The recent report of a WHO Expert Committee on Nutrition in Pregnancy and Lactation, 1965 (28) commented:

> The incidence of pre-eclampsia and eclampsia is so intimately affected by standards of antenatal care that it is difficult on the evidence available to define the precise role of nutrition in toxemia, except to state the nutritional status of the patient may possibly modify the course of the disease.

On the other hand, many authorities believe that nutritional factors are of prime importance, although the mechanisms through which poor nutrition operates in the development of pregnancy toxemia remain obscure.

It is commonly accepted that when two of three "cardinal" findings are present simultaneously in a patient, the existence

of the toxemia syndrome is established. The three are: 1) a persistent rise in diastolic blood pressure to 90 mm Hg or higher after the 24th week of pregnancy, 2) the presence of non-dependent edema, and 3) two or more episodes of proteinuria not attributable to infection. Reid (27) pointed out that the earliest sign of mild toxemia may be found several weeks prior to the later phase when the cardinal signs appear. This earliest phase is characterized by sudden gain in weight which is unexplainable on the basis of caloric intake alone. It should be emphasized that although sudden gain in weight is not necessarily considered to be a precursor of toxemia or pre-eclampsia, nevertheless, in practice, patients with sudden or rapid gain in weight are often treated vigorously on this assumption. The importance of toxemia can be illustrated by several observations. Toxemia of pregnancy is a leading cause of maternal deaths in this country, (22) accounting for about one-sixth of all maternal deaths, and is undoubtedly responsible for large number of stillbirths and neonatal deaths each year in the United States. The harmful effects of pregnancy toxemia on the fetus and on the later development of the child appear to be closely related to the deleterious effects of the disease on the fetus in utero. That is, toxemia appears to be a causative factor in producing low birth-weight, but gestationally mature infants (dysmature or small-for-date

infants) perhaps by altering the fetal-placental exchange which results in inadequate nutrition of the fetus and fetal growth retardation. (12) (23) Toxemia also contributes to the numbers of low birth-weight infants because it necessitates therapeutic early termination of pregnancy.

The incidence of established toxemia has been reported to be 1.5 per cent in private patients and 10 to 12 per cent in patients served by teaching hospitals. (27) These incidence figures, however, may give unreliable estimates of the magnitude of the problem. Clinic patients have a higher incidence of all complications and figures based on such groups are not representative of all pregnant women. In the Kauai Pregnancy Study, which included all pregnant women in a community, the overall incidence of toxemia was 6.6 per cent. (2)

Many clinics have established policies which in effect result in routine treatment of all patients as though they potentially might develop toxemia. In these clinics routine management often includes salt restriction, activity restriction, and the liberal use of diuretics, particularly for patients who show any suggestive increase in rate of gain in weight. Such management makes it difficult to even approximate the true incidence of toxemia. Present evidence does not support the routine restriction of sodium in management of normal pregnancy.

Prevention of Pregnancy Toxemia: Most obstetricians believe that eclampsia can be almost totally prevented and that the incidence of pre-eclampsia can be materially reduced. Tompkins and associates (31), under carefully controlled circumstances, found that in clinic patients receiving adequate protein and vitamin supplementation the incidence of diagnosable toxemia could be reduced to 0.6 per cent in contrast to an incidence of 4.7 per cent in a non-supplemented control group. All of these patients were seen at regular intervals, by the same obstetricians in the research clinic.

Because of the many variables in the management of toxemic patients, including support and activity restrictions, it is nearly impossible to disentangle the precise role of a nutrient or of nutrition from other important therapeutic measures employed. Nevertheless, nutritional manipulation did differentiate the groups in Tompkin's studies, indicating that the incidence of toxemia in a population may be sharply reduced by these means. The studies of others, Ebbs, Tisdall, and Scott, 1941, 1942, (8) Burke and Kirkwood, 1950, (6) Hamlin, 1952, (13) and Corkill, 1961, (7) lend support to Tompkin's observations.

Corkill (7) in commenting on the reasons for the striking improvements in toxemia control in Australia and New

Zealand cited in particular the closer attention given to early signs of edema as an important advance. In commenting on the role of nutrition, he states:

> In fact, instead of searching for the cause of toxemia in nutrient deficiencies or excesses we were beginning to understand the nutritional needs of pregnancy more clearly and were coming to appreciate the fact that the true place of dietary factors in relation to the toxemias was in the maintenance of physiological efficiency.

Nutritional Components in the Treatment of Established Toxemia: The treatment of established toxemia will vary depending on the degree of proteinuria and hypertension and the presence or absence of other symptoms. If the disease is severe or the fetus is believed to be mature enough to be delivered safely, the best treatment may be termination of the pregnancy. If the disease is relatively mild and the duration of pregnancy is less than 35 weeks, the patient can be treated, with the hope that the pregnancy may be carried to near term.

It is in this latter situation that nutrition service is important. The basic dietary principles employed in prevention apply here and consist of a nutritionally adequate diet including a high level of protein (100 g), avoidance of excessive salt, and sufficient calories to meet energy requirements. It should be emphasized that toxemic women may require more food than they have been eating. However, they are often

treated with sharp restrictions in their caloric intakes as though excess caloric intake is the only cause of the excessive gain in weight. In fact, a careful dietary history and appraisal of nutritional status are likely to disclose a generalized state of poor nutrition. Further study is necessary to determine if there is a need for salt restriction once the desired intake of nutrients has been achieved.

Muscle Cramps

Muscle cramps, caused by sustained involuntary and painful muscle contractions, while not peculiar to pregnancy, are a common complaint during pregnancy. Usually a single muscle group is involved and the calf muscles are mainly affected during pregnancy. These spasms commonly occur at night although they may follow unusual muscular activity.

Muscle cramps have been attributed to sodium depletion, peripheral vascular insufficiency, or lowered serum calcium levels, (18) but available evidence is insufficient to permit any firm conclusion about either etiology or treatment. (11) There is no evidence that a restricted milk intake favorably affects the incidence of leg cramps. Calcium lactate (18) and thiamine sources (16, 32) have been administered to relieve this condition.

Vitamin and Mineral Supplementation

The ideal source of vitamins and minerals is the foods

that make up a diet adequate in essential nutrients. These needed foods are available in nearly all market-places. Amounts of nutrients greater than the NRC Recommended Dietary Allowances provide no further protective benefits in pregnancy, as shown by the Vanderbilt study. (20) However, some expectant mothers, especially those who entered pregnancy in poor nutritive status, or are still growing, or are unable to obtain or tolerate all foods recommended may require additional nutrients beyond those normally furnished by the diet. In such cases, the physician may find it necessary to prescribe supplementary or therapeutic amounts of minerals and/or vitamins.

The relation of newborn rickets to maternal deficiency of calcium and vitamin D is well known. In the United States rickets is virtually unknown today largely because of vitamin D supplementation of milk. Vitamin D in excess has been implicated recently in causing congenital malformations and mental retardation. (see Chapter II, page 23) The syndrome of hemorrhagic disease of the newborn is not clearly defined clinical entity, but the prolonged prothrombin time demonstrable in such newborns has been ascribed to a vitamin K deficiency. It is common medical practice to administer a vitamin K preparation to the woman in labor or to the neonate.

There is no established evidence that diets of pregnant women require "routine" vitamin supplementation, particularly

if the woman is eating a well balanced diet. It is, however, customary practice to prescribe vitamin supplements for those women whose diets are or have been substandard, and for those women with chronic gastrointestinal disorders for whom absorption of vitamins may be impaired.

When prescribing vitamin and mineral supplements it is essential to guard against the possibility that some women because of their expenditures for supplements, may be forced to deprive themselves of the other essential nutrients found only in foods.

Anemia in Pregnancy

Iron deficiency anemia is considered to be the most common complication of pregnancy in American women. Folic acid deficiency, chronic infection, and hemoglobinopathies are only rarely responsible. The prevalence of anemia in pregnancy in the United States varies widely in different groups of women and according to the criteria utilized for diagnosis. Rates of from 15 to 58 per cent are reported (1, 14, 19, 25). The menstruating woman has a larger requirement for iron than the adult male or post-menopausal female. Although menstrual losses discontinue during pregnancy, additional iron is required to meet the increasing needs of fetus and placenta and for replacement of blood loss during delivery. The net iron loss

during a pregnancy is approximately 300-400 mg. In normal pregnancy there is a decreased concentration of blood hemoglobin and of serum iron and an increase in unbound iron binding capacity. The total circulating hemoglobin and serum iron may be little changed, however, because of the physiologic increase in total blood volume which accompanies pregnancy. Relatively little information is available concerning the changes which occur in iron stores in bone marrow.

Consideration of all of these factors makes it exceedingly difficult to assess the true incidence of iron deficiency anemia in pregnancy. Nevertheless, it cannot be denied that large demands are made on the iron stores of a pregnant woman, and if these stores are low as a woman enters pregnancy, iron deficiency is likely to result. Provision of supplemental iron has been found to increase blood hemoglobin and serum iron levels of normal pregnant women.

The recommended dietary allowance for iron in pregnancy is 20 mg daily. This quantity may not be readily consumed in a daily diet with usual American food patterns. Careful planning of iron intake is therefore needed. Moreover, the allowance itself may provide but a small margin of safety, particularly for the pregnant adolescent who may still be growing or for a woman with previously reduced iron stores resulting

from menorrhagia or repeated pregnancies.

Therefore, provision of supplemental iron should be considered for all pregnant women. An iron supplement affording 100 to 150 mgs daily of elemental iron may be recommended, with the iron provided in the ferrous form and in divided doses three to four times a day.

Hyperemesis

Nausea and to a lesser extent vomiting occur frequently in association with pregnancy. Probably 50 per cent of all pregnant women experience some degree of nausea and minimal vomiting. The cause is unknown, but physiological and psychological factors are thought to play a part. Hyperemesis gravidarum or pernicious vomiting is uncommon, occuring in 1 in 300 pregnancies and is usually confined to the first trimester. Pernicious vomiting occurs infrequently among patients in lower socio-economic groups.

For most patients the nausea and vomiting usually does not interfere with their nutritional status. Mild sedation or phenothiazine usually keep symptoms at a minimum. Specific treatment with vitamin preparations (vitamin B complex and ascorbic acid, separate or in combination) has been advocated. These medications along with hormones, Lugol's solution, and other drugs, are probably effective by virtue of their psychological impact.

Dietary adjustments commonly used to relieve nausea include feeding small amounts of "dry foods every two hours" or an alternate "dry and liquid" feeding pattern. (4) If these dietary adjustments are not effective in relieving the nausea, the patient may discover by trial and error those foods which are tolerated and those which are not. Simple measures such as these along with continued reassurance by the physician will usually control the nausea of early pregnancy.

As a word of caution, it is not uncommon for women experiencing the nausea of early pregnancy to lose weight. Weight recorded during this period of fluctuation is apt to be misleading and may result in the design of a weight control program which seriously underestimates the total desirable gain in weight during pregnancy. Therefore, when designing a weight control program, the patient's prepregnant and/or desirable weight should be used, rather than weight recorded during the period of nausea.

Pernicious vomiting on the other hand may produce starvation and may require hospitalization. Disturbances of body fluids and electrolytes may result and large losses in weight take place. Correction of dehydration and electrolyte imbalance by intravenous feedings, sedation, and emotional reinforcement help to relieve symptoms and restore normal

eating habits. It is customary to add vitamin B complex and vitamin C to the intravenous solutions. Because the syndrome is usually limited, the over-all effect on nutrition in pregnancy may be minimal.

12. Gruenwold, P. "Chronic Fetal Distress and Placental Insufficiency," Biologia Neonatorum, 5:215, 1965.

13. Hamlin, R.H.J. "The Prevention of Eclampsia and Pre-eclampsia," Lancet, 262:64-68, 1952.

14. Hunter, C.A. "Iron Deficiency Anemia in Pregnancy," Surg. Gynec. and Obstet., 110:210, 1960.

15. Hytten, F.E., and Leitch, I. The Physiology of Human Pregnancy. Oxford: Blackwell Scientific Publications, 1964.

16. Jacobson, H.N. and Reid, D.E. "Neurologic, Muscular, and Skeletal Complications of Pregnancy," Vol. 1, Chap. 45, in Davis Carter Gynecology and Obstetrics, Hagerstown: W.F. Prior Co., Inc., 1965.

17. Kaltreider, D.F. Effects of Height and Weight on Pregnancy and the Newborn. Springfield, Ill.: C.C. Thomas, 1963.

18. Kerr, C. et. al. "Calcium and Phosphorus Dynamics in Pregnancy," Am. J. Obstet. and Gynec. 83:2-8, 1962.

19. Lund, C.J. "Studies on Iron Deficiency Anemia in Pregnancy," Am. J. Obstet. and Gynec. 62:947, 1951.

20. McGanity, W.J., Bridgforth, E.B., and Darby, W.J. "Vanderbilt Cooperative Study on Maternal and Infant Nutrition," JAMA, 168: 2138-45, 1958.

21. National Academy of Sciences-National Research Council, Publication 1146. Recommended Dietary Allowances, 6th Rev., Washington, D.C., 1964.

22. National Center of Health Statistics, Vital Statistics of the United States, Vol. 2, Part A, 1964.

23. North, A.F. "Small for Date Neonates; Maternal Gestational, and Neonatal Characteristics," Pediatrics 38: 1017, Dec. 1966.

24. Oldham, H. and Sheft, B.B. "Effect of Caloric Intake on Nitrogen Utilization during Pregnancy." JADA 27:847-854, 1951.

25. Pritchard, J.A. and Hunt, C.F. "A Comparison of Hematologic Responses Following the Routine Prenatal Administration of Intramuscular and Oral Iron," Surg. Gynec. and Obstet. 106:516, 1958.

26. Public Health Service Publication, No. 1485; Obesity and Health, U.S. Printing Office, Washington, D.C. (Emphasis added.)

27. Reid, D.E. A Textbook of Obstetrics, Philadelphia: W.B. Saunders Co., 1962.

28. Report of a WHO Expert Committee, Nutrition in Pregnancy and Lactation, Wld. Hlth. Org. Techn. Rep. Ser. 302, 1965.

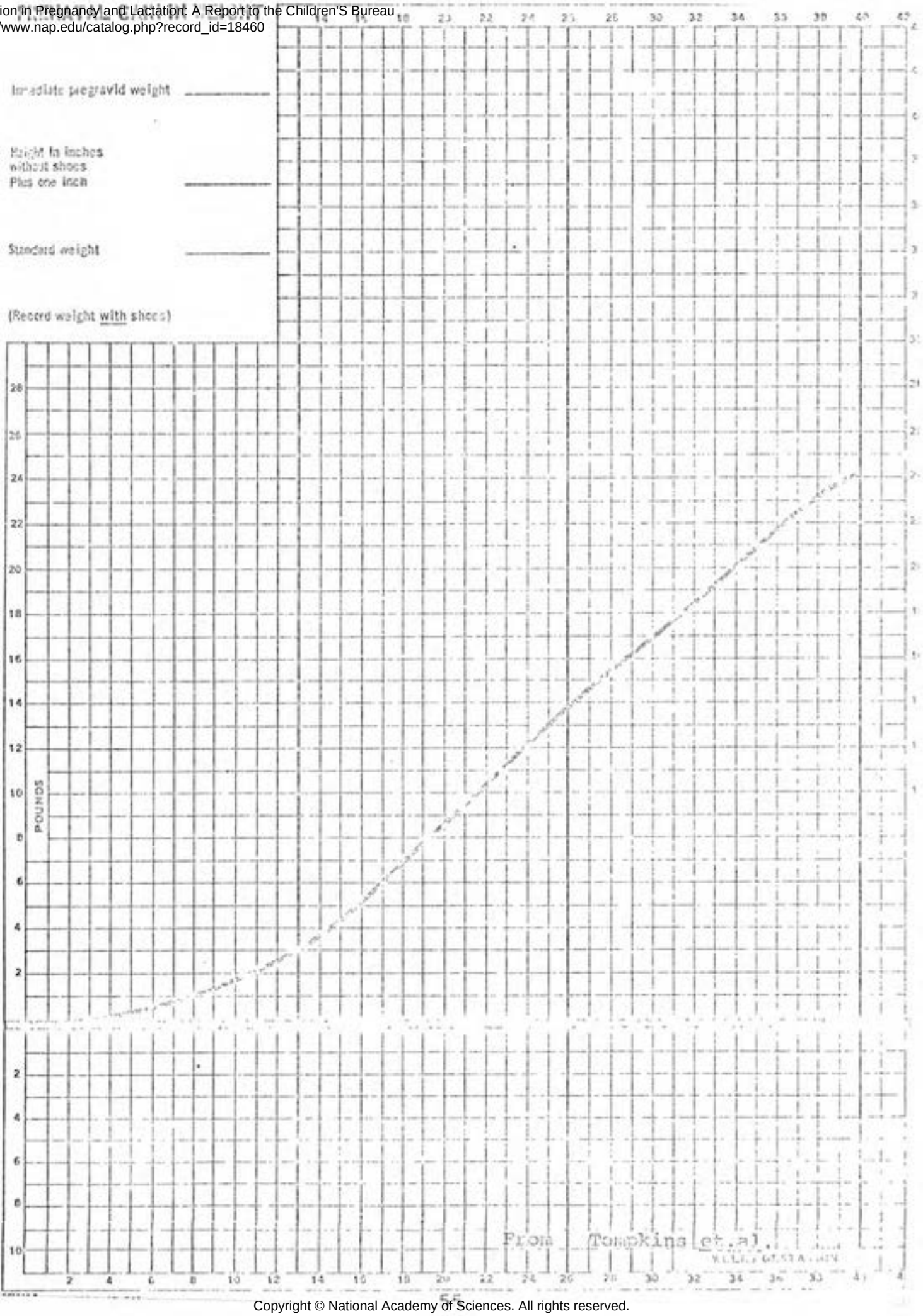
29. Schram, M. and Raji, M. "The Problem of Underweight Pregnant Patients," Am. J. of Obstet. and Gynec., 94: 595-6, 1966.

30. Thomson, A.M. and Billewicz, W.Z. "Clinical Significance of Weight Trends During Pregnancy," Brit. Med. J. i. 243, 1958.

31. Tompkins, W.T. et. al. "Maternal and Newborn Studies at Philadelphia Lying-In Hospital." In Promotion of Maternal and Newborn Health, Milbank Memorial Fund, New York, 1955.

32. Toverud, G. "The Influence of Nutrition on the Course of Pregnancy." Milbank Memorial Fund Quarterly, 18, No. 1, 7-24, 1950.

33. United States Department of Agriculture, Nutritive Value of Foods. Home and Garden Bulletin No. 72, 1964.



QUESTIONNAIRE AND PROCEDURE FOR A DIETARY INTERVIEW WITH A PRENATAL PATIENT

1. How are you feeling today?

2. Since you knew you were pregnant have you made any changes in your eating habits?

3. What changes have you made?

   3a) Do you skip meals?
   What meal?
   Why?
   How often?

4. Why did you make the changes? (Probe for reason)

5. Do you think that women should eat differently when they are pregnant?

   Why?

   How?

6. What kinds of food do you like most?

   6a) Do you like foods such as:

candy	_____	pop	_____
colas	_____	tonic	_____
hot dogs	_____	kool aid	_____
potato chips	_____	pastries	_____
carbonated beverages	_____	pie	_____
coffee and tea with sugar and cream	_____	doughnuts	_____

7. What kinds of food do you like least?

   7a) Do you like salty foods, such as bacon, corned beef, ham?

8. What kinds of food do you think people generally <u>should</u> eat?

9. Now tell me something about how you eat in your home.
   9a) When do you eat first? (Get an account of the meal and snacking patterns and a summary of intake.)

   9b) What kinds of seasonings do you use in cooking? at the table? Example: salt, tabasco, chile sauce, and catsup.

   9c) Do you drink milk? If so, how much? What kind of milk do you prefer? Whole, skim, chocolate, etc. Do you eat custards, puddings, ice cream, creamed soups, and creamed foods? Do you eat cheese? If so, what kind? How much?

   9d) Who prepares the meals in your family and how are they prepared? Example: fry, broil, bake, etc.

10. Do you take any medicine or pills? (If yes, who told you to take it (or them) and what are they?)

11. Since you have known you were going to have a baby, have you craved anything in particular?
    What?

    How much?

12. Evaluate the patient's diet and discuss the evaluation, the corrections which might be made, if any.

13. Ask the patient which of the changes would be possible in in her household and which she would like to make first. Then help her to plan for making the change, i.e., including more milk, etc. Set a goal which she accepts and a time within which she would propose to make it.

MATERIAL ON HEIGHT AND WEIGHT

Body weight is made up of a number of components. Those which cause greatest variation in weight at a given age, sex, and height in most normal individuals are fat, muscle, and bone. Because a number of components contribute to total weight, an individual may be overweight relative to some arbitrarily chosen standard on the basis of either his bony structure or musculature and yet not be obese or excessively fat. It is also true that an individual may be of average weight and yet excessively fat if he has relatively small musculature or bony structure.

> Anyone who has had occasion to examine many individuals of the same sex and of approximately the same age is impressed with the need to consider each person's body structure on AN INDIVIDUAL BASIS. The ratio of bony structure, musculature and fat and the distribution of the fat are of far MORE IMPORTANCE in arriving at an assessment of weight status THAN THE BLIND APPLICATION of even the BEST HEIGHT-WEIGHT TABLE. There is no substitute for good clinical judgment in the determination of the desirable weight for an individual based on his actual weight, his appearance, and some idea of his subcutaneous fat pads. (26)

A table is presented which compares various tables of desirable weights for women at age 25. The tables used for the comparison are:

1. Metropolitan Life Insurance Company Table of Desirable Weights for Women.

2. Desirable Weights for Women from the 1964 edition of Recommended Dietary Allowances (adapted from Heights and Weights of Adults in U.S., Home Economics Research Report No. 10, ARS, USDA).

3. Average Weights for Women Ages 20-24 from the Build and Blood Pressure Study, 1959.

4. Smoothed Average and 25th and 75th Percentile from Weight by Height and Age of Adults.

5. The Baldwin-Wood Table of Height for Weight at Age 18.

Clinical judgment is of first importance in assessing weight status. The use of weight standards and tables, without intelligent clinical judgment, is often only an academic exercise.

Feet	Inches	Metropolitan Life-Desirable wts.	F & NB Desirable wts.	B & BP Study 1959 Average Weights 20-24	U.S. 1960-62 Smoothed quartile Weights - 18-24 P' 25 Average P' 75	Baldwin-Wood Age 18
4	8	89 - 116				
4	9	91 - 119			96-114-131	
4	10	93 - 122		99	98-116-133	
4	11	96 - 125			101-118-136	
5	0	99 - 128	100 - 118	105	103-120-138	109
5	1	102 - 131			105-123-140	114
5	2	105 - 135	106 - 124	112	108-125-142	116
5	3	108 - 139			110-127-144	118
5	4	111 - 143	112 - 132	118	112-129-147	121
5	5	115 - 147			114-132-149	124
5	6	119 - 151	119 - 139	126	116-134-151	128
5	7	123 - 155			119-136-153	133
5	8	127 - 160	126 - 146	133	121-138-156	136
5	9	131 - 165				140
5	10	135 - 170	133 - 155	141		142
5	11					143
6	0		140 - 164	151		

Falkner, F.
5' 4.4"
126.2 pounds.

DESIRABLE WEIGHT FOR WOMEN

AGED 25 AND OVER

Height		Weight		
Feet	Inches	Small Frame	Medium Frame	Large Frame
4	8	89 - 95	93 - 104	101 - 116
4	9	91 - 98	95 - 107	103 - 119
4	10	93 - 101	98 - 110	106 - 122
4	11	96 - 104	101 - 113	109 - 125
5	0	99 - 107	104 - 116	112 - 128
5	1	102 - 110	107 - 119	115 - 131
5	2	105 - 113	110 - 123	118 - 135
5	3	108 - 116	113 - 127	122 - 139
5	4	111 - 120	117 - 132	126 - 143
5	5	115 - 124	121 - 136	130 - 147
5	6	119 - 127	125 - 140	134 - 151
5	7	123 - 132	129 - 144	138 - 155
5	8	127 - 137	133 - 148	142 - 160
5	9	131 - 141	137 - 152	146 - 165
5	10	135 - 145	141 - 156	150 - 170

Adjusted to bare-foot height by subtraction of 2 inches for heels and to nude weight by deduction of 3 pounds for clothing from tables of Metropolitan Life Insurance Company. Derived primarily from data of the Build and Blood Pressure Study, 1959, Society of Actuaries.

SMOOTHED AVERAGE WEIGHT FOR WOMEN BY AGE AND HEIGHT: U.S. 1960-62

Height		Age		
Feet	Inches	18 - 24	25 - 34	35 - 44
4	9	114	110	129
4	10	116	114	132
4	11	118	118	134
5	0	120	122	136
5	1	123	126	138
5	2	125	130	141
5	3	127	134	143
5	4	129	138	145
5	5	132	142	147
5	6	134	146	150
5	7	136	150	152
5	8	138	154	154

Adjusted from National Center Health Statistics: Weight by Height and Age of Adults, United States 1960-62 Vital Health Statistics. P.H.S. Publication No. 1000-Series 11-No. 14, Data from National Health Survey. Adjusted by deducting 2 pounds for clothing.

MEDIAN WEIGHT FOR WOMEN BY AGE AND HEIGHT: U.S., 1960-62

Height		Age		
Feet	Inches	18 - 24	25 - 34	35 - 44
4	9	114	110	123
4	10	105	108	116
4	11	110	116	126
5	0	115	121	130
5	1	119	118	128
5	2	123	125	133
5	3	121	126	136
5	4	124	131	138
5	5	130	132	135
5	6	135	134	140
5	7	132	145	148
5	8	127	145	146

Adjusted from National Center for Health Statistics: Weight by Height and Age of Adults, United States 1960-62 Vital Health Statistics. P.H.S..Publication No. 1000-Series 11-No. 14. Data from National Health Survey. Adjusted by deducting 2 pounds for clothing.

AVERAGE WEIGHT FOR WOMEN BY AGE AND HEIGHT: U.S., 1960-62

Height		Age		
Feet	Inches	18 - 24	25 - 34	35 - 44
4	9	115	126	120
4	10	119	119	115
4	11	119	116	136
5	0	120	122	136
5	1	122	125	135
5	2	126	131	141
5	3	124	133	144
5	4	124	138	145
5	5	133	140	138
5	6	140	137	146
5	7	138	152	152
5	8	129	148	158

Adjusted from National Center for Health Statistics: Weight by Height and Age of Adults, United States 1960-62 Vital Health Statistics P.H.S. Publication No. 1000-Series 11 No. 14. Data from National Health Survey, Adjusted by deducting 2 pounds for clothing.

AVERAGE WEIGHT FOR HEIGHT OF GIRLS FROM 9 - 18 YEARS

Height		Weight Years									
Feet	Inches	9	10	11	12	13	14	15	16	17	18
4	8	74	76	76	77	79	81				
4	9	78	80	80	80	82	86	90			
4	10		82	84	84	86	91	94	99		
4	11		85	88	88	90	94	98	101	102	
5	0		89	93	93	95	99	103	106	107	109
5	1			97	98	99	103	106	110	111	114
5	2			102	103	104	107	111	113	115	116
5	3				108	108	110	114	115	117	118
5	4				112	113	115	117	118	120	121
5	5				116	118	119	120	121	123	124
5	6					122	122	123	126	127	128
5	7					126	128	129	131	131	132
5	8					129	131	133	134	136	136
5	9						133	135	136	138	140
5	10						134	136	138	140	142
5	11						136	138	140	142	143
6	0										

Baldwin-Wood, adjusted to nude weight by deducting 2 pounds for clothing.

WEIGHT FOR HEIGHT OF GIRLS AT 50th PERCENTILE 9-18 YEARS

Height		Weight Years									
Feet	Inches	9	10	11	12	13	14	15	16	17	18
4	4.2	63.6									
4	6.2		71.0								
4	9.0			82.0							
4	11.5				94.4						
5	2.2					105.5					
5	3.1						113.0				
5	3.8							120.0			
5	4.1								123.0		
5	4.2									125.8	
5	4.4										126.2

Adapted from Falkner, F., Pediatrics 29:467-474, 1962 in Obesity and Health P.H.S. Publication No. 1485, 1966.