7 Nutrition in Multifetal Pregnancy

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Summary All multifetal pregnancies can be considered high risk due to frequent obstetrical complications associated with this type of pregnancies. Nutritional assessment with current dietary recommendations and specialized antenatal care are important for a good outcome. Maternal weight and weight gain are also important factors, but nutritional supplements, assessment of calorie intake, and adjustments as needed are crucial as well. Confounding variables must be considered, particularly when examining outcomes. This chapter addresses some of the important components that can contribute to a healthy outcome in multifetal pregnancy. Future research and knowledge is needed in this challenging area. A multidisciplinary approach to antepartum and even preconceptional care will help optimize the outcome.

Keywords: Multifetal pregnancy, Nutrition, Maternal weight, Prenatal care, Supplements

7.1 INTRODUCTION

In 2004 there were more than 139,000 multiple or multifetal births in the United States [1, 2]. The birth rate for twin gestation, which accounts for more than 95% of these multifetal pregnancies, continues to rise, with the latest birth rate in 2004 at a record of 32.2 twins per 1,000 live births. The birth rate of triplets and higher-order multifetal births has been relatively stable since its peak in 1998. Almost all pregnancy complications are more frequent in multifetal pregnancies [3, 4]. The most recent American College of Obstetricians and Gynecologists (2004) published their practice guidelines, that describes many of these complications [4]. However, there is no mention in this document of any nutritional assessment or treatment for this high-risk group.

Nutrition information for clinicians who provide antenatal care for women with twins or triplets often has been based on scientific data obtained from singleton pregnancies and then extrapolated and applied to multifetal pregnancy. A search of Ovid Medline for all English-language articles related to multiple pregnancy in humans and nutrition or diet shows 331 articles published on this subject in the past 30 years. Almost 50% of these articles (151) have been published since 1996, indicating that interest in and knowledge of this specific area of high-risk pregnancy is increasing. The purposes of this chapter are to: (1) evaluate some of the most relevant and important new clinical information regarding nutrition and multiple pregnancy, (2) describe well-documented
differences in nutrition needs between singleton and multiple pregnancies, (3) provide practical antenatal nutritional guidelines for the clinician and nutritionist managing multiple pregnancies, and (4) stimulate further research and knowledge for this interesting and challenging aspect of obstetrics.

7.2 WEIGHT

The first aspect of nutrition to be examined relates to weight. Much attention has been directed toward this aspect of nutrition because weight is measured easily and can be followed over time. Measurement of weight has been examined by prepregnancy maternal weight, maternal weight at different times during the pregnancy, weight gain based on body mass index (BMI), and neonatal birth weight [5–8]. Maternal weight gain and patterns of this weight gain have been shown to be important predictors of a good perinatal outcome defined in various ways, but usually by birth weights greater than 2,500 g [5–8].

Specific guidelines have been established; clinicians have recommended that women with a normal weight (BMI) (20–25) gain approximately 25 lb for a singleton pregnancy and an additional 10 lb for multiple pregnancies [9, 10]. Women with triplet pregnancies should gain at least 50 lb [10]. These recommendations are based on the neonatal birth weight that is considered appropriate.

Luke et al. [11] examined the maternal weight gain stratified by BMI as it relates to the optimal fetal growth and weight in twins. In this historical cohort study of 2,324 twin pregnancies, optimal rates of fetal growth and birth weights were associated with varying rates of maternal weight gain, depending on the pregravid BMI and the period of gestation. These data were obtained over a 20-year period, from 1979–1999, in four different locations, with no specific information on meal plans, dietary interventions, or changes in dietary habits. The authors concluded that the rates of maternal weight gain in twin pregnancies are best viewed as guidelines that can be used antenatally.

The results of an individualized intervention program in twin pregnancy demonstrated that nutritional intervention, that went beyond measuring body weights, can significantly improve pregnancy outcome [12, 13]. In this study, the Higgins Nutrition Intervention program, developed at the Montreal Diet Dispensary, was used first to assess each pregnant woman’s risk profile for adverse birth outcomes and to adjust the diet using an individualized nutrition program. The individualized program included education about food consumption patterns to meet individual dietary requirements and allow for preexisting food habits. Regular follow-up visits at 2- to 4-week intervals with the same dietitian were included. Other features of this intervention program included supplementation with milk and eggs, an additional 1,000 kcal/day, a 50-g protein allowance for each fetus, and smoking cessation. Significantly, the group of patients in this study was at high risk, not only because of the twin gestation, but also because they were economically disadvantaged. The results of this study demonstrated a lower rate of preterm delivery, lower neonatal mortality, and lower maternal mortality. There also was a small (80 g) increase in twin birth weight.

In 2003, a specialized, prospective intervention program in multiple pregnancy at one institution reported its effect not only on maternal, but also on neonatal and early childhood outcomes [14]. In addition to regular prenatal care, this study provided twice-monthly prenatal visits with a dietitian and nurse practitioner, additional maternal nutrition education,
modification of maternal activity, multivitamin supplementation, and individualized dietary prescription with serial monitoring of nutritional status during the pregnancy. Specific dietary recommendations and weight gain goals based on BMI were provided and monitored. The initial dietary assessment was based on a 24-h recall. The diet was adjusted to 3,000–4,000 kcal per day, depending on the pregravid BMI. Dietary assessment was made at each subsequent visit, and changes were made. The plan was to provide three meals and three snacks with 20% of the calories from protein, 40% from carbohydrates, and 40% from fat. A multivitamin containing 100% of the Recommended Daily Allowances (RDAs) for the nonpregnant woman was provided for daily consumption and then increased to twice daily after 20 weeks gestation. In addition, a daily mineral supplement with calcium, magnesium, and zinc in divided doses was provided. Over a 6-year period, participation in this program improved pregnancy outcomes as assessed by the frequency of preeclampsia, preterm premature rupture of the membranes, delivery less than 36 weeks gestation, and an increased birth weight (220 g). There was also less neonatal morbidity, as assessed by retinopathy of prematurity, necrotizing enterocolitis, intraventricular hemorrhage, and ventilator support. Through 3 years of age, children whose mothers participated in the program were less likely to be hospitalized or to be developmentally delayed.

These results form the basis for the most current dietary recommendations and specialized antenatal care during multiple pregnancy.

As guidelines, maternal weight gain in twin pregnancy would be based on the gestational period. The underweight gravida (BMI < 20) should gain between 1.25 and 1.75 lb per week in the early (0–20 weeks) gestational period, 1.5–2 lb per week in the mid (20–28 weeks) period, and 1.25 lb per week in the late (>28 weeks to delivery) period, for a total weight gain of 47–61 lb. A normal-weight gravida (BMI = 20–25) should gain 1–1.5 lb per week in the early period, 1.25–2 lb per week in the mid period, and 1 pound per week in the late period, for a total weight gain of 38–54 lb. The overweight gravida (BMI = 26–30) should gain 1–1.25, 1–1.5, and 1 lb per week in the early, mid, and late periods, respectively. The total weight gain should be 36–45 lb. The obese gravida (BMI > 30) should gain 0.75–1.25, 1, and 0.75 lb per week in the early, mid, and late periods respectively. The total weight gain should be 29–39 lb.

As demonstrated by the study of Luke et al. [11], maternal weight, weight gain based on BMI, and the specific weight at each gestational period represent only some of the aspects of a nutritional management plan for multifetal pregnancy. Another aspect relates to the basic metabolic rate, as measured by resting energy expenditure, which is about 10% higher in the third trimester of twin pregnancy compared with women with singleton pregnancies [15]. Therefore, an increase in caloric intake, frequent monitoring, and adjustment of the dietary plan, maternal activity considerations, educational and instructional assessment, and nutritional supplements are also crucial to a successful outcome.

7.3 NUTRITION SUPPLEMENTS

7.3.1 Iron

Daily iron supplementation is recommended by the National Academy of Science for pregnant women because the iron content in most American diets, and the nonheme iron stores of American woman are insufficient to provide for the increased iron requirements of pregnancy [16–18] as further discussed in Chap. 16 (“Iron requirements and Adverse
Outcomes”). In multifetal pregnancy, as in singleton pregnancies, supplementations should include iron and folic acid. The majority of studies report an iron deficiency in multifetal pregnancy [10, 18, 19].

### 7.3.2 Minerals

There are no known trials using mineral supplements in twin gestation [20]. However, magnesium, calcium, and zinc have been recommended to reduce pregnancy complications and improve outcome [10, 21, 22]. In the study mentioned previously [14], 3 g of calcium, 1.2 g of magnesium, and 45 mg of zinc were added to the specialized diet. Again, there is no scientific proof that this supplementation is effective, but there are some data suggesting that it may be beneficial. However, various studies have been inconclusive, and mineral supplementation remains an area that needs good clinical trials, particularly in multifetal pregnancy.

### 7.3.3 Fish Oil

Fish oil supplementation has been shown to play an important role in pregnancy, parturition, lactation, and even childhood development [23–26]. A recent study in rats showed that dietary docosahexaenoic acid (DHA) can suppress the indices of premature labor and shortened gestation [26]. An older study in rats also reported that gestational age is related positively to high dietary intake of \( n-3 \) fatty acids [27]. In human pregnancy, daily supplements in the third trimester of pregnancy using capsules containing 2.7 g of \( n-3 \) fatty acids have been shown to prolong pregnancy [28]. In a randomized, double-blind, controlled clinical trial, the long-chain omega-3 fatty acid DHA obtained from egg ingestion beginning at 24–28 weeks until delivery has been shown to significantly increase the length of gestation [29]. Other studies have supported the association between an increased intake of DHA and longer gestations, increased birth weight, head circumference, and birth length [25]. Low-birth-weight babies also have lower levels of DHA than full-term infants [24]. Recently, maternal consumption of DHA during pregnancy has been shown to benefit infant performance on problem solving at nine months and infant visual acuity at 4 months of age [30, 31]. It is important to note that none of these studies has shown any detrimental effects on the growth of the fetus, course of labor, or neonatal outcome. Therefore, it appears that DHA supplementation could help prolong pregnancy. In fact, educational materials have been developed for Women, Infants, and Children (WIC) programs to increase DHA intake during pregnancy. This program is called the “Omega-3 for Baby and Me” [32].

In a multicenter, randomized clinical trial including nineteen hospitals in Europe, fish oil supplementation reduced the recurrence risk of preterm delivery from 33 to 21% [33]. However, this study reported that fish oil supplements had no effect on preterm delivery in twin pregnancies. In this study, 579 twin gestations received prophylactic fish oil, beginning at a mean gestational age of 21+ weeks. Some limitations of this study include different recruitment rates between the centers, little available clinical information regarding these pregnancies, and the fact that no other complications of twin gestation other than intrauterine growth rate (IUGR) and pregnancy-induced hypertension (PIH) were reported. Were there any inventions or services provided for this high-risk group of patients that could have influenced the outcome? Should the amount of fish oil be
increased with multiple pregnancies? In spite of these shortcomings, this is the only study that this author was able to find that specifically examined the issue of fish oil supplementation and multiple births. More research is needed in this area.

7.4 CONFOUNDING VARIABLES

There are many confounding variables that can contribute to birth weight and early neonatal outcomes in multifetal pregnancies. All multifetal pregnancies can be considered high risk because of the increase of many obstetrical complications, compared with those of singleton pregnancies. Maternal complications include preeclampsia, hypertension, gestational diabetes, placenta previa, abruptio placenta, cesarean birth, and maternal mortality. For the fetuses, the risks include prematurity, low birth weight, birth asphyxia, cerebral palsy, and neonatal death.

These complications associated with multifetal pregnancies should be considered when examining pregnancy outcomes. Some other important variables can contribute to the outcome of a multifetal pregnancy.

First, pregnancy complications such as preeclampsia, hypertension, diabetes, abruptio placenta, or placenta previa can be very problematic for the clinician and can result in medical or surgical interventions or even early delivery [34]. Some of these pathologic conditions are known to influence intrauterine growth. Would bed rest with reduced maternal activity and stress reduction alter intrauterine fetal growth? Can overdistension of the uterus or an increased amniotic fluid precipitate early labor and delivery? All of these maternal factors and pregnancy complications need to be considered if birth weight is considered as a crude marker for nutrition.

Second, discordancy could account for a difference in fetal growth and birth weights with multifetal pregnancy. Growth discordancy, usually more than 20 or 25%, offers a unique challenge for clinicians. Discordancy occurs at a higher frequency and severity in triplet pregnancies [35]. Fetal growth, discordant or not, depends on many factors. One factor relates to the function of the placenta or uteroplacental unit, as nutrients cross from the mother to the fetus [36]. Umbilical cord insertion and fusion of the placentas has been shown to influence birth weight in twin gestation [37]. Fetal growth also seems to be influenced by plurality, that is, the mean birth weight decreases as the number of fetuses increases [38]. Fetal intrauterine growth depends on the time in gestation, as “growth curves” for singletons, twins, and triplets are similar until 28 weeks’ gestation. After 28 weeks, the curves of the multifetal pregnancies deviate from the singleton pregnancy. Uterine adaptation and volume also may influence fetal growth [39, 40]. Therefore, when considering fetal growth or neonatal birth weight as a marker for nutrition, not only is the length of gestation critical, but pregnancy complications and other factors that influence fetal growth also must be considered. In fact, the monochorionic type of placentation in multifetal pregnancies has been reported as a risk factor for increased discordance [41, 42]. Nutritional status of multifetal pregnancies and outcome has not been well evaluated by the type of placentation or the other placental complications that occur more frequently in multifetal pregnancies.

Third, second-born twins have a greater risk for perinatal morbidity than first-born twins [43, 44]. Is this finding due to difference in mode of delivery, intrauterine or neonatal growth, or perinatal nutrition? The author was unable to find any literature that evaluates or links nutrition to the birth order.
Finally, carbohydrate metabolism in pregnancy can be characterized by the phenomenon of accelerated starvation; that is, the fasting glucose decreases as pregnancy advances with an accelerated insulin response to meals [45]. Pregnant women with twin gestation have an accelerated response compared with singleton pregnancy [46]. This indicates that lower glucose in the fasting state can increase the depletion of glycogen stores resulting in metabolism of fat. Ketones may result, and ketonuria has been associated with preterm delivery. Compared with the recommended diet for women whose pregnancies are complicated by carbohydrate intolerance (diabetes), changes in diet composition for women with multiple pregnancies would be a lowering (40%) of the carbohydrates to avoid more hyperglycemic peaks and an increase in the percent of fats (40%) to provide more substrate. This adjustment in the distribution of the macronutrients may be important not only for nutritional value, but also for prevention of preterm labor. Carbohydrate intolerance, particularly in the absence of longstanding vascular disease, is a well-recognized risk factor for fetal or neonatal macrosomia.

7.5 CONCLUSION

In summary, multifetal pregnancy offers many challenges for both physician and patient. Maternal, fetal, and neonatal complications are more common and make mothers with multifetal pregnancies a high-risk pregnancy group. These patients usually receive their clinical care from well-trained obstetricians or maternal–fetal medicine specialists, and yet, the clinicians do not commonly request nutrition consultation. Certainly, consults are not as common as when pregnancies are complicated by diabetes or hypertension. A reasonable approach would be to obtain a nutritional assessment every trimester. There are good data to support a recommendation for an increase in caloric intake and dietary management, based on BMI. Maternal weight gain, however followed clinically, is only one part of the algorithm for good nutritional care, as other variables are also crucial. Additional supplements with micronutrients and fish oil seem to be supported by the literature. Neonatal birth weight, as a marker for nutrition, must also be considered in its entirety, as many confounding variables can influence birth weight. Nutritional guidelines as part of an overall program to improve perinatal outcome in multifetal pregnancy are important. Further study and research into nutrition during multifetal pregnancy is needed, as many of the complications in the group are increased. Hence, the program for this group should be multidisciplinary and provide close monitoring throughout the pregnancy, even preconceptionally.

REFERENCES