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Review and Update of First Steps Modules

Submitted in partial fulfillment of the requirements for the degree of

Master of Science in Dietetics Practice

University of Washington

2019

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Program Authorized to Offer Degree:

Nutritional Sciences Program

School of Public Health

Acknowledgements: Thank you to Beth Ogata, MS, RD, CSP from CHDD for her assistance, guidance, clinical expertise, and contacts with clinical dietitians during the update of these modules. Additional thank you so Michelle Averill for her assistance throughout the development and writing of this report.

Table of Contents:

	Pages
Chapter I: Introduction	1-3
Chapter II: First Steps and Women and Infants Utilizing First Steps Services	3-4
Chapter III: Pregnancy, Postpartum and Young Infant Nutrition	5
Chapter IV: Methods	6-7
Chapter V: Evidence analysis summary	7
Chapter VI: Executive Summary of the First Steps Modules	7-10
Chapter VII: Evaluation and Dissemination	10-11
Chapter VIII: Next Steps	11-13
References	14-15
Appendix A: Evidence Analysis Summary	A1-A28
Appendix B: Updated Modules	
Module 2: Nutrition and Normal Pregnancy	B1-B35
Module 4: MNT for Specific Conditions – Pregnancy	B36-B76
Module 5: Nutrition and the Postpartum Period	B77-B102
Module 6: Nutrition and the Young Infant	B103-B142
Module 7: MNT for Specific Conditions – Infant	B143-B174
Appendix C: Evaluations	C1-C10

Chapter I: Introduction

The American Academy of Pediatrics has advocated for improving nutrition in the first 1000 days (conception through 24 months old) of a child's development. Prenatal nutrition and a child's nutrition in the first 2 years of life affect a child's neurodevelopment, lifelong mental health and affect health risks including obesity, hypertension and diabetes throughout life. (AAP, 2018) Health care providers and dietitians are responsible for counseling and educating families during the first 1000 days on the importance of nutrition.

First Steps and MSS

First Steps is one program in Washington that helps to ensure that a child is given the opportunity to thrive during the first 1000 days of their development. First Steps provides medical services, Maternity Support Services (MSS), Infant Case Management (ICM) and Childbirth Education to low-income women and newborns through the first year of life. MSS includes pregnancy and parenting information, screening for pregnancy risk factors, solution-based counseling for identified risk factors, and referral to community resources. Risk factors identified may include issues with food security, food access, or knowledge deficits surrounding food and nutrition. Community resources may include referrals to Women, Infant and Children (WIC), and Supplemental Nutrition Assistance Program (SNAP, formerly Food Stamps) to support the woman in providing the best nutrition possible for herself and her child. Women that utilize MSS may be referred to a Registered Dietitian Nutritionist (RDN) to optimize nutrition during this critical time. MSS provides assistance during the entire pregnancy until 60 days postpartum. A woman that is covered by Washington Apple Health (Medicaid) is eligible to access services through First Steps as soon as she knows she is pregnant. Eligibility is based on monthly income standards that change based on household size, including the unborn child. Income standards are less restricted than general Apple Health eligibility for adults and allow greater accessibility. (Table 1)

Table 1: Household income based on household size for Washington Apple Health eligibility for Apple Health for Adults and Apple Health for Pregnant Women

Program	Single Person	2-person household	3-person household	4-person household	5-person household	6-person household	7-person household
Apple Health for Adults	\$1,436 monthly	\$1,945 monthly	\$2,453 monthly	\$2,961 monthly	\$3,470 monthly	\$3,978 monthly	\$4,486 monthly
Apple Health for Pregnant Women	N/A	\$2,790 Monthly	\$3,519 monthly	\$4,249 monthly	\$4,978 monthly	\$5,707 monthly	\$6,437 monthly

Adapted from Washington State Health Care Authority, 2019

Infants are eligible to begin receiving ICM services once MSS is no longer available, 60 days postpartum. ICM services are utilized by families with infants at higher risk for developmental problems due to family situation or medical conditions. ICM helps families learn about and how to use medical, social, educational and community resources to help their baby thrive. Many First Steps providers are

associated with WIC as well. A major goal of both First Steps, and WIC is to ensure that babies have the best 1000 first days possible to set the child up for optimal neurodevelopment and long-term health.

First Steps was implemented after the 1989 Maternity Care Access Act was passed and strives to reduce poor birth outcomes, maternal and infant illness and death, and increase access to maternity and infant care for low-income families. (Washington State Department of Social and Health Services, n. d.) WIC has a similar goal to influence lifetime nutrition and health behaviors in a targeted, high-risk population and was established as a permanent program in 1975. (National WIC Association, 2018) Both First Steps and WIC utilize an interdisciplinary team to ensure individuals are provided comprehensive care that address as many determinants of health as possible. Providers within the First Steps system include Community Health Nurses (CHN), Behavioral Health Specialists (BHS), Registered Dietitian Nutritionists (RDN), and Community Health Workers (CHW). Medical nutrition therapy and nutrition counselling are important aspects of ensuring a safe and health pregnancy resulting in the birth of a healthy infant. Maternal nutrition preconception, during pregnancy, and at the beginning of infancy impacts infant outcomes. (Lowensohn et al, 2016) First Steps and WIC provide nutrition education and medical nutrition therapy for women during the latter two stages.

Continuing Education for Providers

This capstone project focused on updating five education modules focusing on nutrition during the first 1000 days. The original 9-module curriculum was developed specifically for First Steps RDNs through a partnership between the Washington Department of Health (DOH) First Steps Program and the Nutrition Section of the Center on Human Development and Disability (CHDD). CHDD was the partner of choice for DOH due to the development of other similar curricula through previous distance learning grants and other joint projects. The original modules were used by Washington State First Steps RDNs and others with an interest in maternal and infant nutrition around the country. The updated modules are targeted for use by RDNs in the First Steps program but will be available to anyone; continuing education credit will be available to RDNs and marketed using the Academy of Nutrition and Dietetics continuing professional education database. The anticipated participants for the modules are the RDNs within the First Steps system, however depending on site specific staffing (ex. no RDN on staff or RDN with limited hours at a specific site), modules may be used for interdisciplinary education on nutrition. These modules will be a reference for recently credentialed RDNs or RDNs that have recently transitioned to working with pregnant women and infants. Modules cover nutrition related to typical pregnancy, common pregnancy medical complications, typical young infancy, common infant medical complications, and the postpartum period. The curriculum is not meant to be a comprehensive guide to working with all infants or women in pregnancy or postpartum period but will provide a baseline for common nutrition needs, recommendations and additional resources for further education. Educating providers through continuing education requirements increases clinical knowledge. (Vandergrift et al, 2018) By utilizing education

modules providers will be able to enhance or increase their knowledge of nutrition needs for their patients which results in better educated providers and better care and outcomes for patients.

Chapter II: First Steps and Women and Infants Utilizing First Steps Services

Women are eligible to utilize First Steps' services as soon as they know they are pregnant if they qualify for Washington Apple Health coverage. Infants are covered from the end of MSS services, 3 months postpartum, through the last day of the month in which they were born (ex. an infant born December 2, 2018 would receive care until December 31, 2019). Over 53% of all Medicaid-paid births utilized First Steps' services during pregnancy, for infant case management, or both. Women 17 years old or younger, and African American, Hispanic, and Pacific Islander women are the more likely to utilize First Steps' services than older women and other races based on 2015 First Steps statewide patient database. (Table 2, Table 3)

Table 2: Number and percentage of births utilizing MSS and/or ICM services by age in 2015

Age Group	Total Medicaid-paid Births	MSS and/or ICM	Neither MSS or ICM
≤17 years old	896	609 (68.0%)	287 (32.0)
18-19 years old	2,445	1,537 (62.9%)	908 (37.1%)
>19 years old	39,245	20,684 (52.7%)	18,561 (47.3%)
State Total:	42,586	22,830 (53.6%)	19,756 (46.4%)

Adapted from State of Washington First Steps Database, 2015

Table 3: Number and percentage of births utilizing MSS and/or ICM services by race in 2015 (State of Washington First Steps Database)

Race	Total Medicaid-paid Births	MSS and/or ICM	Neither MSS or ICM
White, Non-Hispanic	20,633	8,127 (39.4%)	12,506 (60.6%)
Hispanic	12,613	8,637 (68.5%)	3,976 (31.5%)
African American	2,662	2,108 (79.2%)	554 (20.8%)
Native American	949	385 (40.6%)	564 (59.4%)
Asian	2,206	1,445 (65.5%)	761 (34.5%)
Pacific Islander	889	608 (68.4%)	281 (31.6%)
More Than One Race, Non-Hispanic	1,933	1,051 (54.4%)	882 (45.6%)
Other/Unknown, Non-Hispanic	701	469 (66.9%)	232 (33.1%)

Adapted from State of Washington First Steps Database, 2015

Providers within the First Steps system include Community Health Nurse (CHN), Behavioral Health Specialist (BHS), Registered Dietitian Nutritionist (RDN), and Community Health Worker (CHW). RDNs participate in the screening of MSS patients, perform nutrition assessments, develop nutrition interventions, and develop and incorporate a nutrition care plan into the interdisciplinary care plan. Developing nutrition interventions and a nutrition care plan requires collaboration with patients to assess their needs and resources, and other members of the interdisciplinary team to ensure all aspects of the patients' care are coordinated. The education modules developed will assist providers in determining a

patient's level of nutrition risk, individual needs, and general nutrition education to prevent poor pregnancy and infant outcomes.

In 2018 148 RDNs worked as part of the MSS interdisciplinary team for First Steps agencies throughout Washington as agency staff or contractors. Of the 137 facilities providing MSS services, 135 had an RDN on staff. All MSS teams must include an RDN. The exception to this rule is for Tribes, Indian Health Program or counties who have 55 or fewer Medicaid births in a year. These facilities only require a registered nurse, behavior health specialist or RDN. While these modules are targeted at RDNs, non-RDN health care providers may utilize these modules to advance their own nutrition knowledge. It is not ideal for non-RDN health care providers to be the primary source of nutrition education since their expertise lays outside of nutrition, however there are cases where any health care provider giving nutrition education is preferred to no nutrition education. For example, in First Steps agencies that do not have RDNs on staff or only have part time RDNs on staff it may be unrealistic to have a patient return to the clinic on another day or drive to another clinic much further away to receive basic nutrition education, especially in rural settings. For patients with complicated pregnancies that require medical nutrition therapy, an RDN is the only provider that can provide medical nutrition therapy. It is important when health care providers are required to give basic nutrition education that they are educated on when it is beyond the scope of their practice and must be referred to an RDN.

Studies have shown that women that receive more frequent contact and support antenatal and postpartum are more likely exclusively breastfeed (Gross et al), reduce the introduction of complementary foods and liquids at 3 months of age (Gross et al), mitigate pregnancy related decreases in physical activity (Hawkins et al), decrease consumption of bottles during bottle weaning (Kahn et al), and increase knowledge of infant feeding and increase the age at which complementary foods are introduced (Scheinmann et al). Various studies have also looked specifically at the effect of enhanced Medicaid maternal and infant coordinated care programs on infant outcomes. In Michigan those enrolled in the Maternal Infant Health Program by the 2nd trimester and 3 additional prenatal contacts compared to the matched nonparticipants had lower odds of a low birth weight, very low birth weight, preterm birth and very preterm births. (Roman et al, 2014) Women in Wisconsin that received prenatal care coordination saw similar results with lower odds of low birth weight, very low birth weight, preterm, and fewer transfers to neonatal intensive care units. (Willems Van Dijk, 2011) First Steps was studied from 1999-2002 and showed a reduction in low birth weight among Hispanic women specifically. When controlling for confounding factors there was a possibly protective effect of First Steps to reduce the odds of low birth weight for all participants (OR =0.92, 95% CI: 0.84-1.00; p = 0.051) compared to Medicaid recipients that did not utilize First Steps services. The possible explanation for the definitive effect on infants of Hispanic women may be the result of targeted care to the Hispanic population via the Community and Migrant Health Centers and their culturally sensitive services by bilingual staff members. (Arima et al, 2009) By promoting consistent, routine checks ups including screenings and counseling, First Steps and WIC work to support better outcomes for pregnancies and infants.

Chapter III: Pregnancy, Postpartum, and Young Infant Nutrition

The First Steps nutrition curriculum consists of nine modules that focus on prenatal and postpartum nutrition and nutrition for infants from birth through 2 months. Module topics are listed below. Five were chosen for update based on their relevance to practice, the expectation that the module would need update due to changes in practice, and focus on medical nutrition therapy and nutrition needs. The modules listed in bold are the updated modules.

Module 1: The Role of the MSS RD in First Steps

Module 2: Nutrition and Normal Pregnancy

Module 3: Nutrition Assessment

Module 4: Medical Nutrition Therapy for Specific Conditions – Pregnancy

Module 5: Nutrition and the Postpartum Period

Module 6: Nutrition and the Young Infant

Module 7: Medical Nutrition Therapy for Specific Conditions – Infants

Module 8: Breastfeeding Assessment and Support

Module 9: Skill-Building for First Steps Practitioners

These modules increase the clinical knowledge of providers (Vandergrift et al, 2018). As a result, women are provided better care and education surrounding nutrition for an uncomplicated pregnancy and feeding of typically developing infant throughout their pregnancy. If a woman or infant had risk factors or began to develop signs or symptoms of a common complication, more specific nutrition or behavioral counseling and interventions would be encouraged.

There are many professional organizations, associations and societies that develop guidelines and recommendations centered on maternal and infant health and nutrition. The following professional organizations were utilized to update the First Steps educational modules:

- Academy of Nutrition and Dietetics
- American Academy of Pediatrics
- American College of Obstetricians and Gynecologists
- World Health Organization
- United States Department of Agriculture
- Food and Drug Administration
- The Center for Disease Control and Prevention
- Institute of Medicine

Chapter IV: Methods

Review of current modules was conducted in a systematic three-pass system to ensure that all updates that needed to be made were identified and recorded.

- During read one, the researcher read through the module and identified any information that was definitively out of date based on researcher's current knowledge of maternal or pediatric nutrition. (Ex. Change in growth charts from CDC charts to WHO charts for birth to 24 months.) Each item was logged in a spreadsheet. The information as it currently was written in the module was Column 1. Column 2, 3, 4 recorded the module, the page of the module, and which read through the information was logged during. The current citation for the information provided was in Column 5 as a reference for where to begin research when updating the information. (Appendix A)
- During read two, the researcher identified all information with a citation that was greater than 5 years old. Each citation was highlighted and then logged into the spreadsheet in the same manner as read one.
- During read three, the researcher identified any areas that left questions or required further explanation for the researcher. Information logged during read three often included unknown acronyms and recommendations or statements that did not match with the researcher's current understanding of nutrition.
- References were reviewed and updated or new references were added as needed per Table 4.

Updating Module information:

- Determine if the cited organization or author updated information or reaffirmed the accuracy of information since the original citation. Depending on the source, this involved going to the organization's website, finding the original document that was cited and conducting a search to determine if there was an updated document, or website, or statement of reaffirmation.
- If there was no updated information from the cited organization or author, the researcher determined if there is an Academy position paper, information in the evidence analysis library, resources in the appropriate dietetic practice group (DPG), Pediatric or Women's Health, or other professional organization (ex. American Academy of Pediatrics, American College of Obstetricians and Gynecologists etc.) with updated information.
- If the professional organizations did not have updated data, the researcher conducted a PubMed search utilizing the identical MeSH terms associated with the original source to find a published primary research or a review article. Filters were initially set at 5 years. If there were no articles published within the past 5 years that affirms or offers new insight to the topic, then the filter was increased to 10 years. Each article title that was returned in the search was reviewed to determine if it was related to the initial topic. If the title indicated that the article had relevance to the information being updated, the abstract was reviewed. After review of the abstract, some

articles were discarded due to irrelevance. Of the remaining articles that appeared relevant based on the abstract, the researcher read each article, determined what the outcomes studied were and if they matched with the information that was to be updated. If they matched, the article was read for results and included as a reference to affirm, enhance, or provide new data on the original information in the module.

- If the PubMed search did not yield any clinical recommendations, the researcher determined if the original source could still be used and if there was a reasonable expectation that the data would not have changed since its original publication. When the primary researcher was unable to determine if there was a reasonable expectation for changes in clinical practice, the co-researcher and community advisor advised based on her clinical experience.
- Once each module was completely updated it was sent to the co-researcher for review. Feedback was provided and modules further updated based on her recommendations.

Table 4: References reviewed and added or updated references for each module

Module	Previous References Reviewed	References Added or Updated
Module 2: Nutrition and Normal Pregnancy	43	21
Module 4: MNT for Specific Conditions – Pregnancy	18	18
Module 5: Nutrition and the Postpartum Period	11	17
Module 6: Nutrition and the Young Infant	26	16
Module 7: MNT for Specific Conditions – Infants	17	10

Chapter V: Evidence Analysis Summary

Please see Appendix A.

Chapter VI: Executive Summary of the First Steps Modules

Updates to each module were made based on the methods described in Chapter IV. Modules were developed in Microsoft Word and converted to html pages to facilitate reviewing the curriculum in an easier to view fashion. In addition to the updates in information and procedures, a modification was made to the structure of the modules as well. In addition to the final quiz that is required to gain credit for continue professional education units, knowledge checks were included at the end of each section within the modules. The goal of these practice-based questions is to provoke thought about how a provider will apply the information in a clinical setting while the final quiz is a measure of facts. Adding clinical practice-based knowledge checks complies with the Commission on Dietetic Registration’s guidelines for continuing education activities to promote critical thinking and reflection on clinical and practical relevance. Inclusions of the knowledge checks is a way to reinforce the objectives and themes presented

in the material in a way that is applicable to clinical situations. Including assessments, often in the form of a case study, throughout the modules is consistent with the Knowledge, Process, Practice model. Depending on knowledge level of the individual utilizing the module case study knowledge checks may fall under the Knowledge or Process part of the learning zone. For individuals new to the topics presented the case studies provide an opportunity to cement the knowledge that was learned from the module's content. For individuals that have been working in the field of maternal and pediatric nutrition, the knowledge checks provide an opportunity for the learner to use their pre-existing knowledge and newly acquired knowledge to reflect on the case studies provided. (Shaw et al, 2015) Based on the inclusion of clinical practice-based knowledge checks, there should be an increase in the ability of the participant to apply the information learned in clinical practice. In conjunction with the end of module quizzes focusing on specific facts, the knowledge checks and the module quiz will give the learners the information and ways to apply new information to patients.

Major updates or changes to each module reviewed are listed below. Updates and changes were based on modifications in policies by major professional organization listed in Chapter III. Practitioners should incorporate these policy changes into their standards of care since each policy change was based on guidelines and recommendations from professional groups based on a review and analysis of the research body.

Module 2: Nutrition and Normal Pregnancy

- IOM guidelines surrounding weight gain recommendations during pregnancy were updated to include recommendations based on pre-pregnancy BMI rather than a set weight gain for all pregnancies. The 2009 IOM guidelines were based on research looking at the effects of weight gain during pregnancies and outcomes for mother and baby. The original guidelines from 1990 considered only infant outcomes and not the health of the mother. A range was utilized since positive outcomes occur within a range of weight gain and a single number can not account for differences based on age, race or other factors that may affect pregnancy outcomes.
- Updates were made by the FDA to the recommendations on the safe number of servings for different seafood based on known methylmercury amounts and the potential benefits of eating fish on fetal development. The previous guidelines indicate which seafoods to avoid completely based on high methylmercury content and a general guideline for the maximum number servings of seafood per week. The updated guidelines include a minimum number of servings per week and a maximum number of servings. Additionally, seafood is broken down into "best choices" or low mercury fish, "good choices" or higher mercury fish and "choices to avoid" that have the highest mercury levels.
- Requirements for vitamin D were updated by the IOM from 400 IU to 600 IU for women during pregnancy due to the increase in published research since 1997. The vitamin D

requirements were developed using bone health as an indicator while meeting calcium dietary requirements and with minimal sun exposure. The IOM committee concluded that there was insufficient evidence that vitamin D reduced the risk of nonskeletal chronic disease outcomes and did not include vitamin D levels from studies that were focused on those disease states.

Module 4: Medical Nutrition Therapy for Specific Conditions – Pregnancy

- Testing and diagnosis criteria for gestational diabetes were updated based on changes in guidelines from the American Diabetes Association.
- Diagnostic criteria for hypertensive disorders, including preeclampsia, in pregnancy were added to the module from ACOG guidelines.

Module 5: Nutrition and the Postpartum Period

- Most micro and macronutrient needs listed in the module are from IOM guidelines dating back 20 years or more. There has been little research into the requirements for postpartum care and nutrient needs for low income women in developed countries.
- The recommendations for postpartum care were updated based on changes in WHO's international recommendations from 2013. These guidelines may or may not be applicable to low-income women. The WHO recommends continued iron and folic acid supplementation following birth. However, the incidence of iron deficiency anemia in the U.S. (7.1%, Hong Le, 2016) is much lower than the incidence worldwide (24.8%, WHO) indicating that low-income women in the U.S. may not benefit from continued iron supplementation that may be cost prohibitive.
- Energy requirements for lactating mothers were updated based on recommendations from the AAP and review of the literature. Previous IOM guidelines indicated concern based on a set number of calories independent of a woman's baseline needs rather than adding energy to a woman's baseline needs during lactation. Nutrition care should be individualized and defining one set energy requirement for all women will result in under consumption by some women and over consumption by others.
- Recommendations for postpartum care and screening for women that have common pregnancy complications that may extend into the postpartum period were included. Recommendations for postpartum care are based on the organizations that provided guidelines and diagnosis criteria during pregnancy.

Module 6: Nutrition and the Young Infant

- Complementary foods should be introduced between 4-6 months based on the child's development of skills that are required for feeding. Introducing complementary foods should

not be delayed past 6 months even if all developmental skills are not yet developed.

Beginning complementary foods will help a 6-month-old that does not meet the development milestones to develop the skills needed for feeding. Starting complementary foods after 6 months may slow a baby's growth, delay oral motor function or cause an aversion to solid foods.

Module 7: Medical Nutrition Therapy for Specific Conditions – Infants

- The AAP has reversed their recommendation to delay the introduction of highly allergenic foods until after 3 years of age. The new AAP recommendations are based on results from multiple studies including the Learning Early About Peanut (LEAP) Study and recommends the introduction of highly allergenic foods at the same time complementary foods are introduced. It is thought that earlier introduction to allergens decreases the immune system response when compared to individuals that avoid allergens and are introduced later. If there is thought to be an increased risk of allergies based on family history the introduction of new complementary foods should be spaced out more than in low risk infants.
- Nursing mothers of infants at high risk for developing allergies should not eliminate potential allergens from their diet. Similarly, to the exposure of allergens in complementary foods it is thought that earlier exposure, through breastmilk, may decrease the immune system response to allergens later. There is not convincing evidence that elimination diets in mothers are effective at decreasing the risk for developing allergies in nursing infants.

See Appendix B to review the modules in their entirety.

Chapter VII: Evaluation and Dissemination

Evaluation:

Prior to publishing the curriculum, each module will be reviewed by three independent RDNs that are currently practicing in maternal and infant nutrition settings. Each reviewer will fill out an evaluation form (Appendix C) that has been adapted for each module. Included in each evaluation will be an assessment of how well the modules met the stated learning objectives, if the clinical examples were relevant and consistent with patients encountered in practice, information and procedures were technically accurate, if the material should be organized in a different way, and if additional topics or objectives should be included. Module specific questions are included based on information or sections that were added or changed drastically or retained due to the author's opinion that the information may still be useful. Practitioners with expertise in the field may consider the retained information outdated or no longer useful. (Ex. Module 4 includes sections from a no longer used MSS Policy and Procedure Manual, the new billing guide does not contain the same or similar information) Based on the results of the module evaluations, the author will make updates or changes to each educational module.

After publication, each module will be completed with a similar evaluation form but will also request demographic data to determine the specialties and experience levels of dietitians that are using the modules. The content of these modules assumes a basic understanding of nutrition but not of nutrition needs during pregnancy or infancy. These modules are meant to be used by practitioners that do not have much experience working with patients during pregnancy or infancy. If it is determined by demographics collected that the users of these modules have extensive experience working with these populations, the focus of these modules should shift to more advanced topics and research.

Dissemination Plan:

To ensure that dietitians that would benefit from these modules know that the modules have been updated and are available a variety of means will be utilized. The author presented the updated modules and the methods for reviewing each module at the Washington State Children with Special Health Care Needs Nutrition Network Meeting on 20 May 2019. The audience was entirely made up of Registered Dietitians, many of whom provide First Steps services and WIC services which often overlap with First Steps. For the First Steps dietitians that do not attend the Nutrition Network Meeting, a short description of the modules will be provided and included in the newsletter that is disseminated to First Steps providers. Additionally, marketing plan will be developed by the Nutrition Section at the CHDD. The First Steps educational modules will also be available on UW servers, and CE credit will be available for RDNs, through the Commission on Dietetic Registration.

Chapter VIII: Next Steps

These educational modules focused primarily on nutrition needs during pregnancy, postpartum, and in early infancy and were updated 10 years after they were originally developed. There was little data on the individuals that utilized the modules previously regarding job experience or expertise that could be utilized to direct additions or expansion of topics. The following recommendations are made to decrease the time required to update the modules in the future and to ensure they contain the knowledge that is most needed by providers.

1. Provide the methods section of this report to the next individual or group that updates the educational modules to provide continuity in the processes for future updates.
2. Update each module within five years of publication and space the updates of the modules out so one is updated every six months to one year to decrease the administrative and research burden on an individual.
3. Include the module evaluation questions at the end of each module and request that each person taking the module completes the evaluation. This will ensure that future iterations of the modules include information that is most needed or required. By including the evaluation at the end of each module, the time burden of conducting a needs assessment prior to each module update is reduced.

4. Continue to maintain a database of providers that utilize the modules and their evaluation of the module to demonstrate a continued need for updating the modules and potential for increased funding to improve and update the modules.
5. Document demographics of the providers utilizing the modules and determine the type of provider that utilizes them most. Are the providers mostly newly licensed RDNs, have providers made a switch to maternal and pediatric nutrition recently, or is this a field that they have been in for a long time? Based on this information the modules can be shaped to inform providers at a more basic level or delve deeper into topics that are more complex.
6. Future updates to modules should focus on including components of cultural humility and how to personalize nutrition education to individuals of different cultures. This should be based on an extensive review of the demographics of mothers and infants utilizing MSS and ICM services. Cultures have different views regarding pregnancy and infant nutrition and RDNs should be able to determine if their patients are under pressure from others in the home or community to act outside the established and research guidelines. Additionally, RDNs may provide counseling or refer the patient to other sources to help deter outside forces.
7. Alternative methods for the introduction of complementary foods were not added to the modules during this revision. In future updates research on baby led weaning and other alternative methods for the introduction of complementary foods should be included.

After developing and executing the systematic process for updating recommendations, research and evidence gaps were identified. The list of areas below represents the key areas where more research is needed. These areas were chosen for their potential impact on outcomes and a scarcity of data available to inform practitioners.

Macro and micronutrients in adolescent pregnancies:

Currently, there is very little data to guide recommendations on nutrients needs for adolescents during pregnancy and how they might differ from adult women. It is clear these recommendations would be difficult to specify, given the complexity on age, pre-pregnancy nutritional status, and growth trajectory. However, adolescent pregnancy appear at higher risk for malnutrition and thus further research is warranted.

Macro and micronutrients in multiparous birth:

Nutrient needs for women with multiparous birth are unknown. There are estimates of how many additional calories and how much additional weight a woman with a multiparous pregnancy should consume and gain based on extrapolation of singleton data. However, there is insufficient research documenting nutrients needs for multiparous births and how these could minimize adverse outcomes.

Nutrient needs postpartum:

There are very little guidelines for nutrient needs in the postpartum period. Most of the nutrient recommendations come from the 2001 IOM guidelines and match the needs for women pre-pregnancy. Future research should study the effect of pregnancy on a woman's body and if repletion of specific nutrients needs to occur postpartum or supplementation during breastfeeding is required.

Weight loss postpartum:

Recommendations for weight loss postpartum are non-specific and vary based on which source is being reviewed (Berens, 2018; Cox and Carney, 2017; IOM, 1991; IOM, 1992). Research should be conducted to determine if weight loss is beneficial to recommend, and for those who pursue weight loss how quickly weight loss can be safely achieved in conjunction with breastfeeding. It is important to acknowledge there are a variety of factors that could affect this recommendation including weight gain during pregnancy, BMI postpartum, and BMI prior to pregnancy.

These educational modules provide knowledge and practical application of data to clinical settings. By offering online continuing education modules to RDNs in the First Steps and WIC programs there is an opportunity to improve infant and maternal outcomes. The improvement to outcomes is only as good as the information disseminated and the modules should be continued to be updated at regular intervals to prevent information that is no longer accurate from being taught to patients. Additionally, continued research in the areas identified above will help to provide the best evidenced based nutrition interventions. Expanding the body of knowledge surrounding prenatal, postpartum and infant nutrition requirements will only aid in improving outcomes for infants and mothers.

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Module 2 - Nutrition and Normal Pregnancy

Data/Fact	Module	Page	Read #	Current Citation	Updated Data	New Citation
Resources for foodborne illness	2	14	1		Updated	
Resources for fish recommendations	2	14	1		Updated	
Resources for fetal alcohol syndrome disorders	2	15	1		Updated	
Add drip coffee caffeine content	2	16	1		Updated	
Herb/supplement resources	2	19	1		None required	
Pica resources	2	21	1		None required	
Vegetarian food guide link	2	23	1		Included omega-3 fatty acids as an area of concern, staying up-to-date on new fortified vegan food products	Practice/Position papers from AND
Fortification of folic acid and incidence of neural tube defects	2	3	2	Grosse, 2005	28% reduction in NTD since folic acid fortification	William et al, 2015
Goal of 50% of childbearing age consuming at least 400 mcg/day has not been met	2	3	2	Bentley et al, 2006	Less than 23% are meeting the goal	Healthy People 2020
Development of origins of adult diseases hypothesis	2	3	2	Gluckman et al, 2006	Included epigenetics and the general acceptance of intrauterine environment influencing fetal development	Bianco-Miotto et al, 2017; El Hajj et al, 2014
Avoidance diets for prevention of allergy	2	4	2	Kramer and Kakuma, 2006	Added the AAP recommendation to not utilize an avoidance diet to prevent allergies	AAP, 2008; Kramer and Kakuma, 2012
Vascular changes during pregnancy around concentrations due to enhanced hepatic triglyceride synthesis and decreased catabolism of adipose tissue	2	5	2	Petraglia, 2005	Same Information	Cox and Carney, 2017
Decreases in vascular concentrations	2	5	2	Petraglia, 2005	Same Information	Cox and Carney, 2017
pregnancy outcomes surrounding birthweights and weight gains associated	2	6	2	WHO, 1995		
IOM's 1990 weight gain recommendations	2	6	2	IOM, 1990	Added reference to IOM 2009 weight gain recommendations	IOM, 2009
Supplementation during pregnancy with individual micronutrients or as a prenatal vitamin	2	7	2	Mardis and Anand, 2000; Wright et al, 2003	Same Information	ACOG, 2018
Increased energy needs by trimester	2	7	2	DRI 2002	Same Information	
Increased protein needs to 1.1g/kg/day	2	7	2	FAO/WHO	Change in needs based on which half of pregnancy, increases with proper weight gain	Cox and Carney, 2017
DHA supplementation not recommended	2	8	2	IOM, 2002; Jensen, 2006; Szajewska et al, 2006	included infant visual and cognitive development, postpartum depression associations	Shapiro, 2012
Fiber recommendation of 28 g/day	2	8	2	DRI 2002		
Additional 35 mg/day of magnesium	2	9	2	RDA		
Iron requirements are increased in the second and again in the third trimester	2	10	2	DRI 2002	Same Information	

Module 2 - Nutrition and Normal Pregnancy

Risks associated with anemia in pregnancy	2	10	2	Kaiser, 2002; Georgieff and Innis, 2005; Lozoff et al, 2006	Same Information	Georgieff, 2011 added
Vitamin A is slightly higher in pregnancy with an upper limit for preformed vitamin A during pregnancy	2	11	2	2000 DRI	Same Information	
Intake of folic acid has increased since mandatory fortification of enriched grain products, but only 22-33% are reaching the 400 mcg/day goal	2	11	2	Bentley et al, 2006	22.8% from 2007-2010 met the goal	Healthy People 2020
Recommended intake increased to 600 mcg/day in 1998	2	11	2	IOM, 1998	Same Information	
RDA for vitamin B12 is increased for pregnancy	2	11	2	RDA	Same Information	
Intake of vitamin D to 10 mcg/day (400 IU)	2	11	2	IOM	Increased to 15mcg/day (600 IU)	IOM, 2011
Listeriosis	2	13	2	USDA, 2001	Added symptoms of Listeriosis and timeframe for onset	USDA, 2017
Salmonellosis prevention guidelines	2	13	2	USDA, 2006	Added treatment availability and potential outcomes for baby	CDC, 2018
Prevent methylmercury guidelines	2	14	2	FDA/USDA	Updated recommendations 2-3 serving of good seafood/wk, or 1 serving of okay seafood/wk	FDA, 2017
Limit intake of oil-rich fish to 2 portions per week to avoid pollutants such as dioxins and PCBs	2	14	2	Williamson, 2006	Removed, addressed in the changes to serving recommendations/wk	FDA, 2017
Fetal Alcohol Effects for 1% of the US population caused by prenatal alcohol exposure	2	15	2	CDC, Wattendorf and Muenke, 2005	2-5% of population in US and Western European countries	CDC, 2018
Amount of caffeine associated with increased risk of low birthweight and spontaneous abortion	2	15	2	Signorello and McLaughlin, 2004; Bracken et al, 2003	Updated references, still unknown	Doepker et al, 2016; Li et al, 2014
Herbs for use during pregnancy	2	18	2	Many References (6)	Information is the same added references	Smeriglio et al, 2014
Herbs to avoid during pregnancy	2	19	2	Born and Barron, 2005	Same information	
Recommendations for avoiding food and non-food triggers during "morning sickness"	2	20	2	Erick, 1994	Same Information	ACOG, 2018
Supplemental B6 (10-25mg, 3-4 times per day) and ginger for morning sickness	2	20	2	ACOG, 2004; Vutyavanich et al, 2001	Same Information	ACOG, 2018
Hyperemesis gravidarum incidence of 2% of pregnancies and accompanied by an increase in maternal free thyroid hormone	2	20	2	Erick, 1995	Updated .3-3% and other potential hormonal causes	ACOG, 2018
Read more on hyperemesis gravidarum	2	20	2	Erick, 1995	Same Information	ACOG, 2018

Module 2 - Nutrition and Normal Pregnancy

Pica complications including inhibition of iron absorption, intestinal obstruction, excessive energy intake, infection with worms, and toxicity (lead)	2	21	2	Rose et al, 2000; Rainville, 1998	Same Information	Cox and Carney, 2017
Etiology of pica is unknown, potentially iron deficiency	2	21	2	Rose et al, 2000	Same Information	Cox and Carney, 2017
Vegetarian and vegan food patterns during pregnancy	2	22	2	Williamson, 2006	Same Information	
Lowest mortality rates were seen in infants with birthweights between 3000 and 4499 grams regardless of mother's age	2	23	2	Rees et al, 2006	Removed, increased discussion on additional needs required for adolescent pregnancies	
Recommendations for multiparous	2	24	2	IOM	Same Information	
Add read more sections to outline	2	2	1	N/A	Added	
Look for updated research on artificial sweeteners effecting pregnancy and lactation	2	16	3		No updated data with negative effects, sacharrin seems to be not recommended though	
Weight gain recommendations for adolescent pregnancies	2	23	3		No data for adolescent weight gain	

Module 2 - Evidence Analysis

Author, Year, Study Design, Class, Rating	Research Question	Results	Bias or Limitation
Bianco-Miotto et al, 2017	Connection between epigenetics and developmental organs of health and disease	Evidence surrounding epigenetics, specifically DNA methylation, suggests that it may be a marker of early life exposures and may help predict an increase in risk for disease such as obesity and Type 2 Diabetes later in life.	Review article of multiple areas of epigenetics
Study Design: Review		Large human longitudinal studies utilizing bio-specimens and detailed information on the cohort are required to understand the epigenetic mechanisms involved in developmental organs of health and disease	Not specifically looking at results of maternal behaviors while pregnant
Class: R			
Rating: Neutral			
El Hajj et al, 2014	What are the phenotypic and epigenetic results of adverse nutritional and diabetic intrauterine environment?	Both fetal under and overnutrition in utero has been linked to increased risk for obesity. Intrauterine exposure to GDM has been linked to increased risk for T2DM in youth as well.	Difficult to determine if methylation patterns formed in utero continue into adulthood.
Study Design: Review		Studies in siblings conceived pre-famine vs during famine indicated differences in methylation of specific genes up to 60 years after gestation.	Studied tissues generally have multiple cell types and methylation patterns are often cell type/tissue specific
Class: R		It is unclear if there is a way to treat or reverse epigenetic modifications after birth.	
Rating: Neutral			

Module 2 - Evidence Analysis

Shapiro, 2012	To review the research surrounding 5-HTT gene, a serotonin transporter gene, and omega-3 fatty acids. Omega-3 fatty acids are thought to reduce the risk for depression partially through regulation of gene expression.	A review of the research on 5-HTT gene indicates mixed results indicating there may be some other confounding variables that make it difficult to determine how the 5-HTT genotype and environmental factors relate to the development of postpartum depression	Review article of multiple studies looking at each factor individually and limited studies looking at the combination of n-3 PUFAs and 5-HTT gene.
Study Design: Review		There are multiple studies that link decreased n-3 PUFA intakes to depression in a variety of populations. However it is unclear if increased n-3 PUFA intake would decrease risk for postpartum depression. Since current intake of n-3 PUFAs in pregnant and postpartum women is below current recommendations the possibility for decreasing risk is worth further investigation.	Unable to determine how n-3 PUFA link to depression would be modified or not during pregnancy.
Class: R			
Rating: Positive			
Georgieff, 2011	A review of the evidence for iron deficiency and the long term consequences in human fetal/neonatal and toddlers.	Long-term cognitive and socio-emotional behavioral deficits have been shown in children and young adults following a period of early iron deficiency.	Models for metabolic effects of iron deficiency are all animal based due to ethical concerns with utilizing humans.
Study Design: Review		Abnormalities in neurobehavioral processing continues after the early iron deficiency has been corrected.	
Class: R		Iron deficiency later in life can be corrected with little to no long term effects (adolescents vs infants/toddlers)	
Rating: Neutral			
Doepker et al, 2016;	A review of caffeine and its varied effects based on a panel of experts.	Half of studies reported weak associations with small for gestational age or reduced birth-weight endpoints and the others found no statistically significant associations.	Some studies tried to account for nausea during pregnancy as a potential confounder.

Module 2 - Evidence Analysis

Study Design: Review	Looked at the section on reproductive effects, focusing on associations between caffeine intake and fetal growth and caffeine intake and fetal loss.	Two prospective cohorts both published in 2008 associated higher levels of caffeine consumption with an increased risk of miscarriage. (>200mg or >144.3mg/day(median of cohort consumption))	Difficult to determine how much caffeine is consumed daily due to recall bias.
Class: R			If interviews were conducted after miscarriage occurred there was a greater OR for miscarriage than if interviews were conducted before miscarriage occurred indicating bias in reporting.
Rating: Positive			
Li et al, 2014	Look for any associations between pregnancy loss and caffeine and coffee consumption	For caffeine, risk of pregnancy loss increased by 19% for every 150mg/day. (OR 1.19, 95% CI 1.16–1.23)	The authors conducted the Egger test for publication bias and determined there was no evidence for the analysis between risk of pregnancy loss and caffeine consumption (P=0.20) or coffee consumption (P=0.24)

Module 2 - Evidence Analysis

Study Design: Meta-analysis		There is a dose response for the amount of caffeine consumed and risk of pregnancy loss. Compared with never/lowest drinkers, the pooled ORs were 1.04 (95% CI 0.97–1.11), 1.09 (95% CI 0.99–1.20), 1.16 (95% CI 1.05–1.28), 1.24 (95% CI 1.14–1.36), 1.34 (95% CI 1.22–1.46), 1.43 (95% CI 1.30–1.56), 1.52 (95% CI 1.38–1.66), 1.61 (95% CI 1.47–1.76), and 1.99 (95% CI 1.73–2.29) for caffeine consumptions of 50, 100, 149.5, 199.5, 249.5, 300, 349.5, 400, and 599.5 mg/day, respectively.	Caffeinated food items could not be included because of data limitations.
Class: M		For coffee consumption the risk of pregnancy loss increased by 8% for every increase by 2 cups of coffee/day. (OR 1.08, 95% CI 1.07–1.10)	Recall bias was present in all observational studies included and some case-control studies.
Rating: Positive		There is a dose response for the amount of coffee consumed and risk of pregnancy loss. Compared with never/lowest drinkers, the pooled ORs were 1.00 (95% CI 0.96–1.04), 1.06 (95% CI 1.01–1.11), 1.15 (95% CI 1.10–1.20), 1.24 (95% CI 1.18–1.30), 1.28 (95% CI 1.21–1.35), 1.38 (95% CI 1.29–1.48), 1.44 (95% CI 1.34–1.54), 1.58 (95% CI 1.43–1.75), and 1.64 (95% CI 1.41–1.91) for coffee consumptions of 1, 2, 3, 4, 4.5, 6, 7, 12, and 15 cups per day, respectively.	Some studies were eliminated to remove heterogeneity in the findings of the dose-response analyses.
Smeriglio et al, 2014;	Provide an updated overview of the literature for the most frequently consumed herbal remedies during pregnancy.	Many herbal remedies have potential drug interactions especially with warfarin and other anticoagulant drugs.	Not many clinical studies have been used to determine safety and efficacy due to ethical concerns.
Study Design: Review		Ginkgo, and Blue Cohosh are commonly used and are believed to be unsafe during pregnancy and may have negative effects on the fetus or mother's health. Raspberry leaf does not have any adverse effects observed but is thought to act like the hormone estrogen and cause harm to the pregnancy.	Clinical studies that have been conducted are often small in scale.

Module 2 - Evidence Analysis

Class: R		It is important to communicate the possible dangers to utilizing herbal remedies to pregnant women. Additionally medical treatments should not be avoided because of "treatment" with herbal remedies in some cases, such as UTIs.	
Rating: Positive			

Module 4 - MNT for Specific Conditions - Pregnancy

Data/Fact	Module	Page	Read #	Current Citation	Updated Data	New Citation
IOM MNT for medical issues	4	1	2	IOM, 1992	Same information	NCM
Glucose testing is not indicated for women with low risk	4	5	1	ACOG Practice Bulletin, 2001	All women are tested between 24-28 weeks, tested at first prenatal appointment if high risk	ADA, 2018
GDM definition	4	5	2	ADA, 2004	glucose intolerance that develops during pregnancy	AND, 2018
GDM MNT Goals	4	6	2	Franz et al, 2004	3 goals from NCM	Nutrition Care Manual
Restriction of carbohydrates to 35-40%, obesity restriction to 25 kcal/kg	4	8	2	ADA, 2004	DRI for carbohydrates minimum of 175 g, no specific recommendations for carb % of total energy	ADA, 2018
California Sweet Success Program guidelines	4	8	2	California Sweet Success	Updated, <45%, minim of 175 g of carbs, min of 71 g of protein	California Sweet Success
Update GDM Education websites	4	10	1	Varied	Updated	Varied
GDM, T1DM, T2DM does not contraindicate breastfeeding	4	10	2	Stage et al, 2006	Encourage breastfeeding for all women including those with GDM	ADA, 2018
GDM Resources	4	11	1	Varied	Updated	Varied
Interdisciplinary approach is most effective	4	11	2	Franz et al, 2002	Same information, inclusion of all members of the team providing evidence-based nutritional knowledge	Dyson et al, 2011
12-22% of pregnancies have hypertensive disorder	4	12	2	None listed	6-8% of pregnancies in US	CDC, 2018
Diagnostic criteria for hypertensive disorder in pregnancy	4	12	2	None listed	Included multisystem interaction with preeclampsia instead of just proteinuria, added postpartum hypertension	ACOG, 2013
Calcium supplementation decreasing risk of hypertension	4	14	2	Hofmeyr et al, 2006; Atallah, 2002	Same information	Hofmeyr et al, 2018
Vitamin C and E supplementation, suggested to reduce risk, no benefit shown	4	14	2	Rumbold, 2006	Same information	Rumbold et al 2008; 2015
Food pattern high in fiber, potassium, magnesium, and calcium and lower rates of preeclampsia	4	14	2	Frederick et al, 2006	Added additional study to corroborate	Qiu et al, 2008; Frederick et al, 2006
Restriction of sodium is not supported for reducing risk of preeclampsia	4	14	2	Duley et al, 2005 (Cochrane Review)	No change, or update in Cochrane Review, matches ACOG recommendations	Duley et al, 2005; ACOG, 2013
Weight classifications for obese/overweight	4	15	1	IOM 1990	BMI 25-29.9 and BMI>30	IOM 2009
Overall weight gain between 15-25 pounds for overweight	4	15	1	Edwards 1996	11-20 pounds recommended, lack of weight gain increased risk for SGA, weight gain over 20 pounds increases risk for LGA	Gavard and Artal, 2014
Weight loss or no gestation weight gain is more common among obese women (11%) than those who are not obese (1%)	4	15	2	Edwards, 1996	Women that are obese prepregnancy gain less weight in early and late pregnancy than mothers in lower BMI classes.	Broskey et al, 2017
Weight gain of at least 15 pounds but less than 25 pounds	4	17	1	None listed	Shifted to 11-20 or 15-25 based on prepregnancy BMI	IOM 2009
Add weight gain chart to Case Example Sarah	4	17	1		Added weight gain charts for both Case Example Sarah and JoAnn	

Module 4 - MNT for Specific Conditions - Pregnancy

Maternal underweight associated with risk factors	4	19	2	IOM, 1992	Same information added IUGR, miscarriage, and birth defects	Cox and Carney, 2017
Factors Associated with Low Prenatal Weight Gain	4	19	2	Hickey et al, 1997; Wells et al, 2006; Hickey, 2000	Added Deputy et al to corroborate	Deputy et al, 2015
Increasing energy density by adding margarine or butter	4	20	1	None listed	Changed to cooking oils	
MSS Policy and Procedure Manual - Tobacco Use	4	22	1			
Tobacco is the most commonly abused drug during pregnancy, causing more than 15% of LBW	4	22	2	Shiono et al, 1995	May have the largest effect on fetal growth restriction compared to alcohol, marijuana, and cocaine	Janisse et al, 2014
MSS Policy and Procedure Manual - Alcohol Use	4	24	1			
LMP spell out	4	25	1		No change, last menstrual period	
Effects of selected substance use during pregnancy	4	26	2	None listed		
Use of illegal drugs or alcohol is incompatible with breastfeeding	4	28	1		Add excessive alcohol, rather than just casual alcohol	AAP, 2012

Module 4 - Evidence Analysis

Author, Year, Study Design, Class, Rating	Research Question	Results	Bias or Limitation
Hofmeyr et al, 2018	Does calcium supplementation during pregnancy prevent blood pressure disorders and related problems?	There is greatest reduction in the risk of pre-eclampsia with women that are at high-risk and receive calcium supplementation. (Average RR 0.22, 95% CI 0.12 to 0.42; test for subgroup differences: $\text{Chi}^2 = 6.81$, $\text{df} = 1$, $P = 0.009$, $I^2 = 85.3\%$)	Difficult to assess bias in the included studies due to lack of reporting
Study Design: Meta-analysis Class: M		Pre-elcampsia was not reduced in the subgroup with adequate dietary calcium, but was reduced in those with low baseline calcium intake. (average RR 0.36, 95% CI 0.20 to 0.65; heterogeneity: $\text{Tau}^2 = 0.44$; $\text{Chi}^2 = 29.35$, $\text{df} = 7$, $P = 0.0001$; $I^2 = 76\%$)	Small study effects were included as a bias
Rating: Positive			
Rumbold et al 2008	Is antioxidant supplementation safe and effective during pregnancy to reduce the risk of developing pre-eclampsia? Generally looked at Vitamin C and E in conjunction	There was no statistically significant difference between antioxidant and control groups for the RR of pre-eclampsia. (RR 0.73, 95% confidence intervals (CI) 0.51 to 1.06)	Four trials did not indicate how they defined pre-eclampsia.
Study Design: Meta-analysis Class: M		No statistically significant difference between antioxidant and controls groups for severe pre-eclampsia (RR 1.25, 95% CI 0.89 to 1.76)	Multiple definitions of pre-eclampsia were used across the studies included.
Rating: Positive			

Module 4 - Evidence Analysis

Rumbold et al 2015	What are the effects of vitamin E supplementation, alone or inconjunction with other separate supplements on pregnancy outcomes, adverse events, side effects and use of health services?	There was no statistically significant difference between vitamin E and placebo or control groups for pre-eclampsia. (RR 0.91, CI 0.79-1.06)	Only 3 studies that looked at vitamin E supplementation alone, they did not provide data.
Study Design: Meta-analysis	Concerned mainly with the development of pre-eclampsia.	There is no recommendation for Vitamin E supplementation as it does not prevent problems in pregnancy and may increase abdominal pain for women.	
Class: M			
Rating: Positive			
Qiu et al, 2008;	Is there an association between maternal dietary fiber intake early in pregnancy and risk of pre-eclampsia?	Women in the highest quartile of fiber intake had a reduced risk of pre-eclampsia when compared to women in the lowest quartile of fiber intake. (RR = 0.33; 95% CI =0.14–0.79)	Recall of dietary intake was from FFQs taken at 13.3 weeks on average, recall bias
Study Design: Prospective Cohort		The associated risk for pre-eclampsia based on dietary fiber did not differ according to maternal age, prepregnancy weight status or parity.	Some recall was done via interview at 13.1 weeks on average, recall bias
Class: B		Total fiber intake was more strongly related with pre-eclampsia risk among women with a family history of essential hypertension.	Only utilized women that spoke English and were 18 years old or older
Rating: Neutral			Women had to have started prenatal care prior to 20 weeks gestation.
			Women were generally from a higher socio-economic status.
Gavard and Artal, 2014	The relationship between gestational weight gain categories in obese women and an infant that was LGA or SGA.	The incidence of LGA infants increases with increased weight gain regardless of diabetic status.	Self-report prepregnancy weight and height used to determine BMI

Module 4 - Evidence Analysis

Study Design: Retrospective cohort	Differences in LGA or SGA within gestational weight gain categories in obese women when broken down by diabetic status.	Class I Obese non-diabetic women who gained 3–10 pounds had significantly higher odds of an SGA infant than Class I Obese non-diabetic women who gained 11–20 pounds [adjusted odds ratio (OR) 1.28, 95 % confidence interval (CI) 1.07, 1.52]	Adjusted for confounding including, maternal age, race, socioeconomic status (based on enrollment in Medicaid, WIC, or food stamps), smoking, parity, cardiac disease, renal disease, chronic hypertension, preeclampsia
Class: B		Diabetic women who gained ≤2 pounds did not have a significantly increased risk of an SGA infant compared to diabetic women who gained 11–20 pounds in any obesity class.	
Rating: Positive		Lower gestational weight gain in women classified as obese is not significantly associated with an increased risk for SGA infants but is significantly associated with a decreased risk of LGA infants.	
Broskey et al, 2017	Evaluate the effect of early versus late gestational weight gain (GWG) on infant size at birth.	Mothers with inadequate early GWG but excessive late GWG only had a 15% increased risk of their infant being born SGA (OR: 1.2; 95% CI: 0.8-1.6)	Large cohort over over 16,000 infant-mother dyads
Study Design: Retrospective cohort		Infants born to mothers with inadequate GWG in both early and late pregnancy (OR: 2.0; 95% CI: 1.3-3.0, P 5 0.001) had the greatest risk of being born SGA	Only Chinese women
Class: B		Infants born to mothers with excess GWG in both early and late (OR: 2.4; 95% CI: 1.5-4.0) pregnancy had the highest risk (P 5 0.001) for being born LGA	Limited incidence of GDM, hypertension so it was excluded, no inclusion of pre-eclampsia at all
Rating: Positive		Infants born to mothers who had excessive early GWG followed by either inadequate (OR: 1.9; 95% CI: 1.1-3.2) or adequate late GWG (OR: 1.7; 95% CI: 1.0-3.0) had a reduced risk of being born LGA (P < 0.001)	

Module 4 - Evidence Analysis

Deputy et al, 2015	Assess the relationship among demographic, behavioral, psychosocial and medical characteristics and weight gain above or below the IOM's recommendation based on prepregnancy BMI.	32% of women gained weight within guidelines, 20.9% gained inadequate weight and 47.2% gained excessive weight.	Taken from a cross-sectional survey, participants were chosen at random to answer a survey, recall bias, and selection bias.
Study Design: Cross-sectional	Estimate the prevalence of gestational weight gain below, within, or above the IOM's revised recommendations.	In underweight women, an education less than high school was positively associated with inadequate weight gain and excessive weight gain.	Representitive of only 28 states in the U.S.
Class: D		In normal weight women, smoking cessation and hypertensive conditions were positively associated with excessive weight gain.	Women were excluded based on incomplete or implausible data.
Rating: Neutral		In over weight women education more than high school was positively associated with excessive weight gain.	

Module 5 - Nutrition and the Postpartum Period

Data/Fact	Module	Page	Read #	Current Citation	Updated Data	New Citation
WHO guidelines for postpartum care	5	1	2	WHO, 1998	2013 WHO Recommendations on postnatal care of the mother and newborn	WHO, 2013
Components of postpartum care	5	1	2	WHO, 1998	add signs and symptoms of postpartum medical conditions including pre-eclampsia and eclampsia to counselling	WHO, 2013
Nutrition intervention between pregnancies may improve the outcome of subsequent pregnancy	5	1	2	IOM, 1992	Same information	Louis et al, 2019
"blues" as a maternal issue in late postpartum period	5	3	1	Berens, 2005	correct terminology	Berens, 2018 UpToDate
Complications in the immediate postpartum period	5	3	2	Berens, 2005	add shivering or chills, observed in 25-50% of women lasting up to 60 mins.	Berens, 2018 UpToDate
Maternal issues in late postpartum period	5	3	2	Berens, 2005	add persistent vaginal bleeding for more than 8 weeks	Berens, 2018 UpToDate
Fears that women may have in the postpartum period	5	5	2	WHO, 1998	Same information	WHO, 2013
summary table of nutrients for breastfeeding women is available -- not able to find in module, add	5	6	1	N/A		
Replete calcium, vitamin B6 and folate in postpartum period	5	6	2	IOM, 1992	Same information	
protein needs for lactating women, 1.3g/kg	5	7	2	IOM, 1992	1.1g/kg/day	Cox and Carney, 2017 (Krause)
Carbohydrate intake increases during lactation	5	7	2	IOM, 1992	Added the need for women with poor gestational weight gain to have increased carbohydrates	Cox and Carney, 2017 (Krause)
AI for calcium is the same for lactation and not lactating women	5	7	2	IOM, 1997	Same information	IOM, 2011
Iron needs return to normal unless excessive blood loss during delivery	5	7	2	IOM, 2001	WHO recommends continued supplementation of folate and iron for 3 months after delivery	WHO, 2015
Disintegration of red blood cells releases iron for new RBC	5	7	2	IOM, 1992	Same information	
Zinc during lactation is increased over pregnancy and nonpregnancy levels	5	7	2	IOM, 2001	Same information	
Essential fatty acid recommendations? Increased? Higher for lactating women, affect on breastmilk make up?	5	7	3	N/A	α -linolenic acid, 1.3g/d during lactation, linoleic acid 13 g/d, 200-300mg of docosahexaenoic acid (DHA)	IOM 2005, AAP 2012
Vitamin D does not support routine supplementation for all lactating women, minimal sunlight exposure may indicate supplementation	5	8	2	IOM, 1997	600 IU/day is AI, dose of 6400 IU/day can provide enough for infant and mother. AAP recommends, 400 IU daily at birth	IOM,2011; Cox and Carney, 2017; AAP, 2012
Vitamin A is increased above that for non-pregnant women to replete stores	5	8	2	IOM, 2001	Same information	

Module 5 - Nutrition and the Postpartum Period

average weight loss after the first few weeks postpartum is .5-1.0 kg per month for 6 months, highly variable	5	9	2	IOM, 1991	Add: lose approximately 13 lbs during delivery, with another 5-15lbs puerperium	Berens, 2018 UpToDate
Patterns of weight loss in adolescents post partum are more variable	5	9	2	Worthington-Roberts, 1997	More variable but at higher risk of postpartum weight retention	Berens, 2018 UpToDate
Factors associated with postpartum weight retention	5	9	2	Berens, 2005	Same information	Berens, 2018 UpToDate
Risk factors for poor nutritional status include underweight	5	9	2	IOM, 1991	Rephrase, awkward in document	
CDC recommends that hemoglobin or hematocrit should be measured for women at risk for anemia at 4-6 weeks postpartum	5	9	2	CDC, no date listed	CBC should be tested for based on a case-by-case basis, symptoms that suggest anemia, fatigue, depressed mood, exercise intolerance, pallor or ongoing vaginal bleeding after birth. Ferritin and percent transferrin saturation should be tested 2-3 weeks later to confirm iron store repletion	Auerbach and Landy 2018
"Risk factors include: Anemia as indicated by hemoglobin or hematocrit" redundant, remove	5	10	1	N/A	REMOVE	
Normal hematocrit and hemoglobin levels by age and smoking status	5	10	2	CDC, 1998		
Nutrients of concern for adult women include iron, calcium, folic acid, zinc, magnesium	5	11	2	Wright et al, 2003	Iron, folate, zinc, calcium, vitamin D	AND, 2014
For lactating women, nutrients of concern if energy intakes are less than 2700 kcals/day	5	11	2	IOM, 1991	Well nourished lactating mothers should increase energy by 450-500kcal/day, DRIs are similar to or greater than pregnancy, no routine recommendation for maternal supplements, possible to continue use of prenatal. Vitamin A, Vitamin D, B12, folate (at expense of mother), B6 content in breastmilk varies based on maternal intake. Most mineral levels in breastmilk are independent of dietary intake with the exception of selenium and iodine.	AAP, 2012; Butte and Stuebe 2018 UpToDate
Health status of women who experienced complications during pregnancy should be reassessed in the postpartum period	5	12	2	IOM, 1992	OGTT should be tested again 4-12 week postpartum visit, tested 1-3 years after if 4-12 week test is normal, frequency depending on risk factors. Preeclampsia: monitor BP in hospital or at home for first 72 hours postpartum if normal check BP at 7-10 days postdelivery, longer monitoring may be needed until signs/symptoms have resolved, alternative diagnoses with persistent high BP after 3-6 months Hemorrhage or Anemia at delivery: check ferritin and %transferrin saturation 2-3 weeks after iron therapy	ADA, 2018; Norwitz, 2019 UpToDate; Auerbach and Landy, 2018 UpToDate

Module 5 - Nutrition and the Postpartum Period

psychosocial issues can have effects on appetite, access to food, and sleeping/eating habits	5	13	2	IOM, 1992	Same information	Viguera, 2018. UpToDate
Rate of weight loss in postpartum periods, .5-1.0 kg/month for 6 months	5	14	2	IOM, 1991	Healthy breastfeeding women can safely lose up 1 pound a month and still maintain an adequate milk supply. A slow weight loss of no more than 5 pounds/month supports more permanent weight loss, and adequate energy and nutrition. Breastfeeding mothers are advised to weight until breastfeeding is well established for about 2 months before trying to lose weight so milk supply can be established.	Cox and Carney, Krause
overweight breastfeeding women should not lose more than 2 kg/month and consume at least 1800 kcals/day	5	14	2	IOM, 1992	Remove the difference between overweight and normal weight women.	
Resources for healthy weight and planning	5	14	2	Be a Healthy Mom, A Lifetime of Good Health		
long term effects of pregnancy weight gain and postpartum weight loss	5	15	2	Rooney, 2002	Weight retention at 6 mo and 18 mo postpartum are both related to increased weight gain at 7 years postpartum, high gestational weight gain was correlated to higher weights 7 years postpartum but it was related to increased postpartum weight retention. Breastfeeding duration is inversely correlated to abdominal fat based on circumference 7 years postpartum	Kirkegaard, 2014
No risk factors for anemia, iron supplementation should be stopped at delivery	5	15	2	CDC, 1998	WHO recommends continued supplementation of folate and iron for 6-12 weeks after delivery, https://www.who.int/elena/titles/iron_postpartum/en/ Advise to continue taking prenatal vitamin with folic acid postpartum for 6-8 weeks especially if breastfeeding	WHO, 2016 and Auerbach, Landy 2018
Tools to increase diet quality	5	15	2	Be a Healthy Mom, Congratulations, Mom You have a beautiful baby	Pump up the iron! Can't find "Be a healthy mom"	
Vegetarian Nutrition DPG of the ADA	5	16	1	www.vegetariannutrition.net	https://vndpg.org/	
Resources to promote healthful eating for the whole family	5	16	2	Healthy Choices for Kids, Eat better eat together with growing children healthful meals (WSU)	https://extension.wsu.edu/benton-franklin/health/nutrition/ and https://nutrition.wsu.edu/food-sense_trashed/eteb/eteb-incentives/	

Module 5 - Nutrition and the Postpartum Period

Vegetarian Resources	5	16	2	eatright.org, vegetarian resource group, dietitians' guide to vegetarian diets	"Becoming Vegetarian" brochure https://www.eatrightstore.org/product-type/brochures-handouts/becoming-vegetarian , dietitians guide to vegetarians 3rd ed. 2011
intakes of nutrient rich foods should be encouraged, especially if energy intake is less than 1800 kcals/day	5	16	2	IOM, 1991	Same information

Module 5 - Evidence Analysis

Author, Year, Study Design, Class, Rating	Research Question	Results	Bias or Limitation
Kirkegaard, 2014	How maternal weight changes in each period of the reproductive cycle and duration of breastfeeding relate to maternal weight and BMI-adjusted waist circumference 7 years after delivery?	Each kg increase in gestational weight correlated to increased .18kg weight at 7 years, however each 1 kg increase at 18 mo postpartum correlated to an increase of .51kg at 7 years.	Danish cohort, may not be generalizable, but included 23,701 women. Selection bias.
Study Design: Prospective cohort		Each kg increase in prepregnancy weight corresponded to a .91kg higher weight at 7 years.	Excluded women who had an additional birth between the initial birth recorded and the 7 year follow up timeframe.
Class: B		Each 1 kg increase in weight corresponded to .07cm larger waist circumference	Utilized telephone interviews, FFQs, letter or internet questionnaire, recall bias
Rating: Positive		Inverse association between breastfeeding and waist circumference 7 years after birth.	Women who responded at the 7 year follow up were generally of a higher socio-economic status, lower weight at prepregnancy and 6 and 18 month postpartum, more physically active, less often smokers, breastfed longer, and had a generally healthier dietary pattern compared to women lost to follow up.

Module 6 - Nutrition and the Young Infant

Data/Fact	Module	Page	Read #	Current Citation	Updated Data	New Citation
Breast feeding data, Healthy People 2010 objectives	6	10	1	CDC, 2004	Healthy People 2020 objective of 81.9% of mothers initiating breastfeeding, 60.6% of infants being breastfed by 6 months of age, and 34.1% at 1 year. The estimated rates in the US are around 83.2% of infants ever breastfed, 57.6% breastfeeding at 6 months, and 35.9% breastfeeding at 1 year. (In Washington State, the rates are 92%, 73%, and 48% respectively).	Breastfeeding Report Card, Centers for Disease Control and Prevention National Immunization Survey (NIS), 2015 Births
Guidelines recommend intro of solid foods in an order, no controlled studies to back up recommendations	6	19	1	N/A	Same information	
Use CDC growth charts from 2000	6	20	1	WIC	CDC recommends using the WHO growth charts for infants and children 0 to 2 years of age in the U.S. The change from CDC growth charts to WHO growth charts was implemented October 1, 2012.	https://wicworks.fns.usda.gov/resources/wic-growth-charts
Referral Resources, websites	6	28	1		Updated websites	
Symptoms of water intoxication include hyponatremia, restlessness, nausea, vomiting, diarrhea, polyruia/oliguria, and seizures	6	6	2	Trahms, 2004	Same information	McKean and Mazon
Whole milk and iron deficiency anemia	6	7	2	Akers and Groh-Wargo 2005; Fomon and Ziegler 1999	Decreases the bioavailability of other dietary sources of iron due to higher levels of Calcium and casein than human milk. Also an increase in the potential renal solute load of cows milk by three times human milk leading to an increased risk of dehydration.	Akers and Groh-Wargo, 2012; Ziegler 2011
Vitamin K recommendations based on prophylactic vitamin K at birth	6	8	2	IOM, 2001	Oral vitamin K is not recommended since intramuscular vitamin K is more successful at preventing hemorrhagic disease of the newborn (HDNB) and oral doses of vitamin K are variable absorbed providing inadequate concentrations or stores for the breastfed infant.	IOM, 2001, AAP 2012
Repeating doses of vitmain K during first 4 months of life, does not list amount or how often	6	8	2	AAP, 2005	Oral doses of vitamin K are absorbed variably and provide inadequate stores of Vitamin K for the breastfed infant	AAP 2012, Breastfeeding and the Use of Human Milk
Benefits of breastfeeding	6	10	2	IOM, 1992	Position statement that has not changed	
Breast feeding contraindication based on mother's mediations	6	10-11	2	IOM, 1991; Story et al, 2002	Changes in binder	AAP 2012, Breastfeeding and the Use of Human Milk, Holt et al. 2011

Module 6 - Nutrition and the Young Infant

Breast feeding contraindication based on maternal infections	6	11	2	Story et al, 2002; AAP, 2005	Changes in binder	AAP 2012, Breastfeeding and the Use of Human Milk, Holt et al. 2011
General nutrition needs for women during lactation	6	11	2	Story et al, 2002	Increase in calories by 400 calories or less per day and enough water to stasify thirst may be required to support breastfeeding after the first 6 weeks.	Holt et al, 2011
Use of only breastmilk or commerical infant formula for infants	6	12	2	Hattner, 2005	Only breast milk or iron-fortified infant formula is recommended for the full-term infant during the first year of life. Cow's milk, goat's milk, soy milk or other low iron milks should not be used during the first year of life.	Holt et al, 2011
Human Milk contains antibodies, essential fatty acids, growth factors, and cytokines that are not found in commerical infant formula	6	12	2	Story et al, 2002; AAP, 2005	Same information	Holt et al, 2011; AND 2015 Position Paper
No known medical conditions require low-iron formula, chelation therapy is adjusted to account for iron in formula	6	13	2	AAP, 1999	Due to the minute amount of iron in formula or breastmilk when compared to the iron overload from multiple blood transfusions or genetic conditions leading to increased absorption and storage	AAP 2010
Baby friendly hospital initiative	6	14	2	US GAO, 2006	10 Steps to earn the Baby-Friendly Designation	Baby Friendly USA, 2016
Formula preparation recommendations	6	14	2	FDA, 2001; Martin and Lewis, 1994; Akers and Groh-Wargo, 2005	Same information	FDA 2018; Holt et al 2011
Recommendations for infant feeding generally support exclusive breastfeeding for the first 6 months of life, supplemented by complementary foods for at least 12 months	6	17	2	AAP, 2005; James, 2005	Same information	AND 2015; AAP 2012

Module 6 - Nutrition and the Young Infant

Developmental readiness for solid foods may occur as early as 4 months of age up until 8 months of age	6	17	2	AAP 2005	Introduction of complementary foods can be introduced between ages 4 and 6 months based on the infant's development. After age 6 months, introducing solid foods will aid in the development of feeding and eating skills for all infants. Introducing complementary foods before 4 months of age may increase the risk of obesity later in childhood.	Holt et al, 2011; AAP 2018
Evidence-based guidelines for the introduction of complementary foods including summary of physical and eating skills, hunger and fullness cues, and appropriate food textures for children 0-24	6	17	2	Butte, 2004	Same information	CDC 2018, access 8/7/18
Meat and fortified foods provide many of the nutrients for which young toddlers are often at-risk of deficiency	6	19	2	Butte, 2004	Specifically zinc and iron	CDC 2018, access 8/7/18
Botulism spores in corn syrup are no longer found due to improved manufacturing processes	6	19	2	Cox and Hinkle, 2002	No cases of infant botulism have been proven to be related to the consumption of light or dark corn syrup, but manufacturers are unable to ensure that these products are free of spores.	Carrillo-Marquez 2016
Division of responsibility for development of a healthy feeding relationship	6	19	2	Satter, 2000		
Deviation from expected growth pattern should be evaluated. Growth begins to match genetic potential or indicate a nutrition related problem	6	20	2	Story et al, 2002; IOM 1992	Same information	Holt et al 2011, IOM 1992
Expected growth pattern	6	20	2	IOM, 1991; Trahms, 2004	Infants lose approximately 10% of their body weight due to fluid loss and some tissue breakdown immediately following birth, birthweight is usually regained within 7 days	Holt et al 2011
Rule of Thumb for growth patterns	6	20	2	Story et al, 2002	Regain birthweight within 7 days after birth; everything else is the same	Holt et al 2011
Incremental growth charts and caution against use	6	21	2	IOM, 1991; Roche, 1980	Concerns about incremental growth charts have not changed	IOM, 1991; Roche, 1980
Premature growth charts/growth evaluation	6	21	2	Sherry et al, 2003	The INTERGROWTH-21(st) Project determined that preterm growth patterns differ from babies born within the Newborn Size Standards. Growth outside the uterine environment is not the same as intrauterine growth. The use of size-at-birth charts to monitor postnatal growth in preterm neonates is strongly discouraged. Use of WHO charts may resume at 64 weeks postmenstrual age.	Postnatal growth standards for preterm infants: the Preterm Postnatal Follow-up Study of the INTERGROWTH-21(st) Project. Villar et al 2015

Module 6 - Nutrition and the Young Infant

Barriers to continuation of breastfeeding can be identified	6	21	2	IOM, 1992; Story et al, 2002	Information is the same	Holt et al 2011
Observation of the mother breastfeeding	6	21	2	Story et al, 2002	Information is the same	Holt et al 2011
Expected feeding pattern table	6	22	2	Akers and Groh-Wargo, 2005	Updated table	Akers and Groh-Wargo, 2012
Approximate formula intakes based on age	6	22	2	Pediatric Manual of Clinical Dietetics	Removed based on redundancy and no updated manual	
Elimination pattern expectations for breast fed infants	6	22	2	AAP, 2002; AAP, 2004; Schrago et al, 2006	5-8 wet diapers and 3-4 stools per day by 5-7 days old	Holt et al 2011
Breastfed infants 6 weeks and older may have stools as infrequently as every 3 days	6	22	2	Story et al, 2002	Same information	Holt et al 2011
Psycho-social issues with breastfeeding	6	23	2	Story et al, 2002	Same information	Holt et al 2011
Constructive plan of care by identifying mother's strengths and the resources that are available to her.	6	23	2	IOM, 1992	Same information	Holt et al 2011; IOM, 1992
Interview questions for parents of young infants	6	23	2	Bright Future in Practice: Nutrition	Updated from Bright Futures ed 3	Holt et al 2011
Nutrition Counseling Messages for Parents of Young Infants	6	24	2	Bright Future in Practice: Nutrition	Updated from Bright Futures ed 3	Holt et al 2011
Nutrition Questionnaire for Infants	6	25	2	Bright Future in Practice: Nutrition	Updated from Bright Futures ed 3	Holt et al 2011
Summary of developmental stages related to feeding	6	18	2	Bright Future in Practice: Nutrition	Not in Bright Futures 3 ed, adapting chart from Akers and Groh-Wargo	Akers and Groh-Wargo, 2012
Add DRI table to written material	6	5	3		Chart created in module	IOM 2011 (DRI for Calcium and Vitamin D), IOM 2006 (DRI: The Essential Guide to Nutrient Requirements)
Recommendation for the oral supplementation of Vitamin D	6	8	3	AAP	Recommend breastfed infants receive 400 IU daily beginning with hospital discharge, or shortly after birth and continuing throughout breastfeeding.	Holt et al, 2011; AAP 2012
Add Baby Friendly Hospital Initiatives/Requirements instead of GAO on formula advertising	6	14	3		Added	
Add food safety for breastmilk	6	19	3		Added	Holt et al, 2011

Module 6 - Evidence Analysis

Author, Year, Study Design, Class, Rating	Research Question	Results	Bias or Limitation
Ziegler 2011	What mechanisms contribute to iron deficiency in infants and toddlers consuming cows milk?	The main contributor is thought to be the low iron content of cow's milk leading to a diet deficient in iron.	Most of the studies have been conducted in the US or UK, but all are from Euro centric countries.
Study Design: Review		Occult intestinal blood loss contributes to iron deficiency due to increased iron losses, and inhibiting iron absorption from the diet.	Does not take into account differences in fortification of milk across countries.
Class: R			
Rating: Neutral			

Module 7 - MNT for Specific Conditions - Infants

Data/Fact	Module	Page	Read #	Current Citation	Updated Data	New Citation
Update websites throughout	7	Many	1			
Remove hanging line "More information about nutrition and children with special health care needs" random insert not needed	7	7	1	N/A		
Eggs breastfeeding mothers should avoid albumin, surumi, lethicin	7	19	1		Correct, confirmed in Pediatric Nutrition	N/A
Definition of children with special health care needs	7	4	2	McPherson et al, 1998	Remains the same, still used by the Association of maternal and Child Health Programs as the definition	N/A
Prevalence of nutrition risk factors and criteria for referral to nutrition services	7	4	2	Bayerl, 1993	A screening project of infants and young children with developmental delays in the Massachusetts early head Start Program found that 92% of the infants and children had at least one nutrition risk factor, and 67% met more than one of the criteria for referral to nutrition services. Nutrition reports of children with special health care needs estimate that 40-50% have nutrition risk factors that warrant a referral to a registered dietitian.	Holt et al, 2011
Screening parameters and criteria for referral for children and adolescents with special health needs	7	4	2	Bright Futures, 2002	Updated in notebook	Holt et al, 2011
interactions that affect feeding, growth and development for the premature infant	7	8	2	Zerzan, 2005	Same information	Zerzan and Chabra, 2017
Goals of nutrition assessment for the premature infant	7	9	2	Zerzan, 2005	Same information	Zerzan and Chabra, 2017
Iron supplementation for preterm infants 2-4 mg/kg/day from with supplement or from infant formula with iron	7	10	2	AAP, 1999	Iron supplementation for preterm infants 2-4 mg/kg/day from with oral supplementation or from infant formula with iron	AAP, 2010
Use of post-discharge formulas and the contraindication of soy formulas for preterm infants	7	10	2	Zerzan, 2005	Post-discharge formulas have not consistently demonstrated growth and developmental benefits and there is not sufficient evidence to support routine use of these products. Soy based formulas are still not indicated due to the decreased bioavailability of protein, calcium and phosphorous when compared to cow's milk based formula.	Zerzan and Chabra, 2017
Development of child-caregiver interactions	7	14	2	Arvedson, 1997		

Module 7 - MNT for Specific Conditions - Infants

Observational scales for parent-child interactions, NCAST Feeding Scale	7	15	2	Chatoor, 1997	Inclusion of the parent-child Play Scale for use in conjunction with the parent-child Feeding Scale. Determining dysfunctional play with dysfunction feeding indicates more pervasive adaptive interactional patterns.	Chatoor 2018, DEVELOPMENT OF THE PARENT-CHILD PLAY SCALE FOR USE IN CHILDREN WITH FEEDING DISORDERS
Upper limit of 30-35 mOsm/100kcal for potential renal solute load to decrease an infant's risk of hypertonic dehydration	7	16	2	Fomon and Ziegler, 1999	No updates in the literature	Same
Risks associated with concentrated or fortified feedings	7	16	2	Selecting and Concentrating infant formula: guidelines for healthcare professionals, 2005 Oregon PDPG	Emailed Beth for help	
Appropriateness of soy formulas for cow's milk intolerance	7	19	2	AAP, 1998	10-14% of infants with IgE mediated allergy to cow's milk protein do not tolerate soy formulas either	AAP, 2008
Common food allergies among children and what breastfeeding mothers should avoid/infant formulas that are appropriate or not appropriate	7	18	2	AAP, 1998; Koerner and Hays, 1999	Add peanuts and seafood/shellfish	Christie 2012
Requirements for labeling of ingredients by allergens on the ingredient list, use the word contains, or clarify technical terms	7	20	2	The Food Allergen Labeling and Consumer Protection Act of 2004	No new law	N/A
Nursing mother's of at-risk infants eliminate peanuts and tree nuts from diets, and consider eliminating cow's milk and fish	7	20	2	Butte, 2004; AAP 2000	Insufficient evidence to recommend nursing mothers of at-risk infants eliminate any potential allergens from their diet.	AAP, 2008
Maternal elimination diets are not effective in preventing allergies	7	21	2	Palmer, 2006	Insufficient evidence that elimination diets are effective.	AAP, 2008
Delay introducing solid foods until 6 months old and slower progression for high-risk infants	7	21	3		No convincing evidence that delaying introduction beyond the 4-6 months recommendation has a significant protective effect on the development of atopic disease	AAP, 2008
Foods that are most allergenic should be delayed cow's milk until at least 1 year of age; eggs until 2 years; and peanuts, other nuts, fish and shellfish until 3 years of age	7	21	3		Insufficient evidence to suggest delaying highly allergic foods (cow's milk, fish, eggs, and peanut-containing foods) beyond 6 months of age. Guidelines for the introduction of peanuts have been formalized based on the result from the Learning Early About Peanut (LEAP) Study. Cow's milk should still be delayed to one year of age due to its low iron content.	AAP, 2008; DiMaggio, 2017
Continuum of infant feeding responses	7	22	2	Mentore et al, 2002		Hodges 2013, Hodges 2016

Module 7 - MNT for Specific Conditions - Infants

Add a read more about for types of infant feeding disorders					Feeding disorders of state regulation; Feeding disorder of caregiver-infant reciprocity; Infantile anorexia	DSM V
Collaboration between providers and in-home visits are more effective than conventional "clinic-based" interventions.	7	17	2	Wright, 1998	No updates in the literature	

Module 7 - Evidence Analysis

Author, Year, Study Design, Class, Rating	Research Question	Results	Bias or Limitation
Hodges 2013	Development and initial psychometric evaluation of caregiver responsiveness to child hunger and fullness cues during the first 2 years of life.	Mothers who were responsive to the child during feeding had children that were more responsive to their mothers.	All dyads were mother-child, no fathers included
Study Design: Diagnostic, Validity or Reliability Study		75% of mothers were responsive or highly responsive to hunger cues, 45% of mothers were just as responsive to fullness cues.	Age of the children varied from 7-24 months. Grouped 7-11 month olds and 12-24 month olds. Large variety in child behaviors in those ages.
Class: C		Children that were more responsive to their mothers during feeding tended to have mothers that were older, had higher education and income.	
Rating: Neutral			
Hodges 2016	Characterization of the development of feeding cues during infancy and toddlerhood.	Early receptiveness cues were the most rare of feeding cues. Active receptiveness cues were much more common comparatively.	Participants consisted only of low-income, non-hispanic black first time mothers, limiting generalizability.
Study Design: Prospective cohort		Feeding and fullness cues changed based on age and the transition from breast milk/formula to complementary foods.	Typically developing infants.
Class: B		Late fullness cues were observed the least.	Low breastfeeding rate among dyads, would expect different patterns of cues for dyads that were exclusively breastfeeding or breastfed for a longer duration
Rating: Neutral			Participants were aware of being observed which could also change the behaviors of the mothers.

First Steps Nutrition Modules

Module 2 – Nutrition and Normal Pregnancy

Introduction

Nutrition status plays an important role in pregnancy outcome. Intakes of specific nutrients, for example iron and folate, affect pregnancy outcome (e.g., birthweight, maternal and infant anemia, maternal hypertension). Energy intake, and thus, the amount of weight a woman gains during pregnancy has a direct effect on pregnancy outcome (for example, low gestational weight gain can increase the risk of having an infant with a low birth weight) and on the long-term health of the mother (for example, excessive weight gain can increase the risk of obesity in the mother).

Especially for weight gain, there is wide variation in the “normal” range, and the nutrition assessment should include an evaluation of factors that are specific to the individual.

This module reviews some of the roles that food and nutritional status play in typical pregnancies, and highlights a few specific factors that can affect nutrient needs.

Estimated time to complete this module: 60 minutes.

Learning objectives

Participants will be able to:

- Describe basic nutrient needs during normal pregnancy
- Identify general risk factors during pregnancy and describe the potential complications and nutritional implications associated with each

Outline

- I. INTRODUCTION
- II. GENERAL
 - a. Pre-pregnancy nutritional status
 - b. Physiologic changes during pregnancy
 - c. Birthweight
- III. NUTRIENT NEEDS DURING PREGNANCY
 - a. Energy
 - b. Protein
 - c. Fat
 - d. Carbohydrate
 - e. Minerals
 - f. Vitamins
- IV. DIET- AND FOOD-RELATED CONCERNS
 - a. Foodborne illness
 - b. Special recommendations around fish
 - c. Vitamin A: liver and cod liver oil
 - d. Alcohol
 - e. Caffeine
 - f. Artificial sweeteners
 - g. Other issues
- V. ISSUES FOR SPECIFIC GROUPS
 - a. Vegetarians/vegans
 - b. Adolescents
 - c. Overweight
 - d. Multiparous
 - e. Dieting
- VI. CASE EXAMPLE
- VII. REFERENCES AND RESOURCES
- VIII. QUIZ

General

Pre-pregnancy nutritional status

Pre-pregnancy nutritional status has effects on pregnancy outcomes.

Weight

One of the most obvious indicators of nutritional status is weight. Pre-pregnancy weight affects the amount and rate of recommended weight gain during pregnancy. Pre-pregnancy weight-related risk factors include the following:

Underweight pre-pregnancy increases the risk of:

- low birthweight
- premature delivery

Both of these can raise other risks for the infant, including long-term growth and cognitive deficits, pulmonary disease, diabetes, and heart disease.

Overweight pre-pregnancy increases the risk of:

- gestational diabetes
- pregnancy-induced hypertension
- congenital defects
- abnormal labor (induced labor, need for caesarian section)
- macrosomia, which can lead to lower Apgar scores, and places the infant at an increased risk for childhood obesity
- long-term maternal obesity

Nutritional Status

Pre-pregnancy nutritional status can also affect a pregnancy and birth outcome. Pre- and peri-conceptual folate status has a critical role in the prevention of neural tube defects such as spina bifida and anencephaly. Since the fortification of many grains in the US with folic acid, the incidence of neural tube defects has decreased 28%. (Williams et al, 2015) Healthy People 2020 goals include increasing the proportion of women of childbearing potential with an intake of at least 400µg of folic acid from fortified foods or dietary supplements from 22.8% (2007-2010 proportion) to 26.2%.

Other issues related to nutritional status prior to or early in pregnancy include recommendations around alcohol, drugs, caffeine, tobacco, and vitamin A. These are covered later in this module.

Read more: "Developmental origins of health and disease" hypothesis.

The "developmental origins of health and disease" model (also called "fetal origins of adult disease" hypothesis or "developmental origins of adult disease" hypothesis) postulates links between fetal growth, intrauterine exposures, and the development of other diseases in adult life, including hypertension, type 2 diabetes, obesity, osteoporosis, depression and schizophrenia. (Gluckman et al, 2005). According to this

hypothesis, stressors (including malnutrition, overnutrition, and glycemic variance related to gestational diabetes mellitus) at critical periods of development lead to “fetal programming,” or permanent metabolic and structural changes. One mechanism proposed for this “fetal programming” is epigenetic modifications to the underlying genes that impact phenotype without a change in genotype. (Bianco-Miotto et al, 2017)

It is now widely accepted that the intrauterine environment influences fetal development and has long-lasting effects on health and disease. Infants that are exposed to stressors in utero are predisposed to develop noncommunicable diseases later in life and expose the next generation to similar stressors creating a cycle that contributes to the spread of metabolic diseases worldwide. (El Hajj et al, 2014)

Read more: Avoidance diets for prevention of allergy

The literature around avoidance diets during pregnancy to prevent allergy is controversial. If there is a strong family history of atopic disease, then some suggest that it may be advisable to avoid peanuts or foods containing peanuts during pregnancy. Avoidance of other foods (especially entire food groups, for example milk) is controversial, since this may have a significant impact on a woman’s nutritional status.

The AAP rescinded its previous recommendation for women to avoid peanuts during pregnancy, and lactating mothers of high risk infants to avoid peanuts and tree nuts, and to consider avoiding eggs, cow milk, and fish while nursing based on inconclusive evidence. (AAP, 2008)

A recent Cochrane Review found that the evidence does not support the use of avoidance diets. In fact, in one study, women who avoided milk, eggs, and other foods gained less weight than other women. ([Kramer and Kakuma, 2012](#))

Physiologic Changes During Pregnancy

Maternal weight gain during pregnancy varies depending, in part, on the individual’s pre-pregnancy weight and nutritional status. The average weight gain during normal pregnancy is estimated to be 25-35 pounds (11-16 kg). The components of this weight gain include increases in fluid volume, maternal fat stores and breast tissue, placenta, and fetus. (See Figure below)

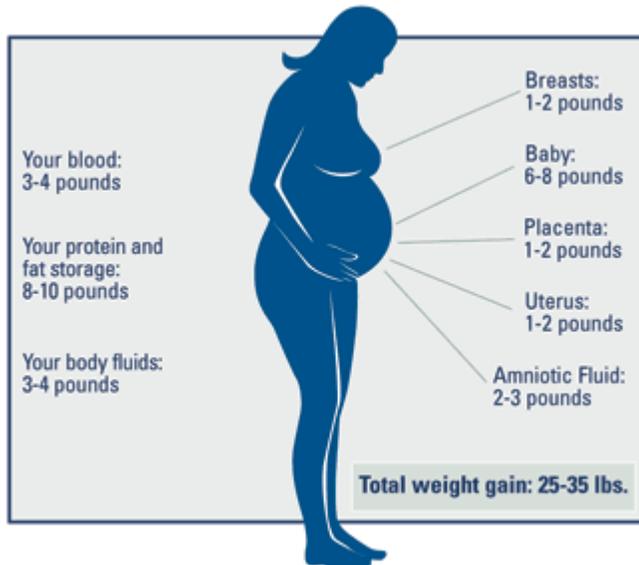


Figure 2-1: Components of weight gain during pregnancy

Nutrient metabolism is affected by hormonal changes. Changes in carbohydrate, fat, and protein metabolism make glucose constantly available to the fetus, while preserving maternal lean body mass. Absorption of calcium and iron increases, and excretion of other nutrients (e.g., riboflavin and taurine) decreases.

Every system is affected by pregnancy. Two systems with direct nutrition-related implications are discussed briefly below:

Vascular

Increase in:

- Plasma volume – up to 50% starting early in pregnancy
- Red cell mass and capacity for oxygen transport
- Concentrations of some fat-soluble vitamins, carrier protein, and lipid fractions (triglycerides, cholesterol, free fatty acids) because of enhanced hepatic triglyceride synthesis and decreased catabolism of adipose tissue (Cox and Carney, 2017)

Decrease in:

- Amino acids, minerals, water soluble vitamins because of the increased plasma volume, concentrations of hemoglobin, albumin. This is a normal physiologic change, and generally not indicative of altered nutritional status. (Cox and Carney, 2017)

Gastrointestinal

Increased progesterone levels decrease GI motility and increase reabsorption of water; this contributes to problems with constipation. Relaxation of the lower esophageal sphincter occurs; combined with pressure on the stomach from the growing uterus, reflux can be a result.

Birth Outcomes, Birthweight and Maternal Weight Gain

The World Health Organization (WHO) Collaborative Study on Maternal Anthropometry and Pregnancy Outcomes examined data from more than 100,000 births from 20 countries to identify factors that were associated with poor outcomes (low birth weight, macrosomia, prematurity, and pre-eclampsia). Birthweights between 6.8 and 8 lbs (3.1 and 3.6 kg) were associated with optimal outcomes for mother and baby. The maternal weight gain associated with this birthweight was 22-30 lb (14-15 kg). (WHO, 1995)

This amount of weight gain is consistent with the Institute of Medicine's 1990 recommendations, which include the influence of pre-pregnancy body weight. Since this study was conducted, the weight gain recommendations during pregnancy have been reexamined and new guidelines were released in 2009. These recommendations are discussed in more detail in Module 3, Nutrition Assessment.

- Infants with low birthweights (less than 5.5 lb or 2.5 kg) are at increased risk for morbidity/mortality in the neonatal period, deficits in later growth and cognitive development, pulmonary disease, diabetes, and heart disease.
- Macrosomia (birthweight greater than 10 lb or 4.5 kg) has been associated with obstetric complications, birth trauma, and higher rates of neonatal morbidity/mortality.

KNOWLEDGE CHECK

What is a typical outcome of altered gastrointestinal tract function during pregnancy?
How might you address this with a patient?

Answer: Constipation, increase water consumption and fiber, physical movement following meals. Reflux, space meals apart, avoid foods and beverages that trigger reflux, stay upright for at least an hour after a meal, physical activity

Nutrient Needs During Pregnancy

During pregnancy, nutrient utilization and absorption is more efficient. Thus, for some nutrients (e.g., calcium), increased intake is not necessary. Even so, some nutrients are needed in higher amounts and supplementation is encouraged by most physicians, either separately (e.g., folate and iron) or as a prenatal multiple vitamin with minerals. (ACOG, 2018)

Guidelines for intake, based on Institute of Medicine recommendations and the Dietary Reference Intakes (DRI) are reviewed below and summarized in a [table](#) at the end of this module.

Practical guidelines for overall intake (including recommended portion sizes and number of servings) are included in a [table](#).

Energy

Energy needs increase during pregnancy for a number of reasons:

- Increased basal metabolic rate due to the metabolic contribution of the uterus and fetus, and the increased work of the heart and lungs
- Products of conception, which include the fetus, placenta and amniotic fluid
- Accretion of maternal tissues, including the uterus, breasts, blood, extracellular fluid, and adipose tissue

This increased energy requirement is not evenly distributed throughout pregnancy. The 2002 Dietary Reference Intakes include guidelines for energy intakes for pregnant women by trimester. For well-nourished women ages 19-50 years the energy needs are listed below:

- 1st trimester - no increase in energy needs
- 2nd trimester - additional 340 kcal per day
- 3rd trimester - additional 452 kcal per day

Note: Energy intakes that promote weight gain in the desired range vary widely because of individual differences in energy expenditure and basal metabolic rate.

Protein

Protein needs **increase** during pregnancy. During the first half of pregnancy, protein requirements remain the same, 0.8 g/kg/day. Over the second half of pregnancy, the protein needs increase to 1.1 g/kg/day. For each additional fetus, the protein requirements increase by at least 25 g/day. (Cox and Carney, 2017) Over the course of a pregnancy, it is estimated that an additional 925 grams of protein (1.1 g/kg/day) is needed for the fetus, uterus, expanded maternal blood volume, placenta, extracellular fluid, amniotic fluid and

to maintain new tissue. (FAO/WHO, 2005) More recent studies in developed countries, however, indicate that protein needs may be less than this.

Fat

The essential fatty acids linoleic (18:2 n-6) and alpha-linolenic acid (18:3 n-3) needs **are the same** for women who are pregnant as those who are not pregnant. However, some experts recommend at least 200 mg/day of docosahexaenoic acid (DHA). (AND, 2014) These fatty acids are important components of cell membranes and essential to the formation of new tissue. Food sources of linoleic and alpha-linolenic acids are primarily vegetable oils, including soybean, safflower, and canola oils.

Read more: What about DHA supplementation?

Supplementation with n-3 fatty acids during pregnancy (particularly docosahexaenoic acid) has received considerable attention recently.

To date, there is no general consensus that maternal supplementation with n-6 and n-3 fatty acids has any beneficial effects to the infant. Various studies have shown an increase in gestation (about 4 days) for women who received supplemental n-3 fatty acids from fish oil, and an improvement in infant visual and cognitive development. Associations have also been identified between n-3 fatty acids, serotonin transporter genotype, and postpartum depression, indicating supplementation could decrease the risk of postpartum depression. (Shapiro et al, 2012, Jensen 2006; Szajewska et al, 2006)

However, there is not enough evidence to determine that n-3 fatty acid requirements are increased during pregnancy and an increase in n-3 fatty acid consumption may contribute to increased methylmercury intake. Thus, the recommended intake level for essential fatty acids is the same for pregnant women and non-pregnant women. In the US, essential fatty acid deficiency is very rare. (IOM, 2002)

DHA is primarily found in fish and other animal products. It can also be synthesized from alpha linolenic acid; flaxseed, canola, and soybean oils are high in alpha linolenic acid.

Carbohydrate

In the US, recommendations for **carbohydrate** intake during pregnancy were developed in order to assure that glucose is provided to the fetal brain and to prevent the formation of ketoacids by the mother. Thus, the RDA for dietary carbohydrate is **slightly higher** (175 g/day) than the RDA for non-pregnant women.

The amount of **fiber** recommended for individuals by the 2002 DRIs is **the same** (28 grams per day) for pregnant and non-pregnant women. It is worth noting, however, while pregnancy does not increase an individual's need for fiber, most people do not consume this amount of fiber, so an individual's intake may need to be increased.

Read more: What does 175 g carbohydrate per day look like?

It's not difficult to fit 175 grams carbohydrate into a food pattern. Take a look:

This food pattern provides approximately 2400 calories, 300 grams carbohydrate, 110 grams protein, 1320 mg calcium, and 20 mg iron

<i>Breakfast</i>	<i>1 large whole grain bagel 2 Tablespoons cream cheese 1 banana 8 ounces milk</i>
<i>Snack</i>	<i>1 ½ ounces cheddar cheese 10 crackers</i>
<i>Lunch</i>	<i>¼ cup chicken salad 2 cups green salad 2 Tablespoons Italian salad dressing 1 roll with 1 Tablespoon butter</i>
<i>Snack</i>	<i>1 apple 8 ounces yogurt</i>
<i>Dinner</i>	<i>½ cup rice 4 ounces lean beef 1 cup stir-fried vegetables ½ cup peaches ½ cup vanilla ice cream</i>

Minerals

For the most part, requirements for minerals during pregnancy are not different from requirements for non-pregnant women of the same age. However, it is still important to evaluate whether or not an individual's intake meets recommendations. Some common minerals to keep in mind with pregnant women are listed below.

Calcium

Most calcium is laid down during last trimester. Although this amount of calcium is significant (approximately 25-30 grams), it seems that maternal calcium needs **do not increase**. Instead, physiologic changes occur, making intestinal calcium absorption more efficient.

During pregnancy some women may not drink milk due to lactose intolerance, so reviewing calcium sources that are not milk-based is important. Other women may simply not have adequate calcium intakes and may need information about milk- and non-milk-based calcium sources. If a woman is still not able to consume enough calcium from food sources then a supplement may be needed.

Calcium supplementation has been suggested as a treatment for pregnancy-induced hypertension. This is discussed in Module 4.

Magnesium

The RDA for magnesium during pregnancy is set at an **additional** 35 mg per day.

Iron

Iron requirements **are increased** during pregnancy, to support the growing fetus and placenta and also to support increased maternal red blood cells. Iron absorption is increased during pregnancy and maternal stores are mobilized. Anemia during pregnancy can increase the risk of low birthweight and of iron deficiency in the infant.

Iron needs increase in the second, and again in the third trimester. The DRIs for iron for pregnant women are based on estimated needs during the third trimester of pregnancy, in order to build iron stores during the first trimester.

Iron intakes in the US are generally below recommendations, so in many cases, supplementation is necessary during pregnancy. There are some compliance issues around iron supplements during pregnancy. Some women have noted constipation and/or nausea when taking supplements. Dietitians should keep this in mind when talking to clients. Usually taking iron with a meal can help decrease the nausea and trying other ways such as walking and increasing fluids to help with the constipation. Other suggestions for women who have difficulty taking vitamins include splitting the supplement (e.g., half in the morning and half in the evening) and using a children's chewable vitamin with iron.

One safety issue to note is that iron supplements contribute to a leading cause of poisoning deaths in US children under 6 years of age; children ingest their mother's iron tablets because they look like candy.

Read more: Anemia

Anemia during pregnancy can increase the risk of hypertension in the mother and poor pregnancy outcome, and low birthweight and of iron deficiency in the infant during the first year of life. Severe maternal iron deficiency compromises fetal iron status. This may affect the infant's development, including socio-emotional behavior, recognition memory, later IQ, motor skills, and interactions with others. (Kaiser, 2002; Georgieff and Innis, 2005; Lozoff et al, 2006; Georgieff, 2011)

Vitamins

For the most part, requirements for vitamins during pregnancy are **not different** from requirements for non-pregnant women of the same age. It is still important to evaluate whether or not an individual's intake meets recommendations, however. Some key vitamins are discussed below.

Vitamin A

Vitamin A is needed for growth and maintenance of the fetus, fetal stores, maternal tissue growth. The RDA for vitamin A during pregnancy is **slightly higher** than the RDA for non-pregnant women.

Preformed vitamin A in excessive amounts can be teratogenic. During the first trimester, toxicity is associated with central nervous system abnormalities, craniofacial malformations, and cardiac defects. The 2000 DRIs set an upper limit for preformed vitamin A (including during pregnancy): 2800 µg per day for 14-18 year olds and 3000 µg per day for 19-50 year olds.

Folate

In addition to folate early in pregnancy, related to prevention of some neural tube defects, folate is needed throughout pregnancy to prevent megaloblastic anemia.

A fortification policy implemented by the US Food and Drug Administration in 1998 mandated that enriched grain products be fortified with folic acid. It was expected that this would increase individuals' folic acid intakes by about 100 µg per day, with 50% of women of childbearing age receiving at least 400 µg per day. A recent study indicates that although folic acid intakes of women of childbearing age have increased since 1998, only 22.8% (2007-2010) are reaching the 400 µg goal. (Healthy People 2020) In addition, the recommended intake level for women was increased to 600 µg per day in 1998. (IOM 1998)

Vitamin B12

Maternal intake of vitamin B12 seems to have more of an influence on fetal B12 concentrations than maternal stores of the vitamin. The RDA for B12 during pregnancy is **increased** above recommendations for women who are not pregnant.

Vitamin D

The recommended intake for vitamin D during pregnancy is **not increased** over that for non-pregnant women. Women who receive regular exposure to sunlight do not need vitamin D supplementation, but those who are at high latitudes during winter months (such as those in Washington State) may be at risk for vitamin D deficiency. The IOM does suggest that an intake of 15 µg (600 IU)/day (the amount supplied by many prenatal vitamin supplements), would not be excessive. Primary food sources for vitamin D are eggs, meat, oily fish, and fortified milk and dairy products.

Table: Recommended nutrient intake levels

Intake Recommendations for Selected Nutrients During Pregnancy

Nutrient	Recommended intake during pregnancy	Change from non-pregnancy recommendations?	Comments
Energy	1st trimester - no increase 2nd trimester - additional 340 kcal per day	Increased during 2nd and 3rd trimesters	Example

	<i>3rd trimester - additional 452 kcal per day</i>		
<i>Protein</i>	<i>All age groups: 1.1 g protein per kilogram per day or + 25</i>	<i>Increased by 0.27 g per kg body weight</i>	<i>Example</i>
<i>Carbohydrate</i>	<i>All age groups: 175 g per day</i>	<i>Increased slightly</i>	<i>Fiber recommendation is not changed during pregnancy (28 g per day)</i>
<i>Calcium</i>	<i>14-18 years – 1300 mg per day</i> <i>19-30 years – 1000 mg per day</i> <i>31-50 years – 1000 mg per day</i>	<i>No change</i>	<i>Food sources</i>
<i>Vitamin D</i>	<i>All age groups: 15 mcg or 600 IU per day</i>	<i>No change</i>	<i>Food sources</i>
<i>Magnesium</i>	<i>14-18 years – 400 mg per day</i> <i>19-30 years – 350 mg per day</i> <i>31-50 years – 360 mg per day</i>	<i>Increased</i>	<i>Food sources</i>
<i>Iron</i>	<i>All age groups: 27 mg per day</i>	<i>Increased</i>	<i>Food sources</i>
<i>Vitamin A</i>	<i>14-18 years – 750 µg RAE per day</i> <i>19-30 years – 770 µg RAE per day</i> <i>31-50 years – 360 µg RAE per day</i>	<i>Increased slightly</i>	<i>Food sources</i>
<i>Thiamin</i>	<i>All age groups: 1.4 mg per day</i>	<i>Increased</i>	
<i>Riboflavin</i>	<i>1.6 mg per day</i>	<i>Increased</i>	
<i>Folate</i>	<i>All age groups: 600 µg per day</i>	<i>Increased</i>	<i>Food sources</i>
<i>Vitamin B12</i>	<i>All age groups: 2.6 mg per day</i>	<i>Increased</i>	

KNOWLEDGE CHECK

For a pregnant woman that has not been taking a prenatal vitamin and mineral, would you be concerned about adequate intake of any vitamins and minerals? If so which ones?

Answer: For a woman that has a well rounded diet and was meeting all of her needs prior to pregnancy, most would not be concerned about any deficiencies and inadequate intakes. However for a woman that might not have met her vitamin and mineral recommendations prior to pregnancy, iron, folate and vitamin D may be of concern.

Diet- and Food-Related Concerns

Foodborne Illness

Foodborne illness can have more significant implications for pregnant women than for non-pregnant women; in some cases, foodborne illness can lead to miscarriage. Some foodborne illnesses that have been associated with risks during pregnancy are reviewed below, along with recommendations for prevention.

Listeriosis, caused by the bacteria *Listeria monocytogenes* can cause miscarriage, premature birth, severe illness or death in the newborn. Pregnant women are advised to avoid foods which have been found to have the bacteria. These foods include pate, soft, mold-ripened cheese (e.g., Brie, Camembert, queso blanco, fresco), unpasteurized milk products, processed meats such as deli and lunch meats and hot dogs, and salads made in a store such as ham salad, chicken salad, egg salad, or tuna salad.

Listeria can grow in the refrigerator. Cleaning the refrigerator after spills, especially from raw meat and poultry, with hot, soapy water, and washing hands for 20 seconds with soap and water after touching hot dogs, raw meat, poultry or seafood may help prevent infection.

The bacteria are heat-sensitive, so guidelines call for reheating meats and cheeses (especially hot dogs, luncheon meats, refrigerated smoked seafood, cheeses, and deli meats) until they are steaming hot and washing raw vegetables and fruits well.

Symptoms of Listeriosis include fever, fatigue, chills, aches, upset stomach, abdominal pain and diarrhea and may appear two to six weeks after ingestion. (USDA, 2017)

Salmonellosis may cause miscarriage or premature labor. The bacteria that cause salmonellosis, salmonella, are most often found in raw eggs and undercooked poultry. Prevention guidelines include thorough cooking of foods, especially those with eggs and poultry, and avoidance of foods which contain raw eggs (e.g., raw cookie dough and homemade mayonnaise). (USDA, 2013)

Toxoplasmosis is caused by *Toxoplasma gondii*. The most common foods that contain *Toxoplasma gondii* are raw/undercooked meat and unpasteurized milk (especially goat's

milk). Pregnant women should also avoid contact with soil or cat litter trays, which often contain the bacteria. Women that are infected with *Toxoplasma* may pass the infection on to their child. Most infected infants will not have symptoms at birth but may develop symptoms later in life such as blindness or mental disability. Treatment is available during pregnancy, however both the mother and baby should be monitored closely. (CDC, 2018)

Campylobacter has been associated with premature birth, spontaneous abortion, and stillbirths. It is sometimes found in poultry, untreated water, domestic pets, soil, and unpasteurized milk.

Women from some cultures are at higher risk for foodborne illness because they use unpasteurized milk, make their own soft cheeses, etc. (e.g., women from Latino or other Hispanic cultures)

Overall:

- No unpasteurized milk
- No soft cheese (unless made with pasteurized milk)
- Cook all meats and eggs thoroughly
- Cook any deli and lunch meats/hot dogs
- Wash hands

Resources related to foodborne illness:

- <http://extension.colostate.edu/docs/pubs/foodnut/09372.pdf>
- <https://www.foodsafety.gov/risk/pregnant/index.html>
- <https://www.foodinsight.org/sites/default/files/Healthy%20Eating%20FINAL%20Web.pdf>
- <https://www.cdc.gov/parasites/women.html>

Special Recommendations Around Fish

To prevent problems associated with methylmercury, the FDA and USDA advise pregnant women to

Best Choices EAT 2 TO 3 SERVINGS A WEEK			OR	Good Choices EAT 1 SERVING A WEEK		
Anchovy	Herring	Scallop	Bluefish	Monkfish	Tilefish (Atlantic Ocean)	
Atlantic croaker	Lobster, American and spiny	Shad	Buffalofish	Rockfish	Tuna, albacore/white tuna, canned and fresh/frozen	
Atlantic mackerel	Mullet	Shrimp	Carp	Sablefish	Tuna, yellowfin	
Black sea bass	Oyster	Skate	Chilean sea bass/Patagonian toothfish	Sheepshead	Weakfish/seatrout	
Butterfish	Pacific chub mackerel	Smelt	Grouper	Snapper	White croaker/Pacific croaker	
Catfish	Perch, freshwater and ocean	Sole	Hallbut	Spanish mackerel		
Clam	Pickrel	Squid	Mahi mahi/dolphinfish	Striped bass (ocean)		
Cod	Plaice	Tilapia				
Crab	Pollock	Trout, freshwater				
Crawfish	Salmon	Tuna, canned light (includes skipjack)				
Flounder	Sardine	Whitefish				
Haddock		Whiting				
Hake						
Choices to Avoid HIGHEST MERCURY LEVELS						
			King mackerel	Shark	Tilefish (Gulf of Mexico)	
			Marlin	Swordfish	Tuna, bigeye	
			Orange roughy			

*Some fish caught by family and friends, such as larger carp, catfish, trout and perch, are more likely to have fish advisories due to mercury or other contaminants. State advisories will tell you how often you can safely eat those fish.

www.FDA.gov/fishadvice www.EPA.gov/fishadvice EPA United States Environmental Protection Agency FDA U.S. FOOD & DRUG ADMINISTRATION

THIS ADVICE REFERS TO FISH AND SHELLFISH COLLECTIVELY AS "FISH." / ADVICE UPDATED JANUARY 2017

Resources:

- <https://www.fda.gov/downloads/Food/FoodborneIllnessContaminants/Metals/UCM537120.pdf>
- <https://www.fda.gov/ForConsumers/ConsumerUpdates/ucm397443.htm>
- <https://www.doh.wa.gov/CommunityandEnvironment/Food/Fish/MercuryAdvisories> - Washington State Fish Advisory for Mercury
- <https://www.doh.wa.gov/CommunityandEnvironment/Food/Fish/HealthyFishGuide> - Healthy Fish Guide
- <https://www.doh.wa.gov/CommunityandEnvironment/Food/Fish/HealthBenefits> - Health Benefits of Fish

Vitamin A: Liver and cod liver oil

To prevent teratogenic effects of high doses of preformed vitamin A (retinol), pregnant women are advised to limit intake of foods that contain large amounts of retinol. These foods include liver and liver products and cod liver oil. The critical period appears to be during the first trimester.

Alcohol

Women who are pregnant should not drink alcoholic beverages, since no safe amount of alcohol has been identified. Alcohol can increase the risk of having an infant with physical, behavioral and cognitive deficits, called Fetal Alcohol Spectrum Disorders (FASD). These include:

- Fetal alcohol syndrome (FAS)
- Fetal alcohol effects (FAE) and possible FAE (PFAE)
- Alcohol-related neurodevelopmental disorder (ARND)
- Alcohol-related birth defects (ARBD)

A discussion about the nutrition-related implications of alcohol use during pregnancy is included in Module 4, MNT for Specific Conditions.

Read more: Fetal Alcohol Syndrome Disorders

Fetal alcohol spectrum disorders (FASDs) include fetal alcohol syndrome (FAS), alcohol-related neurodevelopmental disorder (ARND), and alcohol-related birth defects (ARBD). (The terms ARND and ARBD replaced Fetal Alcohol Effects - FAE - in 1996.) They are caused by prenatal alcohol exposure and may affect 2-5% of the US and Western European population. (CDC, 2018) Infants and children with FASDs might exhibit some of the following characteristics:

- *Small size or short stature (compared to peers or for gestational age)*
- *Facial anomalies (e.g., thin upper lip, short palprebral fissures, longiltrum, epicanthal folds)*
- *Microcephaly*
- *Central nervous system abnormalities*
- *Cardiac defects*
- *Cognitive and behavioral problems (e.g., similar to attention-deficit/hyperactivity disorder, learning disabilities, developmental disabilities, mental retardation)*
- *Sleep and sucking disturbances in infancy*

For more information about FASDs, visit these websites:

- *<http://depts.washington.edu/fasdpr/>*
- *<http://depts.washington.edu/fasdwa/>*
- *<http://www.cdc.gov/ncbddd/fasd/>*

Caffeine

There is an association between high maternal intake of caffeine and increased risk of low birthweight and spontaneous abortion, however there are no definitive data about the amount of caffeine associated with these risks. (Doepker et al, 2016; Li et al, 2015) Although no consensus has been reached, some guidelines suggest that pregnant women limit caffeine intake to 200 mg per day. Another concern is that women who drink large amounts of caffeine from beverages like soda, will fill up on these beverages with low nutrient density and have less room for other nutrient dense foods. Concerns about hydration status with excessive amounts of caffeine have also been raised.

Read more: Caffeine content of commonly consumed beverages

- *135 mg per 8 oz cup drip or percolated coffee*
- *96 mg per 8 oz cup instant coffee*
- *40 mg per 1 oz espresso*
- *48 mg per 8 oz cup leaf/bag tea*
- *36 mg per 12 oz cola beverage*

Artificial Sweeteners

The use of artificial sweeteners during pregnancy receives much attention in the lay press. To date, no studies have been published that link use of artificial sweeteners with adverse pregnancy outcomes.

Read more: use of artificial sweeteners

Saccharin crosses the placenta and appears in breastmilk, but there have been no studies documenting adverse effects on the fetus or infant.

Acesulfame-K crosses the placenta and appears in breastmilk, but there have been no studies documenting adverse effects on the fetus or infant.

Sucralose has not been found to be teratogenic in high doses in animals; there have been no studies of sucralose in breastmilk or during lactation.

Aspartame appears to be safe in pregnancy and lactation. (One of the metabolites of aspartame is phenylalanine, so use of aspartame is not appropriate for individuals with phenylketonuria.)

Stevia appears to be safe in pregnancy and lactation based on animal studies, however there is no data on the use of Stevia during human pregnancies.

Herbal Remedies, Including Teas

Most herbal and botanical remedies (including supplements and teas) have not been adequately studied, especially for use during pregnancy. Some may be safe by themselves but may be dangerous when combined with other medications or nutrients. Clients should report any herbal use to their medical provider.

Read more: herbal supplements and pregnancy

Herbal supplements are used during pregnancy for a variety of reasons; some are safe, others can be harmful. The majority of herbal remedies have not been studied, and their effects during pregnancy are not known. Herbal supplement use during lactation is covered briefly in Module 8, Breastfeeding Assessment and Support.

Product	Purported Use	Comments (Including safety, efficacy, evidence)
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<p><i>Black Cohosh</i></p>	<p><i>Uterine stimulant</i></p> <p><i>Labor-inducing aid</i></p>	<p><i>Efficacy is unclear</i></p> <p><i>Caution during pregnancy (especially during the first trimester) because of potential (though unproven) labor-inducing properties</i></p> <p><i>Caution during lactation is suggested, due to potential hormonal effects</i></p> <p><i>Blue cohosh (not black) is also used for gynecologic disorders and has a greater potential for toxicity than black cohosh.</i></p>
<p><i>Echinacea</i></p>	<p><i>Anti-infective agent, remedy for viral infections (especially upper respiratory infections)</i></p>	<p><i>Evidence for use in treating upper respiratory infections is strong</i></p> <p><i>Oral consumption during the first trimester was not associated with an increased risk of major malformations</i></p> <p><i>Caution for use during lactation until stronger evidence about safety is available</i></p> <p><i>Consider potential for interactions between echinacea and other medications</i></p>
<p><i>Ginger</i></p>	<p><i>Treatment of hyperemesis</i></p>	<p><i>250 mg powdered capsules</i></p> <p><i>The American College Obstetricians and Gynecologists Practice Pattern suggests this as option (ACOG, 2015)</i></p>
<p><i>Ginkgo</i></p>	<p><i>Memory boosting</i></p> <p><i>Treatment for asthma, sexual dysfunction, hormonal changes</i></p>	<p><i>Major safety concern with use during pregnancy is anti-platelet activity and prolonged bleeding during delivery</i></p> <p><i>Some case reports of adverse effects during pregnancy related to product adulteration; clinicians should be aware of manufacturers who use Good Manufacturing Practices (GMP)</i></p> <p><i>Theoretical evidence for avoiding raw ginkgo seed during pregnancy and lactation</i></p>

		<i>Consider potential for interactions between ginkgo and other medications</i>
<i>St. John's Wort</i>	<i>Enhance uterine tone Treatment for depression</i>	<i>Caution is warranted related to use during pregnancy; safety studies are weak Potential side effects during lactation include colic, drowsiness, lethargy Consider potential for serious interactions between St. John's Wort and other medications</i>
<i>References:</i>		
<i>Smeriglio A, Tomaino A, Trombetta A. Herbal Products in Pregnancy: Experimental Studies and Clinical Reports. Phytotherapy Research. 2014;28(8):1107-1116.</i>		

Table 2-1. Selected herbal supplements and implications during pregnancy

Herbs to avoid during pregnancy	
<i>Herb</i>	<i>Action</i>
<i>Blue cohosh</i>	<i>Oxytoxic</i>
<i>Black cohosh</i>	<i>Uterine stimulant effects (used by some midwives in preparation for labor)</i>
<i>Chamomile, valerian</i>	<i>Antispasmodic, sedative</i>
<i>Goldenseal</i>	<i>Oxytoxic</i>
<i>Dong quai</i>	<i>Stimulant, relaxant</i>
<i>Comfrey "internal use"</i>	<i>Liver toxicity</i>
<i>Ephedra</i>	<i>Uterine stimulant</i>
<i>Chaste tree</i>	<i>Uterine stimulant</i>
<i>Pharmacologic dose of zinc</i>	<i>Premature and stillbirth</i>
<i>Reference: Born D, Barron ML. Herb use in pregnancy: what nurses should know. MCN 2005; 30(3):201-206.</i>	

Table 2-2. Herbs to avoid during pregnancy

For more information, see

<http://www.americanpregnancy.org/pregnancyhealth/naturalherbsvitamins.html>

Resources:

- http://www.nlm.nih.gov/medlineplus/druginfo/herb_All.html - Medline Plus index of herbs and other supplements
- <http://nccam.nih.gov/> - The National Center for Complementary and Alternative Medicine website (NIH)

KNOWLEDGE CHECK

What are some simple food safety recommendations that can be given to newly pregnant women and their support network?

Answer: Ensure that all spills are cleaned up quickly with both soap and hot water. Wash your hands with hot water and soap after working with raw meat, lunch meats, and unpasteurized cheeses. Heat all foods until they are steaming hot.

How would you address herbal supplementation with a patient?

Answer: Varies based on the patient-clinician relationship. One potential route is to look up the herbs with the patient to determine the efficacy, potential drug interactions, or risks to the pregnancy with using each supplement. Recommend the patient has a discussion with their doctor about the supplements being used.

Diet- and Food-Related Concerns

Other issues

Nausea and vomiting

“Morning sickness,” though not necessarily limited to the morning, is reported to occur in about 50-80% of all pregnancies, especially in the first trimester. Some recommendations for minimizing problems with nausea and vomiting include:

- eating small frequent meals
- avoid spicy or fatty foods and eat bland or dry foods
- taking a multivitamin prior to pregnancy
- eat high protein snacks and meals
- crackers in the morning before arising

It has been suggested that increased estrogen levels during pregnancy may heighten an individual’s sense of smell (including aversion to strong food odors). Gastric mobility may be affected by elevations in progesterone and the delay in gastric emptying may increase the risk for nausea and vomiting. Recommendations to avoid food and non-food triggers are also common. Other recommendations include use of supplemental vitamin B6 (10-25 mg, every 8 hours) and ginger (ACOG, 2018).

Hyperemesis gravidarum is different than the usual “morning sickness,” and is thought to occur in about 0.3-3.0% of pregnancies. It is typically accompanied by an increase in maternal free thyroid hormone and human chorionic gonadotropin. Hyperemesis gravidarum often requires hospitalization and parenteral nutrition support. (ACOG, 2018)

[Read more: hyperemesis gravidarum](#)

It is estimated that 0.3-3.0% of pregnant women have hyperemesis gravidarum. Diagnostic criteria include intractable vomiting, disturbance of nutritional status, weight loss of at least 5% of prepregnancy weight, ketosis, and acetonuria. Hyperemesis

gravidarum can result in neurologic disturbances, liver damage, retinal hemorrhage, and renal damage.

Hyperemesis gravidarum is different than the “morning sickness” that is not unusual among pregnant women. Symptoms are not time-specific and occur throughout the day (vs. being worse, for example, in the morning). Women are often unable to perform activities of daily living, and hyperemesis gravidarum interferes with sleep. Ketones are often present, dehydration and electrolyte imbalances are common, and urine is scant, dark, and malodorous.

The etiology of hyperemesis gravidarum is not known, however theories include the influence of adrenal dysfunction, hormonal changes, and human chorionic gonadotropin (hCG) levels. Olfactory triggers have also been documented; these are thought to be a result of enhanced chemoreception with increased estrogen levels. (ACOG, 2018)

Treatment is “symptomatic,” and usually includes rehydration therapy and avoidance of “trigger smells,” (both food and non-food); antiemetics, hyperalimentation, and hospitalization are often necessary.

Pica

Pica is the ingestion of non-food items. The most commonly reported pica practices among pregnant women are geophagia (eating dirt or clay) or amylophagia (eating starch). Chewing on ice is not uncommon, but chewing on large quantities of ice can be a red flag, indicative of other forms of pica. Complications of pica can include interference with iron absorption, intestinal obstruction, excessive energy intake (e.g., with amylophagia), infection with worms, and toxicity (lead). (Cox and Carney, 2017)

The etiology of pica, especially during pregnancy, is not understood. One thought is that iron deficiency in pregnancy may result in pica. Some cultures also promote pica believing it helps with the pregnancy, for example, eating clay among the Hispanic population. (Cox and Carney, 2017)

Resources:

- <http://www.anred.com/pica.html> - ANRED (Anorexia Nervosa and Related Eating Disorders, Inc.) website with information about pica
- <https://emedicine.medscape.com/article/914765-overview> - emedicine article - Eating Disorder: Pica

Reflux

Most cases of reflux during pregnancy result from a combination of factors:

- hormonal changes cause the esophageal sphincter to relax
- the enlarged uterus puts increasing pressure on the stomach and intestines

Recommendations for the treatment and prevention of reflux during pregnancy include limiting intake before bed, elevating the head of the bed, wearing loose-fitting clothing, drinking beverages between meals, and eating smaller, more frequent meals and snacks. Some people find that limiting or avoiding specific foods (e.g., acidic foods such as

tomatoes and orange juice) or avoiding eating about during the 3 hours before bed also helps to minimize reflux. Smoking and caffeine also contribute to reflux.

Constipation and hemorrhoids

Constipation and hemorrhoids are two complications of pregnancy due to the slowing of the GI tract and the increase of iron. Increasing physical movement, fiber and fluids may make the problems more manageable.

KNOWLEDGE CHECK

How would you recommend managing reflux, nausea and vomiting in a patient?

Answer: Small frequent meals, avoid acidic or spicy foods

Pica may present during pregnancy. What are the nutritional concerns surrounding the consumption of non-food items?

Answer: Iron deficiency, bowel obstruction, excessive energy intake

Issues for Specific Groups

Several conditions and groups of women present special consideration related to nutrient needs and intake during pregnancy. A few are highlighted in the next few pages.

Vegetarian and vegan food patterns

Women who consume a vegetarian or vegan food pattern may be at risk for some specific nutrient deficiencies, depending upon the foods and food groups that are avoided. (See Table)

Food Pattern	Nutrients at Risk	Vegan or Vegetarian Food Sources
Lacto- ovo-vegetarian – consumes milk and eggs; avoids meat and fish	Iron	Legumes, dark green leafy vegetables, fortified foods including breads and cereals, dried fruit, nuts, seeds
	Zinc	Legumes, beans, nuts, seeds, green vegetables, and fortified cereals
	Vitamin E	Nuts, seeds, avocado, wheat germ
Lacto-vegetarian – consumes milk; avoids meat, fish, and eggs	Iron, zinc, and Vitamin E	(See above)
	Choline	Soy milk, lentils, chickpeas, broccoli, brussels sprouts
Vegan – consumes only foods of plant origin; avoids meat, fish, eggs, and milk	Iron, zinc, Vitamin E and choline	(See above)
	Calcium	Green leafy vegetables, fortified soy foods including bread, soy milk, tofu, corn tortillas
	Vitamin D	Fortified foods including margarine, breakfast cereals, soy milk, and other soy products; sunlight
	Riboflavin	Yeast extract, wheat germ, almonds, soy beans, tempeh, fortified foods, mushrooms, seaweed
	Vitamin B12	Fortified foods, including yeast extract, soy milk, textured soy protein, and breakfast cereals
	Iodine	Iodized salt
Williamson, 2006; AND 2014		

Table 2-3. Vegetarian and vegan food patterns

The Academy of Nutrition and Dietetics released a Position Paper stating that a “well-planned vegetarian diet containing vegetables, fruits, whole grains, legumes, nuts, and

seeds can provide adequate nutrition". (AND, 2016) For those that follow a strict vegetarian or vegan diet during pregnancy the above nutrients and omega-3 fatty acids are of concern. By staying up-to-date on nutrient content of new fortified vegan food products, providers can give appropriate advice on supplementation. (AND, 2014)

Adolescents

The adolescent who is pregnant presents unique nutritional considerations, because in addition to nutrients needed to support a healthy pregnancy, nutrients are also needed for the adolescent's growth and development. Thus, estimates of energy needs for adolescent pregnancy may be higher than for adult pregnancy, in order to promote adequate weight gain. Recommendations for weight gain during pregnancy may be as high as 28-40 pounds (12-18 kg), depending on the adolescent's age and pre-pregnancy weight. (Cox and Carney, 2017)

Many adolescents do not have adequate intakes of calcium, folic acid, and/or iron and may, in fact, have iron deficiency anemia before pregnancy. These nutrients are of special concern, both to maintain good nutritional status of the mother, and because of potential long-term effects on their children. (Cox and Carney, 2017)

When working with teens consider their food preferences, ability to cook, access to grocery shopping, lifestyle (e.g., school, work), and support around food. (Cox and Carney, 2017)

Read more: What is an adolescent?

Data about teen birth rates generally include births to girls ages 15-19 years, and this age range seems to be the accepted definition for "adolescent" in terms of pregnancy. Considerations in the nutrition assessment of an individual should include physical maturity as well as social and emotional maturity.

Overweight

The weight gain goals for mothers who are overweight before pregnancy may be lower than those for women with "normal" weights, depending on the degree of overweight. It is critical to ensure that the woman's nutrient intake (especially vitamins and minerals) is adequate to support a healthy pregnancy. Specific recommendations for women who are overweight are reviewed in Module 4, Medical Nutrition Therapy for Specific Conditions.

Multiparous

The number of multiple births (e.g., twins, triplets) is increasing in the US, in part because of use of fertility drugs. Multiparity is associated with increased risks for the infant (prematurity, intrauterine growth restriction, low birthweight) as well as for the mother (pre-eclampsia, iron-deficiency anemia).

The literature calls for “optimal maternal nutrition,” however this is not always clearly defined. Weight gain goals and intakes of some nutrients are increased for multiparous pregnancies:

- **Weight gain** – IOM recommendations based on prepregnant weight category. Due to the risk of preterm delivery with accompanying intrauterine growth retardation or low birth weight. It is good to target 24 pounds of weight gain by 24 weeks for twins. (Goodnight and Newman, 2009)

Prepregnant Weight Category	Total Weight Gain for Twins
Underweight BMI <18.5	Not enough data for a guideline
Normal weight BMI 18.5-24.9	37-54 lb or 17-25 kg
Overweight BMI 25.0-29.9	31-50 lb or 14-23 kg
Obese BMI ≥30.0	25-42 lb or 11-19 kg

- **Energy intake** – Needs for a twin pregnancy are approximately 40-45 kcal/kg pre-pregnancy weight. Energy intake should be monitored and varied based on weight gain. (AND, 2014)
- **Protein intake** – An additional 50 g/day beginning in the second trimester is recommended by the IOM, however since protein is a source of energy protein intake may make up 20% of caloric intake. (Goodnight and Newman, 2009)
- **Minerals** – Recommendations for supplementation include: 30 mg iron, 2.0-2.5 g calcium, 45 mg zinc, and 1.0 g magnesium per day for multifetal pregnancies. (Goodnight and Newman, 2009)
- **Vitamins** – Recommendations for supplementation include: 2 mg vitamin B6, 1.0 mg folate, 500-1000 mg vitamin C, 400 mcg Vitamin E, and 1000 IU vitamin D for multifetal pregnancies. (Goodnight and Newman, 2009)

Dieting during pregnancy

In general, dieting (restricting energy intake) should be discouraged during pregnancy. Restricted maternal energy intakes have been associated with low gestational weight gain, poor fetal growth and development, low birthweight, and preterm delivery. Some studies also indicate an association with neural tube defects, miscarriage, and post-partum depression. Maternal ketosis may be related to cognitive problems, including mental retardation, for the developing fetus.

Instead, if women are overweight or obese prior to pregnancy they should be encouraged to eat healthy, increase moderate exercise to 30 minutes on most days, and maintain a slow steady weight gain.

KNOWLEDGE CHECK

On which nutrients would you focus your counseling for a patient that follows a vegan or vegetarian diet?

Answer: Iron and zinc due to the increased needs for pregnancy. Patients that follow a strict vegan diet may need a reminder on the need for other micronutrients such as vitamin B12, calcium, and vitamin D, however the needs are not increased for pregnancy so if their prepregnancy diets were sufficient there may be less concern of deficiency during pregnancy.

Adolescents may have poor nutrient status prior to pregnancy. What is the overarching goal for supplementation and intake?

Answer: To ensure adequate intake to support adolescent growth and fetal growth while correcting any prior deficiencies.

Case Example: Kayla

Kayla is a 20-year-old woman, who is about four months pregnant. She has not received medical care for her pregnancy because she has no medical insurance. She has financial problems, and sometimes “runs out of food.”

Kayla says she experienced nausea and vomiting for about three months, and lost weight during that time. Her current weight is ten pounds more than her reported pre-pregnancy weight; her pre-pregnancy weight was appropriate for her height. She is approximately 5 feet, 5 inches tall and weighs about 145 pounds.

1. Estimate Kayla's energy needs. You estimated her pre-pregnancy energy needs to be about 2100 calories. (See [table](#) on nutrient needs during pregnancy)

- a. 1500 calories per day
- b. 1760 calories per day
- c. 2440 calories per day
- d. 2600 calories per day

2. Estimate Kayla's protein needs. (See [table](#) on nutrient needs during pregnancy)

- a. 65 grams per day
- b. 72 grams per day
- c. 100 grams per day
- d. 160 grams per day

3. What nutrients are you concerned about? (Check all that apply)

- a. folate
- b. iron
- c. vitamin C
- d. DHA

Case Example: Eileen

Eileen is a 24-year old woman who is about 5 months pregnant. She had morning sickness throughout the first several months of pregnancy, but found that eating small amounts of cornstarch helps with GI discomfort. She has read about the benefits of fish oil, so tries to eat fish at least two times each week. Eileen is 5 feet, 3 inches tall, and her pre-pregnancy weight was 130 pounds.

1. Estimate Eileen's energy needs. You have estimated her pre-pregnancy energy needs to be about 2000 calories. (See [table](#) on nutrient needs during pregnancy)

- a. 1860 calories per day
- b. 2340 calories per day
- c. 2500 calories per day
- d. 3000 calories per day

2. Estimate Eileen's protein needs. (See table on nutrient needs during pregnancy)

- a. 65 grams per day
- b. 72 grams per day
- c. 100 grams per day
- d. 160 grams per day

3. What nutrients are you concerned about? (Check all that apply)

- a. folate
- b. iron
- c. vitamin C
- d. DHA

4. What else might be a risk factor? (Check all that apply)

- a. eating cornstarch
- b. GI discomfort
- c. Use of fish oil
- d. overweight

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Quiz

1. Underweight pre-pregnancy increases the risk of
 - a. low birthweight
 - b. gestational diabetes only
 - c. low birthweight and premature delivery
 - d. gestational diabetes and macrosomia

2. Overweight pre-pregnancy increases the risk of:
 - a. low birthweight
 - b. calcium deficiency
 - c. maternal cardiovascular disease
 - d. long-term maternal obesity and pregnancy-induced hypertension

3. True or false: Since the fortification of many grains in the US with folic acid, concerns about pre- and peri-conceptual folate status are no longer needed.
 - a. true
 - b. false

4. Energy needs increase during pregnancy for a number of reasons, including:
 - a. increased basal metabolic rate
 - b. products of conception
 - c. accretion of maternal tissue
 - d. all of the above
 - e. B and C only

5. During pregnancy, requirements for the essential fatty acids linoleic and alpha-linolenic acid are:
 - a. increased above pre-pregnancy levels
 - b. decreased below pre-pregnancy levels
 - c. unchanged from pre-pregnancy levels
 - d. depend on the individual's usual fat intake

6. For the most part, requirements of minerals during pregnancy are not different from requirements for non-pregnant women. However, needs for some minerals do increase. These include:

- a. iron only
- b. calcium and iron
- c. magnesium and iron
- d. calcium and magnesium

7. To prevent problems associated with methylmercury, recommendations during pregnancy include:

- a. avoiding shark, swordfish, king mackerel, and tilefish
- b. limiting consumption of marlin, halibut, and catfish to 6 ounces a week
- c. avoiding all fish
- d. none of the above

8. Some recommendations for minimizing problems with nausea and vomiting include all of the following EXCEPT:

- a. taking a multivitamin
- b. eating small frequent meals
- c. eating a large meal in the evening
- d. avoiding spicy or fatty foods

9. Complications of pica can include which of the following:

- a. increased energy needs
- b. interference with iron absorption
- c. development of other eating disorders
- d. interference with calcium absorption

10. Reflux during pregnancy:

- a. Should not be treated with antacids
- b. Can be minimized by eating larger, less frequent meals
- c. Is common because of hormonal changes that cause the esophageal sphincter to relax
- d. Is not more common during pregnancy, but is more pronounced in women who have reflux when they are not pregnant.

11. True or false: adolescent pregnancies may have higher nutrient requirements than adult pregnancies.

- a. true
- b. false

12. In general, nutrient intake recommendations during multiparous pregnancies are:

- a. increased over singleton pregnancies
- b. no different than for singleton pregnancies
- c. no different than for singleton pregnancies, except for energy intake, which is increased
- d. no different than for singleton pregnancies, except for mineral intake, which is increased

First Steps Nutrition Modules

Module 4 – Medical Nutrition Therapy for Specific Conditions

Introduction

An existing medical condition, or one that is acquired during pregnancy, is a risk factor generally for both mother and infant. Medical nutrition therapy (MNT) is often required for conditions that are associated with pregnancy. Usually, collaboration with other health care providers (multi-discipline and/or multi-agency) is required, and referral to other providers needed in some instances.

MNT is within the scope of practice of the First Steps dietitian. The First Steps Policy and Procedure Manual includes “Medical Conditions” as a risk factor, and describes minimal intervention. Read the guidelines for medical conditions in general. Several conditions are reviewed in this module.

The Nutrition Care Manual includes the Nutrition Care Process as a framework for MNT. The NCP includes assessment, evaluation and monitoring of the following areas:

- Estimating nutrient requirements
- Adapting to changing needs
- Physical and physiologic limitations, especially GI (e.g., is client about to handle feedings by mouth? by tube? Are special formulas needed?)
- Effects of medical therapies on nutrition (e.g., medications that cause mineral losses, vomiting, diarrhea; affect method of feeding)
- Summarizing and tracking pertinent nutritional data

Estimated time to complete this module: 60 minutes.

Learning Objectives

Participants will be able to:

- Describe the medical risks and nutritional implications of some common complications associated with pregnancy
- Describe basic medical nutrition therapy for some common complications associated with pregnancy: gestational diabetes, hypertensive disorders, overweight, underweight

Read more: Guidelines for Evaluating Medical Conditions

MNT is within the scope of practice of the First Steps dietitian. Washington Apple Health Medical Nutrition Therapy Billing Guide includes “Medical Conditions Requiring Nutritional Intervention” as an appropriate condition for MNT referral. Pregnancy is listed as an example for a medical condition requiring nutritional intervention.

Evaluate

- *Review the client’s health history*
- *Observe and record any negative physical health symptoms or client complaints discovered or discussed during a visit*
- *Determine the current status of the medical condition/symptoms and management by the obstetrical care provider*
- *Review and record any treatment prescribed or self-administered to decrease symptoms and/or prevent complications during the maternity cycle*
- *Explore the client’s understanding of the medical condition/symptoms, treatment and the potential effects it may have on pregnancy, health, and infant outcomes*

Inform

- *Share preventive health information and self-care methods that may enhance her ability to cope with the condition/symptoms and follow any prescribed treatment regimes*
- *Review basic health care messages including “danger signs” during pregnancy*

Act

- *Document risk factor on care plan*
- *Refer to MSS Nurse regarding any emergent or increasing symptoms of physical distress or discomfort*
- *Consult with the obstetrical care provider regarding emergent symptoms and/or emergency room when symptoms require immediate attention*
- *Case conference and develop a plan with interdisciplinary team when medical conditions are complex, infectious, or chronic*
- *Determine a lead for complex medical issues, based on the client’s needs, team members’ knowledge of the condition, and relationship with the client*

Ongoing Follow-up and Outcomes

- *Continue to follow issues as needed and make referrals*
- *Document any communications with medical providers*
- *Document outcomes on the care plan, and if no changes occurred since the risk factor was identified, note why*

Outline

- I. INTRODUCTION
- II. GESTATIONAL DIABETES
 - a. Screening and Diagnosis
 - b. Medical Management
 - c. Medical Nutrition Therapy
 - i. Assessment: Anthropometric, Biochemical, Clinical, Dietary
 - ii. Intervention
 - d. Post-partum Considerations
 - e. Collaboration
 - f. Resources
 - g. Case Example
- III. HYPERTENSIVE DISORDERS
 - a. Medical Management
 - b. Medical Nutrition Therapy and Nutrition-related Implications
 - i. Assessment, Anthropometric, Biochemical, Clinical/Medical, Dietary
 - ii. Intervention
 - c. Collaboration
 - d. Case Example
- IV. OVERWEIGHT
 - a. Medical Nutrition Therapy and Nutrition-related Implications
 - i. Assessment: Anthropometric, Biochemical, Clinical/Medical, Dietary
 - ii. Intervention
 - b. Collaboration
 - c. Case Example
- V. UNDERWEIGHT
 - a. Medical Management
 - b. Medical Nutrition Therapy and Nutrition-related Implications
 - i. Assessment: Anthropometric, Biochemical, Clinical/Medical, Dietary
 - ii. Intervention
 - c. Collaboration
 - d. Resources
 - e. Case Example
- VI. SUBSTANCE USE DISORDERS
 - a. Medical Nutrition Therapy and Nutrition-related Implications

- i. Assessment: Anthropometric, Biochemical, Clinical/Medical, Dietary
 - ii. Intervention
- b. Collaboration
- c. Resources
- d. Case Example

VII. REFERENCES AND RESOURCES

VIII. QUIZ

Gestational Diabetes

Gestational diabetes (GDM) is characterized by “glucose intolerance that develops during pregnancy” (AND, 2018) 4.6-9.2% of pregnant women develop GDM in the US. GDM is associated with complications for the infant and mother (AND, 2018):

- Infant complications: macrosomia, large fetal size, neonatal hypoglycemia, and obesity and glucose intolerance in late adolescence and adulthood
- Maternal complications: increased risk of difficult labor and delivery, hypertensive disorders, caesarean section and increased risk of developing type 1 and/or type 2 diabetes after pregnancy

For women with type 1 or type 2 diabetes before pregnancy, optimal glycemic control before conception is ideal; hyperglycemia during conception and during the first trimester is associated with congenital defects and spontaneous abortion.

Screening and Diagnosis

Current recommendations from the American Diabetes Association suggest that women with risk factors for GDM or undiagnosed diabetes (see below) should undergo glucose screening at the first prenatal visit. All other women, without previously diagnosed diabetes, should be tested for GDM at 24-28 weeks of gestation. (ADA, 2018)

Generally, testing involves a one- or two-step approach. The one-step approach involves a 75-g oral glucose tolerance test (OGTT) after an overnight fast of 8 hours. Plasma glucose measurements should be measured when the patient is fasting, and at 1- and 2-hours post OGTT. The two-step approach includes: (1) initial screening with a 50-g nonfasting glucose loading test, and (2) 100-g diagnostic OGTT. (ADA, 2018)

Maternal Risk Factors

Risk factors for GDM include:

- Marked obesity (\geq BMI 25)
- Personal history of GDM
- History of cardiovascular disease
- Hypertension, low HDL or high triglyceride levels
- First-degree family history of diabetes
- Diagnosed with polycystic ovary syndrome
- Physical inactivity
- Prediabetes

Medical Management

Intensive treatment is recommended for women with GDM. This usually involves daily self-monitoring of blood glucose and medical nutrition therapy. Insulin is the preferred

medication for treating hyperglycemia as it does not cross the placenta. Metformin and glyburide both cross the placenta and long-term safety data is lacking. Insulin doses typically require adjustment throughout pregnancy because of increases in insulin antagonists and body mass. Lifestyle changes are considered essential for management of GDM and may be the only required treatment for management. Moderate exercise is recommended for most women with GDM. Most women can continue to exercise as they did prior to pregnancy, unless limited by a medical condition (e.g., uterine contractions, fetal distress, or maternal hypertension). (ADA, 2018) Weight gain during pregnancy is based on prepregnancy weight and is discussed more in Module 2.

Medical Nutrition Therapy (MNT)

The goals for Medical Nutrition Therapy (MNT) for gestational diabetes include goals for a typical pregnancy (adequate nutrients to support maternal weight gain and fetal growth and development). In addition, MNT should focus on maintaining maternal blood glucose control and appropriate rate of weight gain during pregnancy. (ADA, 2018)

Read more: Goals of medical nutrition therapy for gestational diabetes

1. Minimize blood glucose excursions and maintain glucose values within target goal ranges before and after meals.

- *Blood glucose should be monitored, including fasting and postprandial levels to help make adjustments to meal patterns and composition.*
- *Blood glucose may be more difficult to control after breakfast due to higher hormone levels during the early morning hours.*
- *Regular exercise can lower fasting and postprandial glucose concentration and reduce common discomforts of pregnancy.*

2. Provide an energy intake that is neither inadequate nor excessive and will achieve appropriate fetal growth and gestational weight gain without maternal ketosis.

- *A minimum of 175 g carbohydrate per day is encouraged for fetal brain development and to prevent ketosis.*

3. Ensure safe and adequate, but not excessive nutrients for maternal and fetal health.

- *Weight loss is contraindicated during pregnancy, however women with GDM who are overweight or obese may benefit from modest energy and carbohydrate restriction to slow gestation weight gain (70% of the DRI for pregnant women).*

From: Nutrition Care Manual – Gestational Diabetes Nutrition Intervention

Medical Nutrition Therapy: Assessment

Anthropometric

Weight and height should be monitored as usual. If there are concerns about slow weight gain, the use of concentrated sweets to enhance weight gain should be avoided.

Biochemical

Blood glucose (typically measured 4 times per day – before breakfast and after each meal)

Goals for GDM:

Fasting: <95 mg/dl

1-hour post prandial: <140 mg/dl

2-hours post prandial: <120 mg/dl

Consider access to monitoring equipment/supplies; ability to check blood glucose levels

Glycosolated hemoglobin (HbA1C) – reflects average blood glucose levels for 4-6 weeks; often monitored monthly during pregnancy, HbA1C goals should account for hypoglycemia risk, targets should range from <6% to <7%.

Urine ketones (may be monitored if type 1 diabetes)

Read more: Ketosis

Ketosis occurs when the liver's glycogen stores are depleted, and the body makes glucose from fatty acids and amino acids. Severe ketosis is called ketoacidosis. It is accompanied by dehydration, lethargy, nausea and/or vomiting, confusion, tachycardia, and hypotension, and can progress to coma. In addition to maternal effects, ketoacidosis has been associated with toxicity to the developing fetus. Ketonemia (ketones in the blood) is indicated by measuring ketones in the urine (ketonuria). Ketotic breath (fruity, with an acetone smell) is another indicator of ketoacidosis.

Urine ketones are checked in women with insufficient energy and/or carbohydrate intake, and with women experiencing weight loss during pregnancy. The general recommendations for this population are to check daily urine ketones when in the fasting state (usually first morning urine) and during the day when meals are missed, if the client is ill, or if blood glucose levels are >200 mg/dl. (NCM)

Potential Causes of Ketosis in Women with GDM

- *Inadequate energy or carbohydrate intake*
- *Omission of meals or snacks*
- *Prolonged intervals between meals (e.g., >10 hours between bedtime snack and breakfast)*
- *Possible worsening of glucose status, with blood glucose >200 mg/dl*
- *Illness (if on insulin therapy)*
- *Inadequate insulin dose*

Clinical

Document any symptoms related to hypo- or hyperglycemia. Document the insulin dose.

Dietary

Past adherence to meal plan.

Estimated energy needs based on diet history and rate of weight gain, activity level, and correction of ketosis.

Medical Nutrition Therapy: Intervention

An individualized meal plan should be developed that incorporates the client's:

- Pre-pregnancy weight, weight gain goals
- Physical activity level
- Usual food pattern, food preferences
- Lifestyle, work schedule, restaurant eating habits

Food intake (specifically energy and carbohydrates) should be distributed into small, frequent meals and snacks (e.g., 3 meals, 2-4 snacks each day). An evening snack is usually needed to prevent ketosis overnight.

There is no specific recommendation for the optimal range of carbohydrates as a percentage of total energy. The DRI for pregnancy requires a minimum of 175 g per day of carbohydrate for optimal fetal brain development. This requirement does not change for women with GDM. (ADA, 2018) The California Sweet Success program suggests the following energy composition:

- <45% total energy as carbohydrate, minimum of 175 g
- 15-20% total energy as protein, minimum of 71 g
- 30-40% total energy as fat

Read more: Sample Menu Following GDM Guidelines

The sample menu below follows the guidelines of the California Sweet Success Program:

*<45% total energy as carbohydrate
15-20% total energy as protein
30-40% total energy as fat*

Meal	Amount of Carbohydrate	Foods
<i>Breakfast</i>	<i>15-30 grams</i>	<i>2 scrambled eggs</i>

		1 slice wheat toast with 1 Tablespoon butter 1/2 grapefruit
Morning Snack	15-30 grams	1/2 cup cottage cheese 10 wheat crackers
Lunch	45-60 grams	1 egg salad sandwich 1/2 cup carrot sticks 1 Tablespoon ranch dressing 8 ounces nonfat milk
Afternoon Snack	15-30 grams	4 ounces yogurt 1 cup peaches (canned in water)
Dinner	45-60 grams	3 ounces lean beef 3/4 cup stir fry vegetables 3/4 cup rice 2 cups green salad with 2 Tablespoons Italian dressing
Bedtime Snack	15-30 grams	2 corn tortillas 1 ounce cheddar cheese

Table 4-1. Sample menu based on the guidelines of the California Sweet Success Program

To maintain good blood glucose control, carbohydrates (including simple sugars) are often limited. Use of alternative sweeteners should also be discussed; they are safe for use with people with diabetes when consumed within acceptable daily intake (ADI) levels established by the FDA. No adverse effects have been reported from use of artificial sweeteners such as aspartame, saccharin, acesulfame potassium, and sucralose during pregnancy and lactation, but some women choose to avoid them. Soluble fiber may help to regulate blood glucose levels (e.g., legumes, oats, bran, and raw fruits and vegetables).

Carbohydrate seems to be less tolerated (have a greater effect on blood glucose levels) in the morning than throughout the rest of the day. Limiting morning carbohydrate to 15-30 g at breakfast and <25% of daily carbohydrate intake before noon is suggested. This will probably require that little or no fruit, milk, and processed cereals be eaten in the morning.

When blood glucose levels are not maintained in the goal range (indicated by self-blood glucose monitoring logs, or glycosylated hemoglobin), a detailed diet history should be obtained. If needed, the diet plan should be adjusted, and/or strategies developed for the patient to better follow the diet plan.

Instruction/education should be individualized to the client's needs and may include one of the following:

- Carbohydrate exchanges (<https://dtc.ucsf.edu/living-with-diabetes/diet-and-nutrition/understanding-carbohydrates/counting-carbohydrates/carbohydrate-exchanges/>)
- Create Your Plate with instruction on portion sizes (<http://www.diabetes.org/food-and-fitness/food/planning-meals/create-your-plate/>). The American Diabetes Association's Diabetes Create Your Plate groups foods based on grains/starchy foods, non-starchy vegetables, and protein.
- Menu planning
- Carbohydrate counting (<http://www.diabetes.org/food-and-fitness/food/what-can-i-eat/understanding-carbohydrates/carbohydrate-counting.html>) This webpage describes how people may use carbohydrate counting as a component of diabetes management.

Information about portion sizes should be provided.

It is important to maintain an adequate intake, even when there is nausea and vomiting. Small, frequent, low-fat meals, with liquids between meals, may minimize symptoms of morning sickness. For severe vomiting, the lost meal may be replaced with 50 g carbohydrate as juice or regular soft drinks (usually about 12 ounces).

Post-partum Considerations

Women with GDM should be monitored for hyperglycemia for at least 4-12 weeks postpartum, tested via OGTT, and then tested at least every 3 years thereafter. Nutrition education should focus on maintaining a healthy weight and recognizing the symptoms of hyperglycemia, since women with GDM are at increased risk for developing diabetes. For women who remain on insulin, food patterns may need more frequent adjustment, and evening and/or late-night snacks may be needed. Family planning is especially important for women with diabetes; hyperglycemia during conception and during the first trimester is associated with congenital defects and spontaneous abortion.

Breastfeeding is recommended and should be highly encouraged for all women including those with GDM due to the longer-term metabolic benefits to both the mother and child. (ADA, 2018)

Collaboration

An interdisciplinary approach is most effective when all members of the team can deliver and implement evidence-based nutrition advice. The patient with diabetes should be at the center of the coordinated care decision making. (Dyson et al, 2011) The inter- or multi-disciplinary team can include health care providers from a number of agencies. The following providers may be included:

- Primary care provider
- Obstetrical care providers
- MSS team member (RN, BHS)
- Hospital and/or WIC dietitian (or other community provider)
- Specialty clinic

Resources

It's Never Too Early to Prevent Diabetes

<http://www.ndep.nih.gov>

This website includes tip sheets in English and Spanish for children at risk for type 2 diabetes, and a booklet for adults to help women and their families make healthy food choices. The website also encourages individuals to be more physically active to help prevent or delay type 2 diabetes.

Gestational Diabetes and Low-Calorie Sweeteners: Answers to Common Questions

<https://www.foodinsight.org/articles/gestational-diabetes-and-low-calorie-sweeteners-answers-common-questions>.

This publication includes information about the use of artificial sweeteners during pregnancy.

Case Example: Maureen

Maureen is a 26-year old woman who was identified as having gestational diabetes at 28 weeks gestation. A glucose challenge test indicated the need for further testing, and an oral glucose tolerance test was used to confirm the diagnosis.

Maureen's pre-pregnancy BMI was 28, indicating overweight. She is working closely with the First Steps team to manage her condition.

So far, Maureen has not needed insulin to maintain blood glucose levels within the desired range. If she needs insulin, the First Steps team will coordinate referrals to a specialty care center, where she can be followed by an endocrinology team.

KNOWLEDGE CHECK

What steps should a clinician recommend she take at home to manage her conditions?

Possible answers:

- she monitors blood glucose levels 4 times per day (before meals)
- she checks her urine for ketones

Where could the clinician focus appointment education to improve glycemic control?

Possible answers:

- Review the blood glucose levels from the past week and determine cause of high or low levels.
- Educate on possible adjustments to Maureen's food pattern based on causes of excursions.
 - Portion sizes
 - Balancing starchy vegetables/grains with protein and non-starchy vegetables
 - Minimizing simple carbohydrate intake before noon

Hypertensive Disorders

Hypertensive disorders occur in about 6 to 8% of pregnancies in the United States. (CDC, 2018) There are four major hypertensive disorders in pregnancy, each with different clinical features, risk factors, and associated risks:

- Preeclampsia-eclampsia is hypertension with multisystem involvement that begins after 20 weeks gestation in a woman who previously had normal blood pressure. Often the multisystem involvement presents as proteinuria, however preeclampsia may present with new onset of thrombocytopenia (platelet count under 100,000/microliter), impaired liver function, renal insufficiency, pulmonary edema or cerebral or visual disturbances. Eclampsia is the progression of preeclampsia to the convulsive stage marked by developing grand mal seizures in a woman with preeclampsia. Not all women with preeclampsia will progress to eclampsia.
- Chronic hypertension is hypertension that predates conception or developed before 20 weeks gestation.
- Preeclampsia superimposed upon chronic hypertension is the onset of proteinuria (after 20 weeks gestation) in a woman with chronic hypertension. Like in the diagnosis of preeclampsia without chronic hypertension, other organ system involvement may be present without the onset of proteinuria or with earlier onset of proteinuria (before 20 weeks gestation).
- Gestational hypertension is mild hypertension without proteinuria that develops in the latter part of pregnancy. Some women with gestational hypertension will develop preeclampsia during the course of the pregnancy. If hypertension persists postpartum, the diagnosis should be changed to chronic hypertension.
- Postpartum hypertension including preeclampsia with organ system involvement may develop in a period ranging from 2 weeks to 6 months postpartum. Generally, blood pressure will normalize by the end of the first year, however this may be a predictor of future chronic hypertension.

Diagnostic Criteria for Hypertensive Disorders in Pregnancy

Disorder	Hypertension (>140/90)	Proteinuria
Preeclampsia-eclampsia	After 20 weeks gestation	Often presents, but not required with other indications
Chronic hypertension	Before 20 weeks	
Preeclampsia superimposed upon chronic hypertension	Before 20 weeks	Generally presents after 20 weeks, but may present prior to 20 weeks in conjunction with

		involvement with another system or exacerbation of hypertension.
Gestational hypertension	During the latter part of pregnancy	
Postpartum hypertension	Develops 2 weeks to 6 months postpartum	May develop

Table 4-2. Diagnostic criteria for hypertensive disorders in pregnancy

Risk factors for preeclampsia include: (ACOG, 2013)

- First pregnancy (excluding miscarriages)
- Overweight
- Hypertension, renal disease, lupus, or diabetes prior to pregnancy
- Multiple gestation
- Family history of preeclampsia (sister or mother)
- Previous preeclampsia
- Advanced maternal age >40 years
- In vitro fertilization

In most cases preeclampsia does not lead to serious complications, however, severe preeclampsia can lead to stroke, heart failure, or liver or kidney damage. It is also associated with fetal growth restriction, preterm delivery, and miscarriage or stillbirth. This section focuses primarily on preeclampsia. (Norwitz, 2018)

Medical Management

For most women, medical management of preeclampsia involves blood pressure monitoring, monitoring of renal and liver function, and fetal monitoring (growth and activity, amniotic fluid volume, and blood flow).

Bedrest is often recommended, but no studies support its effectiveness for most women. Antihypertensive medications are not generally used, unless blood pressure is sustained at a significantly elevated level (e.g., diastolic >110 or systolic >160 mmHg) or other factors are present (e.g., secondary hypertension, end-organ damage, history of stroke). Early delivery is considered in some cases (e.g., women with severe hypertension or pregnancy complications). (ACOG, 2013)

Medical Nutrition Therapy and Nutrition-related Implications: Assessment

The nutrition goals for preeclampsia are the same as those for a typical pregnancy. There are a few additional factors to consider, however.

Anthropometric

Rapid weight gain (e.g., >2 lb/week or 6 lb/month) may suggest preeclampsia

Biochemical

Hematocrit may be elevated due to hemoconcentration associated with preeclampsia

Additional tests may be indicated, including renal function tests (BUN, serum creatinine, creatinine clearance tests), liver function tests and monitoring for proteinuria

Clinical/Medical (Norwitz, 2018)

- Nonstress testing and ultrasounds will provide information about fetal heart rate and growth restriction
- Blood pressure will naturally fall in the first trimester and continue to be low until mid-pregnancy, then increase to non-pregnant values in the third trimester; a single systolic blood pressure reading of >140 mmHg before 20 weeks gestation indicates increased risk of preeclampsia
- Non-dependent edema (e.g., swollen eyes, puffy fingers and hands) can be indicative of preeclampsia and requires immediate medical referral; dependent edema (seen in the ankles and feet) is normal in pregnancy
- Pain in the mid- or right-upper quadrant of the abdomen may present as similar to heart burn
- Symptoms of neurologic dysfunction, which require immediate attention, include headaches, blurred vision, and tendon hyperreflexia
- If antihypertensive medications or diuretics are prescribed, evaluate potential nutrient-medication interactions

Dietary

Calcium intake (dairy, non-dairy, and supplements) in women with low calcium intake may benefit from 1000 mg/day to reduce the risk of preeclampsia. (NCM)

Medical Nutrition Therapy and Nutrition-related Implications: Intervention

Low dietary calcium may increase risk of hypertension during pregnancy. There is limited evidence that high-dose calcium supplementation (≥ 1 g/day) in women with low calcium diets may reduce the risk of preeclampsia and preterm birth. The use of low-dose calcium supplementation is extremely limited but suggests that there may be a reduction in preeclampsia, hypertension and admission to neonatal high care. This data needs to be confirmed with larger, higher quality trials. (Hofmeyr et al, 2018). Calcium intakes greater than 4000 mg per day can cause calcium toxicity.

Supplementation with vitamins C and E has also been suggested to reduce the risk of preeclampsia, however studies have shown no benefit. (Rumbold et al, 2008; Rumbold et al, 2015) Another study showed a link between a food pattern high in fiber, potassium, magnesium, and calcium and lower rates of preeclampsia. (Frederick et al, 2006; Qiu et al, 2008) Magnesium sulfate is not recommend prophylactically, however it is recommended for women with eclampsia, and in women with severe preeclampsia to prevent the progression to eclampsia postpartum and during cesarean delivery. (ACOG, 2013)

Restriction of sodium intake is sometimes recommended to reduce risk of preeclampsia. A Cochrane Review found no evidence to support this recommendation and ACOG does not recommend salt restriction. (Duley et al, 2005; ACOG, 2013)

Certain counseling and nutrition intervention strategies require special consideration for pregnant women with hypertensive disorders. In general, nutrition interventions may be able to help prevent preeclampsia (or its progression), and the dietitian can assist in medical interventions through the early detection of symptoms. Once the condition has progressed, however, medical therapies that are beyond the scope of nutrition practice are often needed.

Collaboration

The inter- or multi-disciplinary team can include health care providers from a number of agencies. The following providers may be included:

- MSS team members
- WIC
- Obstetrical care provider
- Other health/community services

Case Example

Roxanne is a 24-year old woman with preeclampsia.

What are topics or signs and symptoms that a clinician should look for during each visit?

Possible answer:

The dietitian working with Roxanne made a point to assess Roxanne's calcium intake and to watch for non-dependent edema at each visit, in addition to providing counseling about general nutrition. During a routine appointment, the dietitian noticed that Roxanne's eyes, fingers, and hands were "puffy." After consultation with the nurse, an urgent referral to Roxanne's OB provider was made.

Overweight

Obesity increases the risk of some pregnancy complications, including hypertension, gestational diabetes, and obstetrical complications during delivery. It seems that these complications are not decreased by weight loss or slowed weight gain. In fact, the best pregnancy outcomes are associated with maternal weight gain that is within the 11-20 pounds weight gain recommendation for women with a prepregnancy BMI >30. Weight gain in obese women is associated with:

- Lack of weight gain: increases risk for delivery of SGA infants
- Weight gain >20 pounds: increases risk for delivery of LGA infants (Gavard and Artal, 2014)

Nutrition counseling is needed to ensure appropriate weight gain goals and nutrient intakes.

Criteria for overweight and obesity: (IOM, 2009)

- Overweight –prepregnancy BMI of 25 to 29.9
- Obese - prepregnancy BMI \geq 30

Medical Nutrition Therapy and Nutrition-related Implications

The goal of medical nutrition therapy is not weight loss, but weight gain that allows for adequate fetal growth, without increasing maternal adipose tissue.

Assessment

Anthropometric

Record pregravid weight, and weigh and plot weight on “overweight” or “obese” prenatal weight gain chart.

An overall weight gain between 15-25 pounds is recommended for women with an overweight prepregnancy BMI or 11-20 pounds for women with an obese prepregnancy BMI. Women who were obese prior to pregnancy gained less weight in early and late pregnancy when compared to mothers who were overweight, normal weight, and underweight prior to pregnancy. (Broskey et al, 2017)

Evaluate client’s expectations about weight gain for this pregnancy

Biochemical

No special biochemical measurements are indicated, however women who are overweight are at increased risk for developing gestational diabetes, so pay particular attention to the results of the glucose tolerance test.

Clinical/Medical

Evaluation of clinical or medical factors does not generally require anything special. Women who are overweight are at increased risk for some medical conditions (e.g., gestational diabetes, preeclampsia), so associated conditions should be considered. In addition, particular attention should be paid to:

- Fundal height progression, or sonogram results showing macrosomia
- Prenatal care provider's recommendations concerning weight gain during pregnancy
- Prepregnancy weight, gestational weight gain, and birth outcomes for previous pregnancies
- History of eating disorder diagnosis or treatment
- Lifestyle data (e.g., activity level, recreational preferences, sedentary behaviors)
- Psychosocial issues (e.g., depression, boredom, social support)
- Previous bariatric surgery has nutrition-related implications. See Module 3 for more information.

Dietary

Evaluation of an individual's intake will require the same general process for women who are overweight or who have normal weights. Some issues that may require focus are highlighted below.

- Evaluate overall quality and quantity of food intake, including usual intake of fats and sweets, fast or convenience foods, and processed snack foods
- Discuss where food is usually consumed and the mealtime environment
- Is the client currently doing anything to limit weight gain during this pregnancy?
- Is there a history of difficulties with body image, weight loss, dieting, or energy restriction?

Intervention

Details of the nutrition care plan for a woman who is overweight will depend on her individual circumstances, priorities, and resources. Some strategies for specific issues are reviewed below.

Excessive weight gain (>6 pounds per month)

Encourage client to select priorities for intervention and behavioral changes that are acceptable to her

Evidence of fetal macrosomia

The following dietary modifications may be helpful, depending on the individual's food patterns:

- Reduce the amount of sweetened beverages (e.g., soda, juice, sweet tea) consumed
- Decrease the amount of fat consumed from fried foods, fast food, snacks, and dairy products
- Institute a regular meal pattern, including 3 meals per day; skipping meals can contribute to weight gain by stimulating appetite and overeating

Low weight gain (<2 pounds per month after the first trimester)

Help the client understand that total weight gain between 15-25 pounds (prepregnancy BMI between 25-29.9) or 11-20 pounds (prepregnancy BMI \geq 30) will give her baby the best chance of a good birthweight.

Weight loss

- Assess for adequate protein intake, and work to improve the quality of protein sources in the diet, and the nutrient density of foods
- Work with the client to institute a regular meal pattern (e.g., 3 meals, 3 snacks per day) by setting small, achievable, incremental goals
- If medical provider has recommended weight loss, emphasize nutritional quality of food choices, to provide an adequate intake for mother and baby. Communicate nutrition findings with medical provider. Monitor weight progression.

Sedentary lifestyle

Encourage walking or swimming for at least 30 minutes 3 or more days per week. If more strenuous types of exercise are being considered, encourage client to discuss plans with her OB care provider.

Collaboration

The inter- or multi-disciplinary team can include health care providers from a number of agencies. The following providers may be included:

- MSS team members
- RD at WIC
- RD at medical agency
- Primary care provider, referral for specialty care, if eating disorder is a consideration

Case Example: Sarah

Sarah is a 28-year old woman who is 17 weeks pregnant. She has struggled with weight since early adolescence. Her pre-pregnancy BMI was 30, and she has gained about 5 pounds since then. Sarah's goal during pregnancy is not to gain any additional weight, and she says she would be pleased if she lost some weight. She has stopped drinking colas (was drinking about 24 ounces per day) and now eats 2 meals each day, instead of snacking all day.

KNOWLEDGE CHECK

Is Sarah's current rate of weight gain appropriate? Why or why not?

Sarah's prepregnancy BMI (30) meets IOM criteria for obesity. Weight gain throughout pregnancy should be at least 11 pounds. Her current rate of weight gain is appropriate so far.

pregnancy. Eating only 2 meals per day is probably not the best approach, and Sarah may need some help planning meals and snacks.

Weight loss during pregnancy is not healthy for her infant, and a gain of at least 11 pounds is recommended. The dietitian should discuss the risks associated with inadequate weight gain, as well strategies for weight maintenance post-partum.

Are you concerned about her intake?

As discussed previously, Sarah should be congratulated on the changes she has already made. Concerns and areas which can be improved include:

- Food pattern (2 meals per day vs. several meals and snacks)
- Overall nutritional adequacy

In addition to intake, physical activity could be discussed.

Case Example: JoAnn

JoAnn is a 24-year old woman who is 20 weeks pregnant; this is her second pregnancy. She gained about 45 pounds during her first pregnancy, and did not get back to her pre-pregnancy weight. Her BMI at the start of this pregnancy was 28.5. Over the last 2 months, she has gained about 15 pounds. She is not too concerned about gaining weight, since most women in her family are heavier after having children. JoAnn works full-time. She often snacks on things she buys from the vending machine, so she can work through lunch and accrue overtime pay.

KNOWLEDGE CHECK

What should the dietitian consider as JoAnn's nutritional status is assessed and as a plan is developed?

Considerations for JoAnn include:

- Extra attention for hypertension, diabetes, macrosomia
- Regular meals, problem-solving at work
- Nutritional adequacy of intake
- Appropriate rate of weight gain; discuss risks of excessive weight gain to JoAnn and to baby
- Physical activity

Name: _____

Weight Categories for Women According to Height and Pre-pregnancy Weight (lbs)¹:

Height	Under Weight (BMI < 18.5)	Normal Weight (BMI 18.5-24.9)	Over Weight (BMI 25-29.9)	Obese (BMI ≥ 30)
47"	< 80	80-107	108-128	> 128
48"	< 83	83-111	112-133	> 133
49"	< 86	86-115	116-138	> 138
4'10"	< 89	89-119	120-143	> 143
4'11"	< 92	92-123	124-148	> 148
5'	< 95	95-127	129-153	> 153
5'1"	< 98	98-132	133-158	> 158
5'2"	< 101	101-136	137-163	> 163
5'3"	< 105	105-140	141-169	> 169
5'4"	< 108	108-145	146-174	> 174
5'5"	< 111	111-149	150-179	> 179
5'6"	< 115	115-154	155-185	> 185
5'7"	< 118	118-159	160-191	> 191
5'8"	< 122	122-164	165-196	> 196
5'9"	< 125	125-168	169-202	> 202
5'10"	< 129	129-173	174-208	> 208
5'11"	< 133	133-178	179-214	> 214
6'	< 137	137-183	184-220	> 220
6'1"	< 140	140-189	190-227	> 227
6'2"	< 143	143-194	195-233	> 233
6'3"	< 148	148-199	200-239	> 239

BMI = Weight (lbs.)/Height (in.)² X 703

Recommended Weight Gain¹:

Mark One:	Single	Twins
<input type="checkbox"/>	Underweight 28-40 lbs.	N/A
<input type="checkbox"/>	Normal 25-35 lbs.	37-54 lbs.
<input type="checkbox"/>	Overweight 15-25 lbs.	31-50 lbs.
<input type="checkbox"/>	Obese 11-20 lbs.	25-42 lbs.

Pre-pregnancy Weight: _____

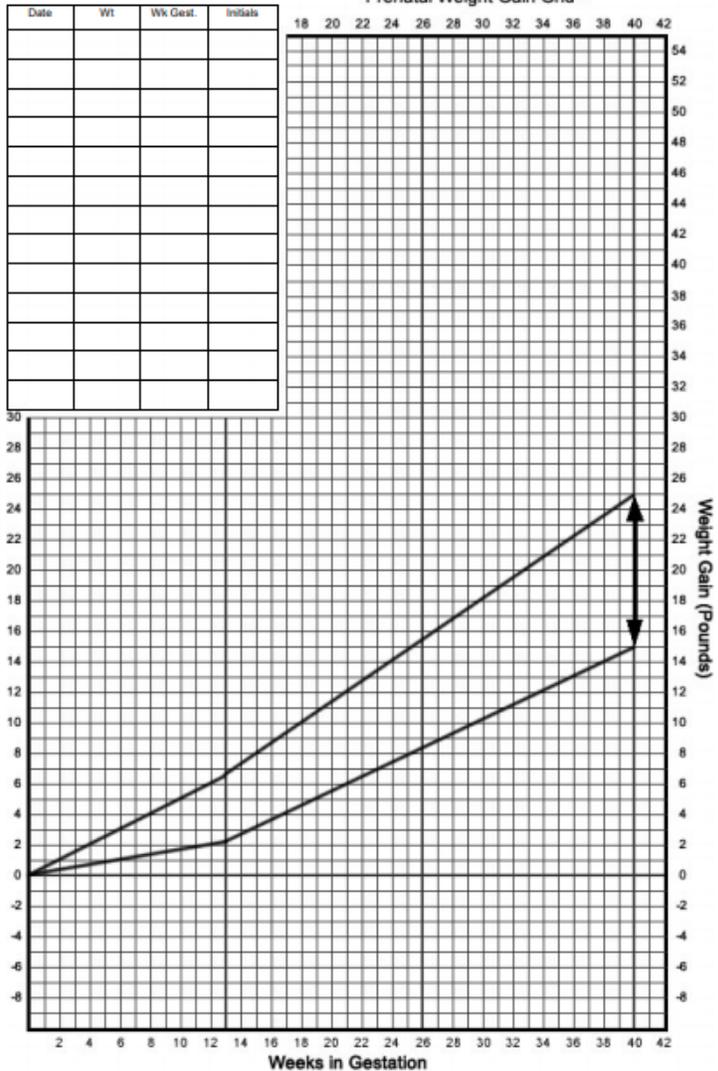
Height: _____

¹ IOM, 2009. *Weight Gain During Pregnancy: Reexamining the Guidelines*. Washington, DC: National Academies Press.

² Per Personal Communication with the Committee to Reexamine IOM Pregnancy Weight Guidelines

CDPH 447283 (03/10)

Pre-pregnancy Overweight Range Prenatal Weight Gain Grid²



Underweight

Maternal underweight in pregnancy is associated with increased risk for infants with low birthweights, miscarriage, and other complications, including anemia, antepartum hemorrhage, birth defects, intrauterine growth restriction, and premature rupture of the membranes. (Cox and Carney, 2017) Although the risks are significant, underweight is less likely to be identified as a risk factor than overweight. Important roles for dietitians include identifying women who are at-risk, and helping to assure positive birth outcomes.

Factors Associated with Low Prenatal Weight Gain (Hickey et al, 1997; Wells et al, 2006; Hickey, 2000; Deputy et al, 2015)

- Underweight (pre-pregnancy BMI <19.8)
- Obesity (pre-pregnancy BMI >29)
- Pregnancy-related nausea
- Preterm labor
- Smoking and alcohol use
- Unwanted pregnancy
- Caring for more than one preschool-aged child at home
- Not using own car for errands
- Working more than 40 hours per week

Unless there is an underlying medical cause for underweight, no medical management is generally indicated.

Medical Nutrition Therapy and Nutrition-related Implications

The nutrition goals for women who are underweight are the same as those for a typical pregnancy. Ensuring an adequate intake of energy and other nutrients may require more attention, however.

Assessment

Anthropometric

Accurate measurements of weight and height are essential in identifying women who are underweight, and also in monitoring the effectiveness of the interventions.

Biochemical

No special biochemical measurements are indicated.

Clinical/Medical

- Is there a history of an eating disorder, or behaviors associated with disordered eating?
- Is nausea and vomiting interfering with an adequate intake?
- Are there other physical reasons preventing an adequate intake? (e.g., oral lesions, preexisting conditions)

Dietary

What is interfering with an adequate intake? (e.g., access to food, lack of time, food choices that are not nutrient-dense, major oral health issues)

Intervention

As with all MNT, intervention for underweight during pregnancy should focus on the identified reasons for the problem, and should be developed based on the client's goals, priorities, and resources. Some general strategies for specific contributors to underweight are discussed below.

Inadequate intake

Address specific barriers to food consumption:

- Resources to purchase sufficient food – refer to available resources (e.g., WIC, Food Stamps, food banks, etc.)
- Transportation to purchase food – identify neighborhood resources, periodic shopping trips, bus routes
- Lack of food preparation skills, storage facilities – work on simple methods for quick meals that require little preparation
- Lack of nutrition knowledge – offer strategies for increasing energy density of food (e.g., added peanut butter, cheese, cooking oils)
- Lack of motivation – monitor fetal growth with client, through fundal height measurements or ultrasound reports

Set small goals to increase meal pattern (3 meals, 2-3 snacks per day)

Consider oral dietary supplement (such as Ensure®) when other strategies fail and fetal risk is demonstrated by poor growth parameters

Maintain regular contact until problem is resolved. Provide frequent encouragement and positive reinforcement for changes

Excessive physical activity

Help client set realistic goals for decreasing activity or adjusting energy intake to meet needs.

Nausea and vomiting

- See Module 2 for specific suggestions related to food pattern
- Consider stress as a factor, work with psychological referrals as indicated
- When vomiting persists into the second and third trimesters, consult with OB provider to discuss appropriate intervention

Stress, depression, lack of social support

Work with psychosocial referrals as indicated. Refer to maternity case management, when available.

Collaboration

The inter- or multi-disciplinary team can include health care providers from a number of agencies. The following providers may be included:

- MSS team members
- Other medical care agencies (e.g., WIC) to coordinate care
- Obstetrical provider
- Mental health care providers

Case Example: Lindsey

Lindsey is a 24-year old woman who was underweight prior to pregnancy. She wants to give her baby the best opportunity, and she sees pregnancy as a good opportunity to improve her overall health.

KNOWLEDGE CHECK

What healthy eating and meal pattern recommendations could be recommended to Lindsey?

Possible answers:

- a referral to the WIC program if she qualifies
- suggestions for increasing the energy density of foods
- recommendations for fitting 3 meals and 2-3 snacks into Lindsey's busy day
- a discussion about the importance of social supports and a referral to the behavioral health specialist

Substance Use Disorders

Substance abuse during pregnancy has a direct negative effect on fetal growth and development. Tobacco is the most commonly abused drug during pregnancy and may have the largest effect on fetal growth restriction when compared to maternal use of alcohol, marijuana, and/or cocaine. (Janisse et al, 2014) Alcohol use during pregnancy is considered the leading cause of preventable intellectual disability, and also contributes to low birthweight and delayed motor development. Dietitians can help clients by providing referrals for treatment programs and nutrition counseling to improve health behaviors.

Substance abuse during pregnancy is identified when 1) the client reports it, or 2) it is documented in the client's medical record (and the client gives permission to obtain her medical record). The following is a list of widely used substances which have a negative impact on the fetal growth and development:

- Alcohol (beer, wine, liquor)
- Tobacco (cigarettes, snuff, chewing tobacco)
- Illicit drugs (e.g., marijuana, cocaine, crack, heroin)
- Prescription and non-prescription drugs for medical or non-medical use (e.g., amphetamines, barbiturates, narcotics, tranquilizers, diet pills, cold medications, methadone, codeine, morphine or other opioids)
- Positive urine drug screen

Read more: MSS Policy and Procedure Manual - Risk Factors and Minimal Interventions - Tobacco Use and Secondhand Smoke Cessation/Reduction

Addressing tobacco usage and exposure should be a brief part of every visit.

Evaluate:

- *Ask the client about her past and current tobacco use*
- *Ask the client about her current exposure to secondhand smoke, and about the environment(s) where the baby will be.*
- *Evaluate her readiness to change by using the following Stages of Change scale:*

Not Ready to Quit: *Has no intention to quit within the next six months.*

These clients may be uninformed of the dangers of tobacco. They may use tobacco as a coping mechanism. They may be unprepared or unwilling to deal with nicotine withdrawal symptoms. They may have been trying to quit, been unsuccessful and unwilling to try again at this time.

Thinking About Quitting: *Intends to quit within the next six months.*

These clients have reasons to quit and reasons to keep smoking. They are aware of risks associated with their tobacco use, but are not ready to make a commitment to quit.

Ready to Quit: *Is willing to set a Quit Date within the next 30 days.*

Quitting: *Has remained tobacco-free for less than six months.*

Staying Quit: *Has remained tobacco-free for more than six months.*

These clients have already quit and are learning to live without tobacco. During this stage, relapse is still a danger.

Relapse: *Is using tobacco again after a period of being tobacco-free.*

Relapse is common, especially among postpartum women: 79-90% return to smoking within one year after delivery. Women often relapse due to the stress of the baby and as they return to their former social activities.

Inform:

- *Tobacco education posters, tabletop signs, and other visible messages create an environment that makes asking about tobacco use a normal and expected part of a visit.*
- *If the woman is a pregnant/postpartum smoker, provide additional information tailored to her, including the American Cancer Society's magazines, Make Yours A Fresh Start Family.*
- *Depending upon her stage of change, offer the appropriate information, messages, handouts and assistance.*
- *Example for a client contemplating change: "As your provider, I need you to know that quitting smoking is the most important thing you can do to protect the health of your unborn baby. If you are thinking of quitting at this time, I can help you get started."*
- *Depending upon her situation, offer information about ways to eliminate secondhand smoke exposure and offer assistance that will support changes. For example: "It is OK to encourage people to smoke outdoors, which is a good way to protect you and your baby from secondhand smoke".*

Act:

- *Document risk factor on care plan*
- *Determine the client's willingness to make a quit attempt at the present time (for example, within the next 30 days).*
- *If the person is willing to make a quit attempt, provide assistance setting a Quit Date.*
- *If the person clearly states an unwillingness to make a quit attempt at the present time, you can offer support and appropriate information to get the person thinking about quitting.*
- *Client-specific information on tobacco use, secondhand smoke exposure, and assistance provided and recording of progress and outcomes should be documented in each client's chart, as required in the Tobacco Cessation During Pregnancy Performance Measure.*
- *Case Conference with team members*

Ongoing Follow-up and Outcomes:

Follow-up may be as simple as an invitation to talk about quitting in the future. Or follow-up may be arranged for a specific time, such as when a pregnant woman returns for an appointment, or when the provider returns for a home visit. It is particularly important to arrange follow-up contact with a tobacco user who is making a quit attempt. Whenever possible, arrange the follow-up within a week after the individual's Quit Date.

During the follow-up contact:

- Ask about tobacco status.
- Congratulate individuals who are tobacco-free and support them in staying quit.
- Support people who have relapsed and help them in making a new quit attempt.
- Develop with the client, a post-pregnancy plan addressing the following:

How to remain tobacco free, or

How to continue to reduce tobacco use.

Keeping the newborn free from exposure to secondhand smoke.

- Support systems that are available to the client; e.g. Medical referral, Community resources, Washington State Quit line, Secondhand smoke materials, WIC, other.
- Document outcomes on the care plan, and if no changes occurred since the risk factor was identified note why.

This risk factor is one of the performance measures. When recording outcomes on the discharge summary, you are allowed to bill for completing the information for this risk factor. Additional information is available in the MSS/ICM Billing Instructions.

Read more: MSS Policy and Procedure Manual - Risk Factors and Minimal Interventions - Alcohol and Substance Use Prior to and During Pregnancy

Evaluate:

- Note any pertinent history and client's verbal and non-verbal behavior suggesting alcohol/substance use.
- Assess the client's motivation to change substance use behavior including: frequency and type of use, client's concern regarding use, knowledge of the effects of substance use during pregnancy and stage of change regarding abstinence.

Inform:

- Offer health messages regarding substance use during pregnancy.
- Provide harm reduction health messages if client is unable to achieve abstinence during pregnancy.

Act:

- Document risk factor on care plan
- Support the client in her change process including: listening to understand her experience; problem solving together to reduce barriers to change; support and

reinforce her sense of self-efficacy to make changes to achieve harm reduction or abstinence.

- *Provide information and/or refer to chemical dependency resources including treatment, NA, AA, etc.*
- *Alert prenatal care provider of use and inform the client of this action.*
- *Alert CPS and hospital if use continues throughout pregnancy and inform the client of this action.*
- *Case conference with MSS team members.*

Alcohol/substance use in the environment (partner, parent, grandparent, support person)

- *Support the client in developing a safety plan for herself and her children if needed.*
- *Refer the client to a support program such as Al-Anon.*
- *Assess basic needs such as food and housing. Refer and advocate for linkages.*

Ongoing follow-up and Outcomes:

- *Observe the client and environment for signs of use at each encounter.*
- *Reassess the client periodically in pregnancy and post-pregnancy period for stage of change, progress and if abstinent, ability to maintain. Support problem solving and reinforcing self-efficacy through out.*

Medical Nutrition Therapy and Nutrition-related Implications

The nutrition goals for women with substance abuse problems are the same as those for a typical pregnancy. Special considerations that are sometimes associated with substance abuse are reviewed below

Assessment

Anthropometric

- Women who abuse substances often obtain prenatal care later in pregnancy than other women, and may not know or remember LMP, pregravid weight, or weight gain pattern
- Women who smoke or abuse alcohol or drugs tend to have lower prepregnancy weights and tend to gain less weight during pregnancy than women who do not

Biochemical

- Evaluate hemoglobin and hematocrit according to general hematological assessment guidelines and smoking status, if appropriate
- Urine screens for drug use may be included in the care process

Clinical/Medical

- Emphasize the importance of regular prenatal medical care
- Consider history of previous deliveries with congenital conditions related to maternal substance abuse (known effects are summarized in the table below)
- Include evaluation for obvious clinical signs of malnutrition

- Consider HIV status
- Consider lifestyle data (including history and current use – frequency, amount, last use – and history and current use by others in household or family)

Substance	Known effects of use during pregnancy
Tobacco	<ul style="list-style-type: none"> • Reduced birthweight, length, head circumference • Altered auditory functioning contributing to lower reading and language scores (older, middle-class children)
Alcohol	<ul style="list-style-type: none"> • Fetal Alcohol Syndrome (FAS) – series of effects seen in the offspring of women who chronically drink to excess during pregnancy • Pre- or post-natal growth retardation with weight, length, or head circumference <10th percentile for age • Neurologic abnormality, developmental delay, or intellectual impairment • Facial dysmorphism with at least 2 of the following: <ul style="list-style-type: none"> • Microcephaly • Microphthalmia or short palpebral fissures • Poorly developed philtrum, thin upper lip, or flattening of maxillary area
Alcohol	<ul style="list-style-type: none"> • Fetal Alcohol Effects (FAE) – series of effects seen in the offspring of women with moderate or heavy use of alcohol during pregnancy • Any of the above abnormalities, without the full syndrome • May include irritability, sleep disturbances, poor feeding, facial dysmorphism, learning disabilities
Cocaine	<ul style="list-style-type: none"> • Prematurity • Low birthweight, length, and head circumference • Decreased state regulation (poor ability to regulate arousal), attention and responsiveness in the newborn period • Increased excitability at 3-week neurobehavioral performance
Heroin	<ul style="list-style-type: none"> • Spontaneous abortion, stillbirth • Prematurity • Intrauterine growth restriction • Infant addiction
Marijuana	<ul style="list-style-type: none"> • Prematurity

Table 4-3. Effects of selected substance use during pregnancy

Dietary

Because maternal-fetal nutritional status is a significant factor in moderating impact of drug use on pregnancy outcome, diet assessment is important and should give special attention to:

- Food availability, access to food, and food purchasing, storage, and preparation resources
- Effect of drug use on appetite and intake

Intervention

Interventions should be individualized to the client's needs. Some general recommendations for specific issues related to substance abuse are discussed below. Some have specific nutrition-related implications. Nutrition appointments may provide opportunities for intervention traditionally started by mental health professionals as well as the opportunity for identification of problems and referral.

Active alcohol or illegal drug use

- Refer to and encourage participation in drug/alcohol treatment program. In the State of Washington, all pregnant women have priority eligibility for live-in drug treatment.
- Encourage participation in Maternity Case Management
- Avoid making judgmental statements about the client's lifestyle
- Utilize a "Stages of Change Model" for assisting client to problem-solve about her substance use
- Reinforce and encourage all clients to remain drug-free
- Intervention for depression may be necessary before drug/alcohol treatment can be effective

Smoking or exposure to tobacco smoke during pregnancy

- Utilize a "Stages of Change Model" for client decision-making regarding when and how to reduce harm from tobacco.
- Refer to smoking cessation program, when client is ready
- If client is unable to stop smoking, but willing to limit use, attempt to reduce to 5 or fewer cigarettes per day
- Educate client about negative impact of tobacco use and environmental exposure on fetal growth and development
- If client lives with smokers, discuss importance of avoiding exposure of herself or her infant to secondhand smoke, and develop list (with client) on steps to take to avoid exposure

Inadequate intake, weight loss or inadequate gain, anorexia

- Ensure that client has access to food
- Assess possible effects of substances on appetite
- Discuss importance of prenatal weight gain and nutrition for healthy growth, physical and mental development of fetus
- Encourage use of prenatal vitamin and mineral supplement
- If client is unable to consume adequate energy and nutrient-dense foods, recommend a complete liquid or powdered nutritional supplement
- Evaluation for mental depression should be considered. Risk of depression is high among people with substance abuse problems, and may cause anorexia or loss of motivation to eat.

Preparation for parenting responsibilities

- Cocaine-exposed neonates, with decreased state regulation, attention, and responsiveness, may interact negatively with caregiver (who may already have compromised parenting skills because of drug use, withdrawal symptoms, depression, or other factors)
- Reinforce the need for, and encourage client to remain drug-free
- If client has not yet had treatment for substance abuse, reassess readiness
- Refer client to parenting classes before the infant is born
- Drug use is often associated with less stable and more isolated living situations. Encourage eligible clients to MSS or ICM services. Referrals for housing and community support are important for parenting success.
- Encourage prenatal decision making about family planning and implementation as early as possible postpartum.

Infant feeding choice

- Women who are otherwise drug-free but who continue to smoke, should be encouraged to breastfeed.
- Use of illegal drugs or excessive alcohol is incompatible with breastfeeding
- Communicate with infant’s primary care provider re: nutritional status

Collaboration

The inter- or multi-disciplinary team can include health care providers from a number of agencies. The following providers may be included:

- MSS team members and medical provider (referral is required)
- Other medical care agencies (e.g., WIC) to coordinate care
- Substance abuse treatment resources – even if client is not yet ready to reduce or abstain at present
- Infant’s primary care provider

Case Example: Kayla

Kayla is a 20-year-old single woman, who came to her local WIC office seeking food assistance. She is living with a friend temporarily, but wants to find her own apartment. She works part time at a convenience store for minimum wage. Kayla is pregnant with her first baby and uncertain of her due date, but believes she is about four months pregnant. She has not received medical care for her pregnancy because she has no medical insurance. Kayla does not know how to apply for medical/financial assistance, but has serious financial difficulties including “running low on food.”

Kayla says she experienced nausea and vomiting for about three months, and lost weight during that time. Her current weight is ten pounds more than her reported pre-pregnancy weight; her pre-pregnancy weight was appropriate for her height. Kayla says she smoked ½ pack of cigarettes per day and is not concerned about the effects of smoking on the

baby. Several of her friends smoked during their pregnancies and “their babies were fine.”

KNOWLEDGE CHECK

Where do you think Kayla falls on the Stages of Change scale?

- a. not ready to quit
- b. thinking about quitting
- c. ready to quit
- d. quitting
- e. staying quit
- f. relapse

Possible answers:

It seems that Kayla has no intention of quitting. She may be uninformed about the dangers of tobacco or may be unprepared to deal with nicotine withdrawal symptoms.

How could a clinician counsel Kayla given that she seems to have no intention to quit smoking?

Possible answers:

The dietitian can provide information to Kayla. One example is: "As your provider, I need you to know that quitting smoking is the most important thing you can do to protect the health of your unborn baby. If you are thinking of quitting at this time, I can help you get started.

The dietitian should document this risk factor on Kayla's care plan, offer support, and provide additional client-centered information. This should be discussed during Kayla's case conference.

Case Example: Marie

Marie is a 25-year old woman who has abused alcohol. Referrals to appropriate treatment and counseling resources have been made.

KNOWLEDGE CHECK

What recommendations or counseling would be appropriate for Marie in relation to her nutrition status?

Possible answers:

The dietitian completes an assessment of Marie's nutritional status, and works with Marie to incorporate the following recommendations into a plan:

- appropriate rate of weight gain

- appropriate meal and snack pattern
- adequate macro- and micro-nutrient intake
- access to food, including purchasing, storage, and preparation resources

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Resources

Gestational Diabetes

It's Never Too Early to Prevent Diabetes

<http://www.ndep.nih.gov>

This website includes tip sheets in English and Spanish for children at risk for type 2 diabetes, and a booklet for adults to help women and their families make healthy food choices and be more physically active to help prevent or delay type 2 diabetes.

Gestational Diabetes and Low-Calorie Sweeteners: Answers to Common Questions

<https://www.foodinsight.org/articles/gestational-diabetes-and-low-calorie-sweeteners-answers-common-questions>.

This publication includes information about the use of artificial sweeteners during pregnancy.

Exchange lists

<https://drc.ucsf.edu/living-with-diabetes/diet-and-nutrition/understanding-carbohydrates/counting-carbohydrates/carbohydrate-exchanges/>

Food Guide Pyramid with instruction on portion sizes

<http://www.diabetes.org/food-and-fitness/food/planning-meals/create-your-plate/>

The American Diabetes Association's Diabetes Food Pyramid groups foods based on carbohydrate and protein content.

Carbohydrate counting

<http://www.diabetes.org/food-and-fitness/food/what-can-i-eat/understanding-carbohydrates/carbohydrate-counting.html>

This webpage is written for families of children with diabetes, but describes how people may use carbohydrate counting as a component of management.

Substance Abuse

Guidelines for Screening for Substance Abuse During Pregnancy - Washington State Department of Health (note: this links to a pdf)

<https://www.doh.wa.gov/Portals/1/Documents/8350/950-135-PregSubs-en-L.pdf>

Fetal Alcohol Spectrum Disorders

For more information about Fetal Alcohol Spectrum Disorders, visit these websites:

- <http://depts.washington.edu/fasdpn/>
- <http://depts.washington.edu/fasdwa/>
- <http://www.cdc.gov/ncbddd/fasd/>

Drinking and Reproductive Health: A Fetal Alcohol Spectrum Disorders Prevention Tool Kit

This continuing education activity presents strategies to help health professionals identify women who drink and risky levels and engage them in changing behavior to reduce their risk for an alcohol-exposed pregnancy. Other materials include handouts for patients, screening tools, and counseling tips. Ordering information (no cost) at:

<https://www.acog.org/-/media/Department-Publications/FASDOrderForm.pdf?dmc=1&ts=20181128T2004548127>.

Quiz

1. Gestational diabetes is associated with increased risk of complications for the infant including:
 - a. hypertensive disorders
 - b. increased risk for type 1 diabetes
 - c. low birthweight, prematurity, and failure to thrive
 - d. macrosomia, neonatal hypoglycemia, and jaundice

2. Maternal risk factors for gestational diabetes include:
 - a. marked obesity
 - b. family history of diabetes
 - c. history of gestational diabetes
 - d. a and c only
 - e. all of the above

3. Medical management of gestational diabetes usually involves:
 - a. daily self-monitoring of blood glucose and medical nutrition therapy
 - b. daily self-monitoring of blood glucose and insulin
 - c. daily self-monitoring of blood glucose and oral glucose-lowering agents
 - d. medical nutrition therapy only

4. The California Sweet Success program suggests the following energy composition for management of gestational diabetes:
 - a. <35% total energy as carbohydrate, 30-40% as protein, 10-25% as fat
 - b. <45% total energy as carbohydrate, 15-20% as protein, 30-40% as fat
 - c. 60-70% total energy as carbohydrate, 15-20% as protein, 10-25% as fat
 - d. 65-75% total energy as carbohydrate, 10-20% as protein, 5-15% as fat

5. Post partum considerations for women with diabetes include all of the following, EXCEPT:
 - a. Family planning
 - b. Monitoring for hyperglycemia
 - c. Maintaining a healthy weight
 - d. Infant feeding, since breastfeeding is contraindicated

6. For most women, medical management of preeclampsia involves which of the following:

- a. antihypertensive medications
- b. early delivery
- c. monitoring of blood pressure, renal and liver function, and of the fetus
- d. supplemental sodium

7. A systolic blood pressure reading of >_____ mm Hg before 20 weeks gestation indicates increased risk of preeclampsia.

- a. 80
- b. 100
- c. 120
- d. 140

8. Which of the following statements is correct:

- a. Excessive dietary calcium intake may increase risk of hypertension during pregnancy.
- b. Restriction of dietary sodium will prevent preeclampsia.
- c. One study showed a link between a food pattern high in fiber, potassium, magnesium, and calcium and lower rates of preeclampsia.
- d. Many studies indicate that supplementation with vitamins C and E will reduce the risk of preeclampsia

9. Obesity increases the risk of some pregnancy complications. The best outcomes are associated with maternal weight gain that is:

- a. at the lower range of what is recommended for all pregnant women
- b. at the upper range of what is recommended for all pregnant women
- c. as low as possible or weight loss
- d. between 11-20 pounds

10. The goal of medical nutrition therapy for overweight and obesity is:

- a. weight loss
- b. weight maintenance
- c. weight gain that allows for adequate fetal growth
- d. weight gain of at least 40 pounds

11. Factors associated with low prenatal weight gain include all of the following EXCEPT:

- a. underweight
- b. obesity
- c. unwanted pregnancy
- d. smoking and alcohol use
- e. low socioeconomic status

12. Medical nutrition therapy for underweight should include which of the following:

- a. recommendations for decreasing physical activity
- b. use of an energy-dense supplement, such as Ensure
- c. assessment of the cause(s) for inadequate intake
- d. referral for an endocrine work-up

13. Because maternal-fetal nutritional status is a significant factor in moderating the impact of drug use on pregnancy outcome, diet assessment is important and should give special attention to which of the following:

- a. food availability, access to food, and food purchasing, storage, and preparation resources
- b. use of a prenatal vitamin supplement
- c. possible effects of substances on appetite
- d. all of the above

14. True or false: Women who are otherwise drug-free but who continue to smoke should be encouraged to breastfeed.

- a. true
- b. false

First Steps Nutrition Modules

Module 5 – Nutrition and the Postpartum Period

Introduction

The postpartum period is a critical one. Worldwide, most maternal deaths occur during the postpartum period. From a nutrition perspective, this period is critical to the health (and nutrition status) of the mother and infant, and to setting the stage for a healthy feeding relationship.

The World Health Organization (WHO) has published guidelines for postpartum care. (WHO, 2013) Many of the guidelines have implications for the nutrition professional, including guidelines for maternal nutrition, including supplementation, general diet, and prevention of micronutrient deficiencies. Guidelines for breastfeeding and infant nutrition are also published, and are covered in Module 7, Breastfeeding Assessment and Support and in Module 6, Nutrition and the Young Infant.

Postpartum care should be a collaboration between parents, families, caregivers, health professionals. Essential components of care include promotion of breastfeeding, contraceptive, nutritional advice and the physiological process of recovery including signs and symptoms of postpartum medical concerns including pre-eclampsia and eclampsia. (WHO, 2013) In addition to the benefits for the mother, child and family, nutrition intervention between pregnancies may improve the outcome of a subsequent pregnancy. (Louis et al, 2019)

Estimated time to complete this module: 60 minutes.

Learning Objectives

Participants will be able to:

- Describe basic nutrient needs during the normal postpartum period
- Identify risk factors during the postpartum period and describe the potential complications and nutritional implications associated with each risk
- Complete a nutrition assessment for a woman during the postpartum period (including evaluation of anthropometrics, biochemical indicators, dietary intake, medical data, psycho-social issues)
- Develop an individualized intervention and education plan (including weight goals, treatment/prevention of iron deficiency, general diet quality)
- Refer clients to appropriate members of the First Steps team and/or community providers, as appropriate

Outline

- I. INTRODUCTION
- II. CHANGES IN THE POSTPARTUM PERIOD
 - a. Summary of immediate postpartum physiologic changes
 - b. Summary of late postpartum changes
 - c. WHO Recommendations During the Postpartum Period
- III. NUTRIENT NEEDS IN THE POSTPARTUM PERIOD
 - a. Energy
 - b. Protein
 - c. Fat
 - d. Carbohydrate
 - e. Minerals
 - f. Vitamins
- IV. CONSIDERATIONS IN THE NUTRITIONAL ASSESSMENT
 - a. Anthropometrics
 - b. Biochemical Indicators
 - c. Dietary Intake
 - i. Guidelines
 - ii. Factors that affect an individual's intake
 - d. Medical Data
 - e. Psychosocial Issues
- V. DEVELOPING INTERVENTIONS
 - a. Weight goals
 - *Read more about the long-term effects of pregnancy weight gain and postpartum weight loss*
 - b. Iron deficiency
 - c. General diet quality
 - d. Vegetarian
 - e. Restrictive food pattern
- VI. CASE EXAMPLES
- VII. REFERENCES AND RESOURCES
- VIII. QUIZ

Changes in the Postpartum Period

The postpartum period is also called the “puerperium,” and it begins with the delivery of the baby and the placenta. The end of the postpartum period is generally considered to be 6-8 weeks after delivery (though some systems do not return to pre-pregnancy states for 12 months).

Summary of immediate postpartum physiologic changes

It can be helpful for the dietitian to have an understanding of some of the changes that occur in the immediate postpartum period. If problems persist past discharge, they may have nutrition implications. At the very least, a basic understanding of the client’s experience can make communication easier.

Skin-to-skin contact (mother and infant) is recommended, as soon after birth as possible. In addition to promoting breastfeeding initiation, this helps the infant maintain body temperature and glucose levels. After the baby is delivered, 25-50% of women experience chills and shivering, which may last up to an hour. Uterine involution begins, and the cervix, vagina, vulva, and abdominal wall begin to return to their pre-pregnancy states. Mean weight loss in this period is about 18-28 pounds (fetus, placenta, amniotic fluid, and other fluid). Rooming-in and on-demand infant feedings are current trends that promote breastfeeding initiation.

Complications that can occur in the immediate postpartum period include hemorrhage, preeclampsia/eclampsia, infection, urinary retention, adverse reactions to medications, thromboembolism, musculoskeletal pain, neuropathy, and persistent vaginal bleeding for greater than 8 weeks. (Berens, 2018)

Summary of late postpartum changes (after discharge from the hospital)

After the immediate postpartum period, the woman’s body continues the gradual transition toward its prepregnancy state. Lochia (the normal shedding of blood and tissue) can last for 6-8 weeks. Gonadotropins and sex steroids are decreased for the first 2-3 weeks postpartum, and if the woman is breastfeeding, menstruation is delayed. About half of the gestational weight gain is lost in the first 6 weeks, and weight loss continues for about 6 months postpartum.

Issues to be addressed in the postpartum period include contraception, underlying medical conditions (and recommendations for follow-up and screening), weight loss, infant feeding method, and patient mood. Recommendations for postpartum activity are generally for the mother to resume activities when she is comfortable performing them; she should not drive until she has stopped using narcotic analgesics.

Maternal issues in this period can include problems with sexual function (related to decreased libido, increase in vaginal atrophy, and decrease in lubrication), blues and depression, and abnormal thyroid function (hyper- and/or hypothyroidism). (Berens, 2018)

WHO Recommendations During the Postpartum Period

The World Health Organization has identified special needs of women in the postpartum period. Many of these needs have relevance to the dietitian. Some are covered in this module; others are discussed in Module 7, Breastfeeding Assessment and Support and in Module 6, Nutrition and the Young Infant.

Information/counseling on the following:

Topic	Possible Resources
Care of the baby and breastfeeding	<ul style="list-style-type: none"> • Modules 6 • Module 7
What happens to their bodies, including signs of possible problems	<ul style="list-style-type: none"> • https://kidshealth.org/en/parents/recovering-delivery.html?WT.ac=ctg • http://www.nlm.nih.gov/medlineplus/childbirth.html • Community Health Nurse
Self-care, hygiene, and healing	<ul style="list-style-type: none"> • Community Health Nurse • Behavioral Health Specialist • Dietitian
Sexual life	<ul style="list-style-type: none"> • Community Health Nurse • Behavioral Health Specialist • Dietitian
Contraception	<ul style="list-style-type: none"> • Community Health Nurse • Behavioral Health Specialist • Dietitian • Community Health Worker
Support from: <ul style="list-style-type: none"> • Health care providers • Partner and family: emotional, psychological 	<ul style="list-style-type: none"> • Community Health Nurse • Behavioral Health Specialist • Dietitian • Community Health Worker
Health care for suspected or manifest complications	<ul style="list-style-type: none"> • Community Health Nurse
Time to care for the baby	<ul style="list-style-type: none"> • Community Health Nurse • Behavioral Health Specialist • Dietitian
Help with domestic tasks	<ul style="list-style-type: none"> • Community Health Nurse • Behavioral Health Specialist • Dietitian • Community Health Worker
Maternity Leave	<ul style="list-style-type: none"> • Behavioral Health Specialist
Social reintegration into her family and community	<ul style="list-style-type: none"> • Community Health Nurse • Behavioral Health Specialist • Dietitian • Community Health Worker
Protection from abuse/violence	<ul style="list-style-type: none"> • Community Health Nurse • Behavioral Health Specialist

- | | |
|--|-------------|
| | • Dietitian |
|--|-------------|

Table 5-1. Special needs of women in the postpartum period

In addition to this, fears that women may have in the postpartum period may include (WHO, 2013):

- Inadequacy
- Loss of marital intimacy
- Isolation
- Constant responsibility of caring for the baby and others

Interventions for many of the specific needs can be supported by health care providers, including nutrition professionals.

KNOWLEDGE CHECK

Patients may have several concerns about the drastic life changes a baby brings during the postpartum period. What are some areas that dietitians can provide advice or help?

Possible answers:

Helping the mother focus on self-care, ensuring the mother is making time to eat properly, a plan to figure out how domestic tasks will be completed, like cooking or grocery shopping.

Nutrient Needs in the Postpartum Period

Recommendations for nutrient intake during the postpartum period are based on the following goals:

- Replenish nutrient stores, specifically, calcium, vitamin B6, and folate (IOM, 1992)
- Support requirements of lactation, when the woman is breastfeeding

Non-breastfeeding women

There are no nutrient intake guidelines for non-breastfeeding women that are specific to the postpartum period. In this case, it is reasonable to use the DRIs for nonpregnant women as the basis for nutrition therapy, with adjustments for situations that might affect needs.

Breastfeeding women

Recommendations for intake of selected nutrients during lactation are reviewed below. Higher intakes may be needed for women who are breastfeeding more than one infant. A summary table is available.

Requirements for some nutrients (e.g., fluoride and chromium) are thought to be unchanged by lactation. The increase in energy utilization increases needs for some nutrients (e.g., thiamin and niacin). Recommended intakes for other nutrients (e.g., copper, iodine, manganese, biotin, choline, riboflavin, and folate) are increased, based on the amount of the nutrient secreted in milk.

Recommendations for water intake (i.e., from food, beverages and drinking water) are increased during lactation from 3.0 liters per day during pregnancy to 3.8 liters during lactation. (2.7 liters per day is the recommended amount for women who are not pregnant.)

Guidelines for intake, based on Institute of Medicine recommendations and the Dietary Reference Intakes (DRI) are reviewed below and summarized in a table at the end of this section.

Practical guidelines for overall intake (including recommended portion sizes and number of servings) are included in later in this module.

Energy

For lactating women, recommendations for daily energy intake include an increase for breastmilk production (500 calories in the first 6 months, 400 calories after that) and a decrease for weight loss (170 calories in the first six months).

Protein

Although the protein concentration of breastmilk is not affected by protein intake, adequate intake is necessary to promote conservation of maternal skeletal muscle. A factorial approach was used to determine the RDA for protein during lactation; it was assumed that protein and amino acid requirements increase in proportion to milk production. It is estimated that 1.1 g protein per kg is needed per day (Cox and Carney, 2017)

Fat

The essential fatty acids linoleic (18:2 n-6) and alpha-linolenic acid (18:3 n-3) are important components of cell membranes and essential to the formation of new tissue. Long-chain derivatives of linoleic and alpha-linolenic acids (arachidonic – AA and docosahexaenoic – DHA acids, respectively), are important for neural development. (IOM, 2005) The AAP recommends that lactating women consume 200-300mg of DHA preferably from food sources. (AAP, 2012)

Carbohydrate

Recommendations for carbohydrate intake increase during lactation, because of increased needs for production of breastmilk. Women with poor gestation weight gain may require increased carbohydrates. (Cox and Carney, 2017)

Minerals

Calcium

The primary source of calcium in human milk seems to be from maternal bone resorption, and not maternal calcium intake. It is thought that this is a normal, physiologic adaptation, and that there are no long-term detrimental effects on maternal bone mass. Thus, the AIs for calcium during lactation are the same as AIs for women who are not lactating. (IOM, 2011)

Iron

Iron needs return to pre-pregnancy levels, unless blood loss exceeded the usual amount lost during a vaginal delivery (~500 mL). (IOM, 2001) In addition, the gradual disintegration of excess red blood cells releases iron that can be used for synthesis of new hemoglobin. (IOM, 1992) However, the WHO recommends supplementation of iron continues for 3 months after delivery. (WHO, 2015)

Zinc

Requirements for zinc during lactation are increased above pregnancy and nonpregnancy levels. (IOM, 2001)

Vitamins

Vitamin D

Although there is concern about vitamin D-deficient rickets in infants, the literature does not support routine supplementation for all lactating women. Most people can meet some of their vitamin D needs through sunlight exposure, however based on a variety of factors, sun exposure cannot be counted on to fully meet the vitamin D need, an Adequate Intake of 600 IU/day from dietary sources is needed. (IOM, 2011) Studies found that a daily dose of 6400 IU of vitamin D is safe and provides enough vitamin D for production of milk that meets adequate intakes for the child and mother. (Cox and Carney, 2017)

Vitamin A

To assure adequate body stores of vitamin A, the RDA for vitamin A is increased above that for non-pregnant women. (IOM, 2001)

The upper limit for vitamin A intake for lactating women is the same as for nonpregnant and pregnant women (2800 µg preformed vitamin A per day for 14-18 year olds, and 3000 µg preformed vitamin A for 19-50 year olds).

Vitamin B6

There is evidence that low maternal intakes could lead to compromised B6 status in the infant, so an increased intake is suggested for lactating women.

Vitamin B12

As with pregnancy, it is thought that vitamin B12 concentrations in breastmilk are more reflective of the mother's current B12 intake than of B12 stores. The RDA for B12 during lactation is based on prepregnancy requirements and the amount of the vitamin secreted in breastmilk.

Vitamin B12 intake of women who are strict vegetarians may be marginal and require supplementation.

KNOWLEDGE CHECK

A lactating mother has different nutrient needs than a mother that chooses to formula feed their infant. What nutrients are of concern for lactating mothers?

Possible answers:

Vitamin A, Vitamin B12, Vitamin D, Vitamin B6, carbohydrate intake, zinc.

What nutrients could be of concern postpartum regardless of breastfeeding status?

Possible answers:

Iron (depending on iron status during pregnancy and blood loss during delivery), Vitamin B12 (dietary restrictions such as vegetarian/vegan)

Intake Recommendations for Selected Nutrients in the Postpartum Period

The Dietary Reference Intakes include recommendations for intake during lactation. Separate recommendations are not included for women who are not breastfeeding; the DRIs for healthy women are included in this table.

<i>Nutrient</i>	<i>Recommend Intake for Lactating Women</i>	<i>Recommended for non-lactating women</i>	<i>Comments</i>
Energy	1st 6 months – additional 330 calories per day 2nd 6 months – additional 400 calories per day	EER, based on weight, height, physical activity level, and age	Example 1 listed below
Water	3.8 liters per day	14-18 years – 2.3 liters per day 19-30 years – 2.7 liters per day 31-50 years – 2.7 liters per day	
Protein	All age groups: 1.3 g protein per kilogram per day or + 25 grams protein per day	0.8 g protein per kilogram per day	Example 2 listed below
Carbohydrate	All age groups: 210 g per day	All age groups: 130 g per day	(45-60% of total energy intake)
Calcium	14-18 years – 1300 mg per day 19-30 years – 1000 mg per day	14-18 years – 1300 mg per day 19-30 years – 1000 mg per day	Food sources listed below

	31-50 years – 1000 mg per day	31-50 years – 1000 mg per day	
Iron	14-18 years – 10 mg per day 19-30 years – 9 mg per day 31-50 years – 9 mg per day	14-18 years – 15 mg per day 19-30 years – 18 mg per day 31-50 years – 18 mg per day	Food sources listed below
Zinc	14-18 years – 13 mg per day 19-30 years – 12 mg per day 31-50 years – 12 mg per day	14-18 years – 8 mg per day 19-30 years – 8 mg per day 31-50 years – 8 mg per day	Recommendations during lactation are increased above pregnancy and non-pregnancy levels
Vitamin D	All age groups: 15.0 µg (600 IU) per day	All age groups: 15.0 µg (600 IU) per day	
Vitamin A	14-18 years – 1200 µg per day 19-30 years – 1300 µg per day 31-50 years – 1300 µg per day	All age groups: 700 µg per day	Food sources listed below
Vitamin B6	All age groups: 2.0 mg per day	14-18 years – 1.2 mg per day 19-30 years – 1.3 mg per day 31-50 years – 1.3 mg per day	Food sources listed below
Vitamin B12	All age groups: 2.8 mg per day	All age groups: 2.4 µg per day	

Example 1: The energy requirement for a 25-year old woman who weighs 50 kg, is 165 cm tall, and is moderately active is estimated to be 2000 kcal. Her energy needs during lactation are estimated to be:

- 1st 6 months: $2000 + 330 = 2330$
- 2nd 6 months: $2000 + 400 = 2400$

If she is not breastfeeding, her estimated energy needs remain around 2000 kcal.

Example 2:

The protein requirement for a 25-year old woman who weighs 50 kilograms, is estimated to be about 65 grams per day:

- $1.3 \times 50 = 65$
- $(0.8 \times 50) + 25 = 65$

Food sources of calcium:

- milk, milk products
- legumes, nuts, dried fruits
- dark leafy green vegetables – kale, cabbage, collards, turnip greens
- spinach, chard, beet greens – bound with oxalic acid, making the calcium unavailable

Food sources of iron:

- red meat
- seafood
- poultry
- dried beans
- blackstrap molasses

Food sources of vitamin A:

- sweet potato
- carrots
- spinach
- squash
- mixed vegetables
- apricots

Food sources of vitamin B6:

- fortified cereals
- mixed foods with meat, fish, or poultry as the main ingredient
- white potatoes and other starchy vegetables
- non citrus fruits

Considerations in the Nutritional Assessment

Anthropometrics

Good reference data for body composition during lactation and the postpartum period are not available. Women lose approximately 13 pounds during delivery and another 5-15 pounds puerperium. The average rate of weight loss by lactating women (after the initial rapid weight loss in the first few weeks postpartum) is 0.5 to 1.0 kg per month for the first 6 months. This is highly variable, however. Patterns of weight loss among adolescents are even more variable but adolescents are at a higher risk of postpartum weight retention. This is probably related to differences in pre-pregnancy growth status and gestational weight gain patterns. (Berens, 2018)

Postpartum weight retention is associated with several factors, including excessive weight gain during pregnancy, Black race, obesity, quitting cigarette smoking. (Berens, 2018)

Clinical judgment should be used when evaluating the weight and body mass index (BMI) in the postpartum period. Questions to consider include:

- What was the client's prepregnancy weight? BMI?
- What was her rate of weight gain during pregnancy?
- What are her goals for weight?

Risk factors for poor nutrition status include:

- Underweight (e.g. low weight-for-height or BMI) (IOM, 1991)
- Excessive weight gain during pregnancy
- Unrealistic (or excessive) weight loss goals

Biochemical Indicators

The use of biochemical indicators in the postpartum period can be limited. Again, clinical judgment is critical in the assessment process – when the use of a biochemical marker is indicated, the clinician should consider how postpartum and/or lactation might affect the level. In addition, any risk factors identified during pregnancy (e.g., diabetes, hypertension) should receive follow-up attention.

The Centers for Disease Control and Prevention (CDC) recommend that hemoglobin or hematocrit should be measured for women at risk for anemia at 4-6 weeks postpartum. Varying recommendations include testing only on based on symptoms and risk factors that may suggest anemia. (Auerbach and Landy, 2018) Risk factors include:

- anemia continued through the third trimester
- excessive blood loss during delivery

- ongoing vaginal bleeding after birth
- fatigue
- depressed mood
- exercise intolerance
- pallor
- multiple birth

CDC guidelines call for measurement of hemoglobin or hematocrit and comparison to nonpregnant women for evaluation.

<i>Age</i>	<i>Hematocrit*</i> (%)	<i>Hemoglobin*</i> (g/dL)
<15 years	>35.7	>11.8
15-18 years	>35.9	>12.0
>18 years	>35.7	>12.0
CDC. Recommendations to Prevent and Control Iron Deficiency in the United States. MMWR. April 3, 1998 / 47 (RR-3); 1-26. Accessed 05/16/2006.		
* Low levels may indicate iron deficiency. High values (Hct >45.0% or Hgb >15.0 g/dL) in the 2nd trimester or later may indicate poor blood expansion.		
Exceptions: Race-based differences in hemoglobin concentration and hematocrit levels have been documented; the Institute of Medicine suggests lowering cutoff values for black adults (by 2% for hematocrit and 0.8 g/dL for hemoglobin).		
Smoking may falsely elevate hemoglobin and hematocrit and mask anemia. The CDC recommendations suggest adjusting the cutoffs for hemoglobin and hematocrit, based on smoking level.		

Table 5-2. Guidelines for evaluating indicators of iron status in the postpartum period

	<i>Hematocrit*</i> (%)	<i>Hemoglobin*</i> (g/dL)
> 2.0 packs per day	2.0	0.7
All smokers	1.0	0.3
CDC. Recommendations to Prevent and Control Iron Deficiency in the United States. MMWR. April 3, 1998 / 47 (RR-3); 1-26. Accessed 05/16/2006.		
Adjustment of maximum hematocrit values and hemoglobin concentration for anemia, based on smoking. (Smoking increases hemoglobin/hematocrit)		

Table 5-3. Adjustment of maximum hematocrit values and hemoglobin concentration for anemia, based on smoking

For women that have anemia and are treated with iron repletion, ferritin and percent transferrin saturation levels should be tested 2-3 weeks later to confirm repletion. (Auerbach and Landy, 2018)

Dietary Intake

Evaluation of dietary intake involves the same general process during the postpartum period as was used during pregnancy. (See Module 3, Nutrition Assessment)

Guidelines

For the non-lactating woman, guidelines for intake should be consistent with general recommendations for women, and may include considerations for weight loss.

See the Table below for a sample meal pattern. Nutrients of concern for adult women in general include iron, calcium, folic acid, zinc, and vitamin D. (AND, 2014)

Sample Meal Pattern

This food pattern provides approximately 2000 calories, 100 grams protein, 1000 mg calcium, and 20 mg iron.

Breakfast	1 large whole grain bagel 2 Tablespoons cream cheese 1 banana 8 ounces milk
Snack	1 ½ ounces cheddar cheese 10 crackers
Lunch	¼ cup chicken salad 2 cups green salad 2 Tablespoons Italian salad dressing 1 roll with 1 Tablespoon butter
Dinner	½ cup rice 4 ounces lean beef 1 cup stir-fried vegetables ½ cup vanilla ice cream

Table 5-4. Sample meal pattern – postpartum period

Lactation increases the need for some nutrients. A general estimate is that intake should be increased to cover the cost of lactation – by about 10% if a woman is not active, or 20% or more if she is moderately or very active. WHO suggests an emphasis on high-protein, energy-dense foods and encouraging foods rich in iron.

In the US, lactating women whose intakes meet recommendations for energy intake, usually meet recommendations for all nutrients except calcium and zinc. Well-nourished

lactating mothers should increase energy needs by 450-500 kcal/day with nutrient needs similar to or greater than in pregnancy. Despite this increase in nutrient needs, no routine recommendation for use of maternal supplements exist. Some doctors may recommend continued use of prenatal vitamins. (AAP, 2012) The content of some vitamins and minerals will vary in breastmilk based on maternal intake, as result nutrients of concern include vitamin A, vitamin D, vitamin B12, folate, vitamin B6, selenium, and iodine. (Butte and Stuebe, 2018)

Factors that affect an individual's intake

Factors that affect an individual's intake (and readiness for intervention) were reviewed in Module 3, Nutrition Assessment. These are important factors in the postpartum period as well, and include the goals of the woman and her family, the home and work environment, food security, and family and cultural beliefs and attitudes about nutrition, eating, and parenting.

Risk factors include:

- Food insecurity and/or an inadequate food supply
- Restrictive food pattern for rapid weight loss (See discussion below)
- Vegetarianism (See discussion below)
- Lactose intolerance
- Limited support system
- Domestic abuse
- Psychological stresses; disinterest in healthy eating practices
- Negative feelings about parenting
- Beliefs/practices related to food and eating (cultural, regional, etc.)
- Low level of mastery or self esteem
- Fatigue
- Loss of appetite
- Excessive intake

Medical Data

Chronic medical conditions or conditions that were acquired during pregnancy may affect the nutritional status of a woman in the postpartum period. The health status of women who experienced complications during pregnancy should be reassessed in the postpartum period. For example:

- Gestational diabetes: blood glucose levels should be reevaluation 4-12 weeks postpartum (ADA, 2018)
- Preeclampsia: evaluate blood pressure and renal status (Norwitz, 2019)
- Hemorrhage associated with delivery: evaluate iron status (increased risk for anemia) (Auerbach and Landy, 2018)

See Module 4, Medical Nutrition Therapy for Specific Conditions for more information.

Medical **risk factors** were summarized in Module 3. In general, nutrition risk factors can include:

- Chronic diseases and disorders
- History of mental illness or depression
- Oral health, dental issues
- Observable injuries, old or new
- Past or present use of tobacco, alcohol, drugs
- Medication-nutrient interactions
- Inappropriate use of vitamins, minerals, herbs

Psychosocial Issues

Considerations related to psychosocial issues are reviewed in Module 3 and apply to the postpartum period as well. The clinician should also consider emotional lability (especially symptoms of mild depression). In addition to the overall health and well-being of the mother and family, this can have specific nutrition-related implications. Consider the effects on appetite, access to food, and sleeping/eating habits. (Viguera, 2018)

KNOWLEDGE CHECK

There is no blanket recommendation for continued supplementation postpartum. What are some instances in which a practitioner may recommend the continued use of a prenatal vitamin postpartum?

Possible answers:

Underweight prior to pregnancy, extremely restrictive diet due to desire for weight loss, restrictive diet due to dietary preferences (vegetarian/vegan), patient with a limited support system that is not prioritizing self-care/health.

Developing Interventions

During the postpartum period, women are adjusting to a new role, especially if breastfeeding. They are tired and may not have support from their families or friends. In addition, they are adjusting to a new, postpartum body and typically have decreased appetites. It is important to be aware of these issues and provide support in the assessment process and as interventions are developed. Help the client to develop realistic goals that she feels she can achieve. Recommendations may incorporate the following:

- Small, frequent meals
- Meals that are easy to prepare
- Use of a multivitamin
- A discussion about weight – how does she feel about her postpartum body? If weight loss is a concern, talk about safe weight loss and support (e.g., WIC, parent support groups)

Some plans that address common issues for women in the postpartum period are reviewed in this section:

Weight Goals

The rate of weight loss in the postpartum period is highly variable. Healthy women who are breastfeeding can safely lose up to 1 pound per month and maintain an adequate milk supply. Slow weight loss of no more than 5 pounds/month supports more permanent weight loss and adequate energy and nutrition. Breastfeeding mothers should be advised to wait until breastfeeding has been established for about 2 months before actively trying to lose weight. (Cox and Carney, 2017) The energy intake to achieve this can be estimated, with considerations for the woman's height and activity level, and whether or not she is breastfeeding. (See previous section.)

It is the role of the health care team to help a woman identify a reasonable body weight goal and develop a plan for achieving that goal. Some tools and resources for helping clients with this include the following:

- <https://www.womenshealth.gov/getting-active>
- <http://www.parenthelp123.org/pregnancy/healthy-for-life>

Read more: about the long-term effects of pregnancy weight gain and postpartum weight loss

A study examined the effects of prepregnancy weight, gestational weight gain, postpartum weight changes, and breastfeeding status on maternal weight and BMI adjusted waist circumference at 7 years after delivery. Researchers looked at a prospective cohort of 23,701 women with singleton births and no births during follow up. Subjects were interviewed to determine weight at 6 months postpartum, 18 months postpartum, and a follow up questionnaire was used at 7 years after the index delivery for weight and waist circumference. (Kirkegaard et al, 2014)

The most significant predictor of increased maternal weight at 7 years postpartum was a high gestational weight gain resulting in increased weight retention. Weight retention at 6 months postpartum and weight gain between 6-18 months postpartum independent of gestational weight gain also had an effect on weight and waist circumference 7 years later.

Breastfeeding had a small inverse association with both weight and waist circumference at 7 years postpartum. The result of breastfeeding had a slightly stronger effect on waist circumference than weight.

The researchers concluded that:

- *High gestational weight gain increases maternal weight 7 years later primarily by causing an increase in postpartum weight retention.*
- *Postpartum weight retention at 6 months and weight gain from 6-18 months postpartum contribute to increase weight and waist circumference at 7 years after delivery.*
- *Breastfeeding duration may have a beneficial effect.*

Iron Deficiency

Treatment for iron-deficiency anemia includes an oral iron supplement (60-120 mg per day) and counseling about obtaining iron through diet. WHO recommends continued supplementation of folate and iron for 6-12 weeks after delivery. (WHO, 2017) Other recommendations include stopping supplemental iron if there is no risk factors or anemia present. (Auerbach, Landy, 2018)

- Pump up the iron!

General Diet Quality

Some guidelines for evaluating the general diet quality of women in the postpartum period are described previously. Tools and resources to help plan interventions to improve overall diet quality and/or address specific nutrient needs are listed below:

- “Congratulations, Mom. You have a beautiful baby.” This brochure explains why folic acid is important even after childbirth and reminds new mothers to take a multiple vitamin with folic acid every day. Tips on postpartum self-care, such as getting enough rest; finding time to relax; and eating a healthy, varied diet are presented. The brochure is available in English
https://www.cdc.gov/ncbddd/orders/pdfs/Congrats_Mom_Brochure_English508.pdf
and Spanish
https://www.cdc.gov/ncbddd/orders/pdfs/Congrats_Mom_Brochure_Spanish508.pdf

In addition, the postpartum period may present a good opportunity to promote healthful eating for the entire family. The clinician can provide general information about meal planning, food preparation, and food choices that can benefit the entire family. (IOM, 1992) Some general nutrition resources include the following:

- Healthy Choices for Kids
- Eat Better, Eat Together materials, including brochures: 10 Tips for Quality Family Meals, Family Meals with Growing Children, Healthful Meals. Available from Washington State University, Nutrition Education: <https://extension.wsu.edu/benton-franklin/health/nutrition/>

Vegetarian

Women who follow vegetarian food patterns may have inadequate intakes of specific nutrients. Depending on the foods consumed, special attention (and/or supplements) may be required to ensure adequate intakes of protein, iron, vitamin B12, zinc, and calcium. (See the Table in Module 2, Nutrition and Normal Pregnancy for more detail about specific nutrients and vegetarian food patterns.)

- 10 Tips for Vegetarians: <https://choosemyplate-prod.azureedge.net/sites/default/files/tentips/DGTipsheet8HealthyEatingForVegetarians.pdf>
- Vegetarian Nutrition Dietetic Practice Group of the American Dietetic Association <https://vndpg.org/>
- Vegetarian Resource Group <http://www.vrg.org>.
- Mangels R, Messina V, Messina M. The Dietitian's Guide to Vegetarian Diets, 3rd ed. Boston, MA: Jones and Bartlett Publishers, 2011.

Restrictive Food Patterns

Food patterns may be restrictive for other reasons, including the client's desire to lose weight rapidly. Intakes of nutrient-rich foods (food rich in protein, vitamins, and minerals) should be encouraged, especially if energy intake is less than 1800 calories per day. (IOM, 1991)

KNOWLEDGE CHECK

Case Examples

Case Example: Kayla

Kayla is a 20-year-old single woman, who initially came to her local WIC office seeking food assistance. She found an apartment and moved in about a month before her infant (Skylar) was born. Skylar is healthy. Kayla will return to work the night shift at a convenience store in 2 weeks, and a friend has agreed to watch Skylar while Kayla works. She is not sure how this will work because she is already very tired. Money is very tight, and Kayla still has problems finding enough food at the end of the month. She is looking forward to losing the weight that she gained during pregnancy.

Kayla described a usual day's intake:

- Breakfast: coffee, cereal with milk (though she often skips breakfast)
- Snack: Poptart
- Lunch: peanut butter sandwich
- Dinner: fast food (usually a hamburger value meal with french fries and a soda)

What concerns do you have about Kayla's nutritional status?

Kayla's food pattern indicates risk of deficiency for several nutrients, (based on her description of a usual day's intake and her comment about being very tired).

Other "red flags" include:

- food insecurity (not having enough money for food at the end of the month)
- upcoming return to work may make healthy food selection even more difficult

What will you incorporate into the nutrition care plan?

Counseling should include information about general diet quality and address concerns about specific nutrients. A discussion about expectations for weight loss and infant feeding methods is also indicated.

The dietitian could discuss a healthy approach to eating. If a mother is already run down and tired she needs to be careful about an overly restrictive food pattern. Without adequate nutrition, she could become even more tired, and with the added stress of working could increase her risk of becoming sick. The discussion could include meal planning strategies that will help Kayla get easy nutritious meals and still allow for some weight loss.

The care plan might also include referrals, including:

- for medical insurance for Skylar
- resources for food

- other resources (e.g., community resources that provide diapers and other infant items)

Case Example: Yolanda

Yolanda is a 30-year old woman who had an uncomplicated pregnancy, labor, and delivery. She is currently breastfeeding and offering some supplemental formula. Yolanda says that she is overwhelmed. She is tired and doesn't have time to cook meals for herself, so she snacks a lot. Yolanda is very worried about her baby's well-being. She says, "I would never do anything to hurt my baby, but I have these panic attacks where I've left her somewhere."

What concerns do you have about Yolanda's nutritional status?

Yolanda's food pattern (snacking vs. scheduled meals and snacks) may be putting her at risk. Nutrition-related risk factors for Yolanda also include being tired and overwhelmed; this can interfere with her ability to make healthy food choices.

What concerns do you have about other (non-nutrition) issues?

Yolanda's concerns about her infant's well-being and "panic attacks" are red flags. Feeling overwhelmed and tired are also indicators that she might need additional help.

What will you incorporate into the nutrition care plan?

The nutrition care plan should include:

- counseling about general diet quality
- discussion of expectations for weight loss
- referral to behavioral health specialist because of concerns about postpartum depression
- discussion about the need to monitor the infant's nutritional status

References and Resources

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Resources

Changes in the Postpartum Period

Recovering from Delivery - KidsHealth for Parents website, Nemours Foundation
<https://kidshealth.org/en/parents/recovering-delivery.html?WT.ac=ctg>

Medline Plus- Childbirth

<http://www.nlm.nih.gov/medlineplus/childbirth.html>

General Diet Quality

Pump up the iron! <https://www.doh.wa.gov/Portals/1/Documents/8100/961-194-WICiron-en-L.pdf>

Congratulations, Mom. You have a beautiful baby - This brochure explains why folic acid is important even after childbirth and reminds new mothers to take a multiple vitamin with folic acid every day. Tips on postpartum self-care, such as getting enough rest; finding time to relax; and eating a healthy, varied diet are presented. The brochure is available in English

(http://www.nbdpn.org/archives/2006/2006pdf/NTDpostpartum_hr_eng.pdf) and Spanish (http://www.nbdpn.org/archives/2006/2006pdf/NTDpostpartum_hr_span.pdf)

Eat Better, Eat Together materials, including brochures: 10 Tips for Quality Family Meals, Family Meals with Growing Children, Healthful Meals. Available from Washington State University, Nutrition Education: <https://extension.wsu.edu/benton-franklin/health/nutrition/>

Vegetarian

10 Tips for Vegetarians: <https://choosemyplate-prod.azureedge.net/sites/default/files/tentips/DGTipsheet8HealthyEatingForVegetarians.pdf>

Vegetarian Nutrition Dietetic Practice Group of the American Dietetic Association
<https://vndpg.org/>

Vegetarian Resource Group <http://www.vrg.org>.

Messina V, Mangels R, Messina M. **The Dietitian's Guide to Vegetarian Diets**, 3rd ed. Boston, MA: Jones and Bartlett Publishers, 2011.

Quiz

1. True or false: Rooming-in and on-demand infant feedings are current trends that promote breastfeeding initiation.
 - a. true
 - b. false

2. In general, recommendations for postpartum activity are for the mother to:
 - a. resume activities as soon as possible
 - b. resume activities after 6 weeks
 - c. resume activities when she is comfortable performing them
 - d. postpone resuming activities for as long as possible

3. In general, about ____ of gestational weight is lost in the first 6 weeks, and weight loss continues for about __ months postpartum.
 - a. half, 6
 - b. half, 3
 - c. one-quarter, 2
 - d. one-quarter, 4

4. A discussion about emotional and psychological support from the woman's partner and family is suggested by the WHO. Which of the following First Steps providers might include this discussion as part of the visit?
 - a. Community Health Nurse
 - b. Behavioral Health Specialist
 - c. Dietitian
 - d. All of the above

5. According to the IOM, recommendations during the postpartum period include replenishing stores of which of the following nutrients:
 - a. energy, calcium, and iron
 - b. calcium, vitamin B6, and folate
 - c. magnesium, calcium, and iron
 - d. calcium, and vitamin B12

6. The AI for calcium during lactation is _____ AI for women who are not lactating.
- a. higher than
 - b. lower than
 - c. the same as
 - d. dependent upon how long the woman is planning to breastfeed
7. For most women, iron needs during lactation are _____ pre-pregnancy levels.
- a. higher than
 - b. lower than
 - c. the same as
 - d. dependent upon how long the woman is planning to breastfeed
8. The CDC recommends that screening for iron deficiency anemia at 4-6 weeks postpartum for which of the following groups:
- a. all women
 - b. women who smoke
 - c. women with anemia during the third trimester
 - d. none of the above; the recommendation is for routine iron supplementation (18 mg per day)
9. Recommendations during the postpartum period may include all of the following, EXCEPT:
- a. Small, frequent meals
 - b. Meals that are easy to prepare
 - c. Planning for weight loss
 - d. The need for a high protein (e.g., 2.5 g/kg) food pattern

First Steps Nutrition Modules

Module 6 – Nutrition and the Young Infant

Introduction

Early nutrition status is important to a child's growth, and to the development of motor and cognitive skills.

The Institute of Medicine's (IOM's) Nutrition Services in Perinatal Care, 2nd edition calls for several actions by health care providers that are related to nutrition. Many of these are within the scope of practice of the Registered Dietitian. (IOM, 1992)

The health care provider should:

- Offer or organize structured programs to provide information about infant feeding choices to pregnant women and their partners and to support breastfeeding
- Evaluate and manage the nutritional care of the infant:
 - Screen for nutrition-related problems, such as PKU, over- or under-feeding, inappropriate feeding or nutrient supplements, and abnormal patterns of growth
 - Measure, monitor, and assess infant growth
 - Assure the mother is getting accurate and appropriate breastfeeding support and breastfeeding is going well
 - Provide instructions for the safe preparation of infant formula, feeding instructions, and anticipatory guidance for the primary caregiver and others as appropriate
 - Address feeding practices to prevent the development of tooth decay in infants
 - Determine the need to adjust feeding strategies, formula (if used), and vitamin-mineral supplements
 - Adjust recommendations to treat food- and nutrition-related problems of the infant, such as overnutrition, undernutrition, anemia, and allergies
 - Consult with specialists concerning complex nutritional challenges and make referrals as necessary
- Provide for continuity of nutritional care – referral to and communications with outpatient and home health services, and parental support groups, as well as referral to local agencies with food and nutrition programs

This module reviews the process of nutrition assessment for the young infant. Nutrient needs are discussed, and interventions for some common nutrition-related problems are reviewed.

Estimated time to complete this module: 60 minutes.

Learning Objectives

Participants will be able to:

- Describe basic nutrient needs during normal the first 2 months of life
- Identify risk factors during first 2 months of life and describe the potential complications and nutritional implications associated with each
- Complete a nutrition assessment for a young infant (including evaluation of anthropometrics, biochemical indicators, dietary intake, medical data, psycho-social issues)
- Develop an individualized intervention and education plan
- Refer clients to appropriate members of the First Steps team and/or community providers, as appropriate

Outline

I. INTRODUCTION

II. NUTRIENT NEEDS DURING THE FIRST TWO MONTHS OF LIFE

- *Read more: How we have learned about nutrient deficiencies in infancy*
- a. Energy
- b. Protein
- c. Fat
- d. Carbohydrate
- e. Water
- f. Minerals: iron, zinc
 - *Read more: Iron and the Older Infant*
 - *Read more: Whole Milk and Iron*
- g. Vitamins: Vitamin K, Vitamin B12, Vitamin D
 - *Read more: Oral Vitamin K*
- h. Overall guidelines

III. CHANGES TO NUTRIENT NEEDS AFTER TWO MONTHS OF LIFE

- a. Fat and Fatty Acids
- b. Iron
- c. Zinc
- d. Vitamin D
- e. Introduction of complementary foods – preliminary discussions with family
 - i. Developmental readiness
 - What can I expect my baby to do as he grows?
 - ii. Introduction of complementary foods
 - iii. Introduction of cow's milk
 - iv. Use of honey (botulism)
 - v. Continued development of a healthy feeding relationship

IV. DIET-RELATED CONCERNS

- a. Breastfeeding
 - i. Benefits
 - ii. Contraindications
 - iii. Composition of breastmilk
 - iv. Initiating and continuing breastfeeding
 - v. Maternal diet
- b. Breastmilk and Infant Formulas
 - i. Human milk
 - *Read more: Ten Steps to Successful Breastfeeding*
 - ii. Commercial infant formula: standard, soy-based, protein hydrolysate, elemental, low-iron, premature and human milk fortifiers

- c. Formula preparation
- d. Common concerns

V. CONSIDERATIONS IN THE NUTRITION ASSESSMENT

- a. Anthropometrics
 - i. Expected growth pattern
 - ii. Growth charts
 - *Read more: Preterm Growth Charts*
- b. Biochemical indicators
- c. Dietary intake
- d. Clinical and Medical Data
 - i. Infant elimination patterns
 - ii. Medical conditions
- e. Psycho-social Issues
 - Interview Questions for Parents of Young Infants
 - Nutrition Counseling Messages for Parents of Young Infants

VI. NUTRITION QUESTIONNAIRE FOR INFANTS

VII. REFERRAL RESOURCES

VIII. CASE EXAMPLES

IX. REFERENCES AND RESOURCES

X. QUIZ

Nutrient Needs During the First Two Months of Life

This section reviews the nutrient needs of young infants and some general guidelines around nutrient intake.

In general, the Dietary Reference Intakes (DRIs) for young infants (0-6 months) were set using information about average intake and composition of breastmilk by healthy, term infants. This information, intake of complementary foods, and some data about nutrient absorption and deficiency were used to set DRIs for older infants. The DRIs for older infants (7-12 months) are included in this section for comparison and to aid in understanding of the recommendations.

This information is summarized in a table.

Nutrient	0 to 6 Months	7 to 12 months
Protein (g/kg/d)	1.52	1.2
Carbohydrate (g/d)	60	95
Total Water (L/d)	.7	.8
Fat (g/d)	31	30
Linoleic Acid (g/d)	4.4	4.6
α-Linolenic Acid (g/d)	.5	.5
Iron (mg/d)	.27	11
Zinc (mg/d)	2	3
Vitamin D (IU)	400	400
Vitamin K (μg/d)	2.0	2.5
Vitamin B12 (μg/d)	.4	.5
IOM 2011 (DRI for Calcium and Vitamin D), IOM 2006 (DRI: The Essential Guide to Nutrient Requirements)		

Bold type indicates Recommended Daily Allowance, normal type indicates Adequate Intakes

Table 6-1 Dietary Reference Intakes: Recommended Dietary Allowances and Adequate Intakes

Read more: How we have learned about nutrient deficiencies in infancy

While most nutrient recommendations for young infants are based on the amounts and types of nutrients provided by breastmilk, some knowledge of thresholds for and effects of single nutrient deficiency in infants comes from a variety of “mistakes.”

An understanding of the effects of chloride deficiency comes from studies of infants who consumed formulas that were produced incorrectly, with low chloride content. Symptoms included growth failure, lethargy, irritability, anorexia, gastrointestinal symptoms, and weakness. Long-term studies (9 to 10 years later) indicated that the effects of early growth retardation had resolved, cognitive skills appeared normal, but some deficits in language skills were present in some children. (IOM, 2004)

Energy

In general, healthy infants are able to adjust their intakes to meet energy needs. Recommendations for energy intake were updated in 2005 and are about 15% lower than previous guidelines.

Recommendations are based on studies using doubly-labeled water. Although age, sex, length, and feeding method also influence energy needs, an equation using only weight was found to accurately predict total energy expenditure.

Protein

Protein needs (per kilogram body weight) are highest during infancy because of needs for rapid growth. Some amino acids (tyrosine, cystine, taurine) may be essential for premature infants.

Fat and fatty acids

Total fat provides about 55% of total energy intake for infants under 6 months of age. The most common sources of fat in infant formulas are soybean, safflower, sunflower, coconut, and palm oils. The fatty acid composition of breastmilk varies, depending on the mother's diet.

Deficiency of n-6 fatty acids has been linked to skin lesions and poor growth in formula-fed infants. The AI for n-6 fatty acids is higher for infants and children than for adults – about 8% of total energy intake for 0-6-month olds. The primary source of n-6 fatty acids in infant formula is linoleic acid.

The AI for n-3 fatty acids is about 1% total energy intake for young infants, and slightly less for older infants. Breastmilk concentrations of n-3 fatty acids vary, depending on maternal diet. Most formula manufacturers in the US add DHA to infant formulas. Arachidonic acid (ARA) is also added; formulas supplemented with DHA but no ARA have been associated with growth delays.

Carbohydrate

Carbohydrate intake of infants is estimated to be about 37 percent of total energy intake. The carbohydrate in human milk and milk protein-based formulas for term infants is almost exclusively lactose. Conventional infant formulas also contain sucrose or glucose polymers.

Water

Infants have higher total body water content (per kg of body mass) than children and adults and higher rates of water turnover. In addition, a limited ability to sweat, excrete solutes, and express thirst make attention to fluid intake very important. As with most

nutrients, recommendations for water intake are based on the amount consumed with an average intake of breastmilk.

Dehydration can result from improperly prepared formula, boiled formula, inadequate breastmilk intake, vomiting, and diarrhea. Symptoms of dehydration include decreased urination, concentrated urine (e.g., dark yellow), lack of tears, dry skin/mouth/tongue, lethargy or listlessness, sunken eyes, sunken fontanel.

Water intoxication can result from excessively dilute formula, water instead of milk or formula, and bottled water instead of electrolyte solution as treatment for diarrhea. Symptoms of water intoxication include hyponatremia, restlessness, nausea, vomiting, diarrhea, polyuria/oliguria, and seizures. (McKean and Mazon, 2017)

Minerals

In general, recommendations for mineral intakes for young children are based on average intakes of breastmilk. Unless a special medical need changes an infant's ability to metabolize a mineral or significantly affects overall intake, breastmilk and/or standard, iron-fortified infant formula should meet an infant's mineral needs.

Iron

Iron deficiency anemia is associated with cognitive and motor impairments in infants. For term infants whose mothers did not have iron deficiency anemia, iron stores are high at birth. Iron in breastmilk is significantly more bioavailable in human milk (45-100%) than in infant formula (10%).

Both iron intake (amount of breastmilk and/or formula) and iron requirements are related to body size and growth rate. It is expected then, that the needs of most infants will be met if their overall intakes are primarily breastmilk or iron-fortified infant formula and are adequate to support appropriate growth. Iron needs of infants born prematurely may be higher, since the majority of iron accretion occurs during the last trimester of pregnancy and preterm infants experience more rapid postnatal growth than infants born at term. Additionally, preterm infants are potentially exposed to more blood draws that require lab monitoring to ensure that iron stores are not depleted. Supplemental iron (2 mg/kg/day) starting at age 1 month is recommended for preterm infants who are breast fed. Supplementation for formula fed preterm infants may be necessary but no general recommendations exist. (AAP 2010)

Read more: Iron and the older infant

Unlike many nutrients, estimations of iron requirements for older infants involve a factorial approach, looking at the components of iron need, including the following, as well as the bioavailability of dietary iron:

*Basal losses (through feces, urine, and skin)
Increase in hemoglobin mass*

*Increase in tissue iron
Increase in storage iron*

Read more: Whole milk and iron

Consumption of whole milk during infancy can contribute to iron-deficiency anemia:

- *GI tract blood loss can occur when cow's milk is offered during infancy.*
- *Cow's milk is low in iron, and the iron that is present has low bioavailability.*
- *Decreases bioavailability of other dietary sources of iron due to higher levels of calcium and casein than human milk.*

The relatively high potential renal solute load of whole milk is approximately 3 times human milk and is associated with an increased risk for hypertonic dehydration for infants, especially during illness.

(Akers and Groh-Wargo 2012, Ziegler 2011)

Zinc

Zinc absorption from breastmilk is highest (41%); zinc from cow's milk formula is more bioavailable (31%) than zinc in soy-based formulas (14%). Zinc concentration in human milk is unaffected by maternal diet and declines rapidly in the first six months of lactation. After the first 6 months, human milk is an inadequate source of zinc.

Growth delays have been seen in infants fed infant formulas with low amounts of zinc, and zinc supplementation has been found to improve growth in infants with failure to thrive.

Vitamins

As with minerals, unless there are special circumstances, breastmilk and/or standard, iron-fortified infant formula should meet an infant's vitamin needs. Three vitamins of special concerns are discussed below.

Vitamin K

Recommendations for vitamin K intake for infants 0-6 months old is based on the vitamin K content of breastmilk and also on the assumption that infants receive prophylactic vitamin K at birth. (IOM, 2001)

Read more: Oral Vitamin K

Oral vitamin K is not recommended because oral doses are absorbed at varied rates and may not provide adequate stores in breastfed infants unless repeated doses are administered during the first 4 months of life. Intramuscular vitamin K is more successful at preventing hemorrhagic disease of the newborn since a universal dose allows for less variation in vitamin K stores in newborns. Vitamin K supplementation should be delayed until after the first breastfeeding but within 6 hours of delivery. (AAP, 2012)

Vitamin B12

Recommended intake levels for vitamin B12 are based on the assumption that the mother's B12 status is adequate. The breastmilk of women who are vegans or who have untreated pernicious anemia may be inadequate, and clinical signs of B12 deficiency may appear in the infant at about 4 months of age. It is recommended that infants of vegan mothers receive supplemental vitamin B12 from birth.

Vitamin D

Vitamin D available to the infant during the first 6 months of life depends on the vitamin D status of the mother during pregnancy and the infant's diet and exposure to sunlight. Because of variations in exposure to sunlight (both regional and seasonal), the recommendations were developed with the assumption that infants do not receive any vitamin D from sunlight.

The American Academy of Pediatrics recommends that all breastfed infants receive 400 IU of vitamin D (oral) beginning with hospital discharge or shortly after birth and continuing throughout breastfeeding or until the daily consumption of vitamin D-fortified formula is 500 mL. (Holt et al, 2011; AAP 2012)

Overall guidelines: Breastfed infant, formula-fed infant

Intakes will vary from infant-to-infant and even from day-to-day. Some overall guidelines for evaluating an infant's intake are included in the assessment section of this module.

KNOWLEDGE CHECK

Match the micronutrient to the recommended supplementation from birth to two months of age.

Vitamin D	2mg/kg/day for preterm infants 1-12 months
Vitamin B12	400 IU/day for breastfed infants from discharge until daily consumption of vitamin fortified fluids is 500 mL
Vitamin K	Supplementation from birth if born to a vegan mother
Iron	Recommendations based on prophylactic supplementation

Changes to Nutrient Needs After Two Months of Life

This section reviews the nutrient needs of older infants and some general guidelines around supplementation and the introduction of complementary foods to meet increased vitamin and mineral needs.

Fat and Fatty Acids

At 7-12 months of age and corresponding to the introduction of complementary foods, total fat decreases to about 40% of the total energy needs. The AI for n-6 fatty acids remains elevated compared to adults but drops to 6% of total energy intake. Similarly, the AI for n-3 fatty acids also decreases to slightly less than 1% in older infants.

Minerals

Iron

Iron accretion occurs primarily during the third trimester resulting in iron stores large enough to fulfill iron requirements from birth until 4 to 6 months of age. Once iron stores are depleted exogenous iron is needed from iron fortified complementary foods or formula. (AAP 2010)

Beginning at 4 months of age, exclusively breastfed term infants should begin receiving 1 mg/kg/day of supplemental iron and continue until iron-containing complementary foods have been introduced. Partially breastfed infants that receive more than half of their daily feedings from human milk and are not receiving iron-containing complementary foods should also receive 1 mg/kg/day of supplemental iron. (AAP 2010)

Zinc

Zinc concentration in human milk is unaffected by maternal diet and declines rapidly in the first six months of lactation. After the first 6 months, human milk is an inadequate source of zinc. The introduction of fortified cereals and meat as complementary foods at 4-6 months of age provides the zinc required for the older infant. (DiMaggio et al, 2017)

Vitamins

Vitamin D

Vitamin D supplementation for breastfed infants can cease once the mother is no longer breastfeeding or when infant formula exceeds 500 mL per day. For infants receiving a combination of breastmilk and formula, formula consumption can be monitored by a health care provider to determine when vitamin D supplementation is no longer necessary. (Holt et al, 2011; AAP 2012)

Introduction of complementary foods – preliminary discussions with family

Recommendations for infant feeding generally support exclusive breastfeeding for the first 6 months of life, supplemented by complementary foods for at least 12 months. (AAP, 2012; AND, 2015) It is important to look at the infant's developmental readiness

for complementary foods; some infants show signs of readiness as early as 4 months of age and others may not be ready until after 6 months of age. Complementary foods should not be introduced before 4 months of age, specifically the thickening of bottles with infant cereal should be avoided. Introduction of solids too early has been linked to childhood obesity. Complementary foods should be introduced by 6 months of age. Introducing complementary food will aid in the development of feeding and eating skills for all infants 6 months or older. (AAP, 2018; Holt et al, 2011) Evidence-based guidelines for the introduction of complementary foods have been published. These guidelines also include a summary of physical and eating skills, hunger and fullness cues, and appropriate food textures for children 0 to 24 months. (CDC, 2018)

Developmental readiness

Understanding infant development, relative to feeding skills can help the dietitian to make a more complete assessment of an infant’s nutritional status and to develop effective interventions, when there are nutrition-related problems.

A discussion of an infant’s cues that shows she is developmentally ready to begin complementary foods can also be helpful to families. It will help them understand the rationale behind the recommendations and make plans for their infant’s transition to complementary foods. It is important to develop balanced child-caregiver interactions. This is discussed in greater detail in Module 7.

The ages outlined below are based on an infant’s developmental age, and may not match chronologic age.

Age in Months	Feeding Skills	Oral Motor Skills	Suggested Activities
Birth-4		Rooting Reflex Sucking Reflex Swallowing Reflex Extrusion Reflex	Breast-feeding Bottle-feeding
5	Able to grasp objects voluntarily Learning to reach mouth with hands	Disappearance of extrusion reflex	Possible introduction of thinned cereal
6	Sits with balance while using hands Ready for high chair	Transfers food from front of tongue to back Closes lips around spoon	Prepare cereal with formula or breastmilk to semi-liquid texture Use spoon Feed from a dish Advance to 1/3-1/2 cup cereal before adding fruits and vegetables
7	Improved grasp Drinks from cup with help	Mashes food with lateral movements of jaw Learns side-to-side or “rotary” chewing	Thicken cereal to lumpier texture Sit child in high chair with feet supported Introduce cup

8-10	Holds bottle without help Drinks from cup without spilling Decreases fluid intake and increases complementary foods Coordinates hand-to-mouth movement	Swallows with closed mouth	Begin finger foods Do not add salt, sugar, or fat to foods Present soft foods in chunks ready for finger feeding
10-12	Feeds self with fingers and spoon Holds cup without help	Tooth eruption Improved ability to bite and chew	Provide meals in pattern similar to rest of family Use cup at meal
Adapted from Akers and Groh-Wargo, 2012			

Table 6-2. Guidelines for Progression of Solid Foods

Resources related to the introduction of complementary foods are listed in the resource list.

Introduction of complementary foods

It is generally recommended that single-ingredient foods be introduced first, and that they be started one at a time, at 3- to 5-day intervals. Many pediatricians will advise starting with iron-fortified cereal or vegetables prior to the introduction of fruits to avoid the infant being exposed to sweeter flavors and/or to provide a source of iron, however there is insufficient evidence to support any specific order for the introduction of complementary foods to infants. (DiMaggio et al 2017) Meat and fortified foods provide many of the nutrients for which young toddlers are often at-risk of deficiency, in particular iron and zinc. (CDC, 2018) Exposure to a variety of flavors early in life may help a child to accept a variety of new foods later in childhood.

Introduction of milk

Unmodified cow’s milk is inappropriate for infants. The curd that is produced is difficult to digest, less fat is absorbed than with human milk or commercial infant formula, and the renal solute load is higher and may pose a risk for young infants. Whole fat cow’s milk can be introduced beginning at 1 year of age and reduced-fat (2%), low-fat (1%), and fat-free (skim) milk should be avoided during the first two years of life. (Holt et al, 2011)

Goat’s milk is not appropriate for infants. Its protein content is higher than human milk and infant formula, which puts an infant at risk for dehydration, and has a higher renal solute load. It is also deficient in folic acid and vitamin B6.

Use of honey (botulism)

Honey has been implicated as a source of spores that can cause botulism in infants. For this reason, honey (or foods that contain honey, including many graham crackers) should

not be offered to infants under 1 year of age. There has been some controversy over the presence of botulism spores in corn syrup. No cases of botulism have been proven to be related to the consumption of light or dark corn syrup, but manufacturers are unable to ensure that these products are free of spores. (Carrillo-Marquez, 2016)

Continued development of a healthy feeding relationship

The introduction of complementary food provides more opportunities for families to help their infants develop healthy relationships with food and eating. Ellyn Satter describes the division of responsibility in this way: It is the parent's responsibility to offer developmentally-appropriate foods; it is the child's (or infant's) responsibility to control how much and what to eat. At each stage, this keeps the child in charge of the feeding/eating process and promotes a sense of trust between parent and child. (Satter, 2000) This is discussed in greater detail in Module 7 – MNT for Specific Conditions – Infants.

KNOWLEDGE CHECK

Six-month old Jamie has not had complementary foods introduced yet by her caregiver and is still exclusively breastfed. Jamie might be deficient in which nutrients?

In which order should complementary foods be introduced?

Diet-related Concerns

Breastfeeding

Research has repeatedly demonstrated the importance of breastmilk for infants. This is reflected in national and international initiatives to promote breastfeeding, including a Healthy People 2020 objective for 81.9% of mothers initiating breastfeeding, 60.6% of infants being breastfed by 6 months of age, and 34.1% at 1 year. It is estimated that rates in the US are around 83.2% infants ever breastfed, 57.6% breastfeeding at 6 months, and 35.9% breastfeeding at 1 year. (In Washington State, the rates are 92%, 73%, and 48% respectively). (CDC, 2015)

Benefits

The benefits of breastfeeding are covered in Module 8, Breastfeeding Assessment and Support.

A statement from the IOM's Nutrition Services in Perinatal Care, 2nd edition summarizes many of the benefits of breastfeeding:

“Exclusive breastfeeding is the preferred method of feeding normal infants throughout their first 4-6 months. Breastfeeding provides the infant with a clean

supply of milk, in an amount that is responsive to the infant's needs, and in a manner that promotes optimal interaction between the mother and infant. Human milk provides all essential nutrients in a form that is easily digested and absorbed and in amounts that allow normal growth and development. Moreover, human milk provides the infant with immunoglobulins and many other antiinfective substances, as well as anti-inflammatory substances, hormones, enzymes, and growth factors that appear to have important health-promoting effects.” (IOM, 1992)

Risks of not breastfeeding and barriers to breastfeeding are also addressed in Module 8.

Contraindications

Breastfeeding is contraindicated for a small number of infants, including:

- Infants who have a genetic metabolic disorder, such as galactosemia, where metabolism of galactose (and thus lactose) is impaired, or other disorders where the amount of protein ingested must be carefully limited or monitored
- Infants whose mothers have HIV infection
- Infants whose mothers take some medications, including radioactive isotopes, some antipsychosis medications (e.g., lithium), some antithyroid medications, a few antibiotics and synthetic anticoagulants, antiprotozoan agents and estrogen-containing oral contraceptives (these may inhibit milk production) (IOM, 1991; Holt et al, 2011; AAP, 2012)
- Infants whose mothers use “street” drugs or abuse alcohol
- Infants whose mothers have HTLV-1, HTLV-2 or untreated brucellosis infection

Breastfeeding is contraindicated but the use of expressed milk is encouraged for some infants, including:

- Infants whose mothers have untreated active pulmonary tuberculosis should be separated, breastfeeding may resume when the mother has been treated for a minimum of 2 weeks and is determined to be no longer infectious
- Infants whose mothers have herpes simplex lesions on both breasts (infant may feed from other breast if clear of lesions)
- Infants whose mothers have H1N1 influenza should be separated until the mother no longer has a fever
- Infants whose mothers develop varicella 5 days before through 2 days after delivery should be separated

Many maternal infections do not contraindicate breastfeeding. Breastfeeding is not necessarily contraindicated for mothers who have hepatitis A, B, or C. (Breastfeeding is generally considered to be safe for an infant whose mother who is hepatitis B-positive, if the infant is receiving the hepatitis B vaccine; breastfeeding should be stopped if the mother develops cracked nipples or open sores on her breast.) Cytomegalovirus is not a risk to fullterm infants, but may be a risk to an infant born prematurely. (Holt et al, 2011; AAP, 2012)

Composition of breastmilk

A general comparison of the nutrient compositions of breastmilk and infant formula is included below. The composition of breastmilk varies during the course of breastfeeding. For example, colostrum has more protein and less fat and lactose than mature milk, and secretory IgA concentrations gradually decline.

The mother and infant share the same environment, thus, the mother can provide specific antibodies to viruses and bacteria to which both mother and baby are exposed. Likewise, maternal diet and environment can transfer substances which are not beneficial to breastmilk. Recommendations for maternal practices are covered in Module 8, Breastfeeding Assessment and Support.

Initiating and continuing breastfeeding

Supporting the initiation and continuation of breastfeeding is discussed in Module 8, Breastfeeding Assessment and Support. Many of the discussion points may be relevant to assessing the nutritional status of the young infant and helping the family as they develop a plan for feeding.

Maternal diet

The nutrient needs of women during lactation are reviewed in Module 5, Nutrition and the Postpartum Period. In general (Holt et al, 2011):

- Fat stores provide an adequate energy source during the first few weeks of lactation; extra fluids should be encouraged
- An increase of 400 calories or less per day and enough water to satisfy thirst may be required to support breastfeeding after the first 6 weeks
- Most foods eaten by the mother are well-tolerated by breastfeeding infants; a few infants may exhibit symptoms of allergy or intolerance
- Caffeine and alcohol intake should be eliminated or restricted

Breastmilk and Infant Formulas

The IOM, American Academy of Pediatrics (AAP), and many other national and international organizations recommend breastmilk as the first choice for nearly all infants. For families who cannot or choose not to provide breastmilk, however, commercial infant formulas are available.



The compositions of breastmilk and commercial infant formulas are discussed below. These are the only appropriate oral feedings for infants. Cow's milk, goat's milk, soy milk or other animal or grain milks are not appropriate for infants and can lead to protein malnutrition or iron deficiency due to malabsorption or increased losses. (Holt et al, 2011)

Human milk

In general, human milk is lower in protein than standard commercial infant formulas. The protein in human milk is better absorbed because of the protein structure (whey to casein ratio). Fat and minerals are also in forms that are better absorbed than from commercial formulas. In addition, human milk contains antibodies, essential fatty acids, growth factors, and cytokines that are not found in commercial infant formulas. (Holt et al, 2011; AND, 2015) The nutrient composition of human milk changes to meet the nutritional needs of the growing infant.

Commercial infant formula

Commercial infant formulas are made from heat-treated nonfat cow's milk (or hydrolyzed soy protein) and are designed to provide nutrients in an easily absorbable form. The Food and Drug Administration regulates manufacturing practices and the general composition of infant formulas through the Infant Drug Act. This law requires that infant formulas provide nutrients in amounts that are consistent with Federal guidelines. A discussion of the recent addition of DHA and ARA to many infant formulas is included earlier in this module.

A list of formulas provided by the Washington State WIC program can be found online: <http://www.doh.wa.gov/YouandYourFamily/WIC/WICFoods/InfantFormula>. This website also includes information about obtaining approval for therapeutic formulas and Health Recovery Services Administration (HRSA – formerly MAA) coverage for formulas that are not provided by WIC.

Instructions for billing Medicaid can be found at <https://www.doh.wa.gov/YouandYourFamily/WIC/WICFoods/InfantFormula>. Necessary forms include the HCA Oral Enteral Nutrition Worksheet Expedited Prior Authorization Request Form (HCA 13-761).

Standard

Standard infant formulas are made from cow's milk protein (casein and whey), lactose (sometimes corn syrup solids), and a variety of vegetable oils. Standard infant formulas

are appropriate for most infants who receive formula. Examples include Enfamil Infant (Mead Johnson) and Similac Advance (Abbott)*. Store-brand formulas are also available; contact information for the manufacturer is generally found on the label.

Soy-based

A number of formulas with soy as the protein source are available. They contain more total protein than standard formulas, because protein quality is not as high. Soy-based formulas are indicated for use with infants who have galactosemia, or non-breastfed infants with vegan diets. Soy-based formulas are not indicated for premature infants. Examples include ProSobee (Mead Johnson), Soy Isomil (Abbott), and Good Start Soy (Gerber)*. Store-brand formulas are also available; contact information for the manufacturer is generally found on the label.

Protein hydrolysate

Some formulas are made from hydrolyzed casein, and thus their protein source is small peptides and amino acids, which are more easily absorbed. They are indicated for children with some specific gastrointestinal disorders (e.g., protein-induced enterocolitis, protein-induced proctocolitis, and food protein enteropathy). The fat sources for these formulas vary. Examples include Nutramigen (Mead Johnson)*, Alimentum (Abbott)*, and Pregestimil (Mead Johnson). Partial whey hydrolysate formulas are made from whey that is broken down into peptides. Examples include Good Start (Nestle).

Elemental

Amino acid-based formulas are available for infants who have cow's milk protein or multiple food protein intolerance and cannot tolerate hydrolysate formulas, including infants with allergic eosinophilic esophagitis. Examples include Neocate (Nutricia), EleCare (Abbott), and Extensive HA (Gerber)*.

Low-iron

There are no known medical conditions for which the use of low-iron formulas is indicated. According to the AAP Policy Statement, the primary treatment for iron overload disorders is chelation therapy. Medication doses can be adjusted to account for the iron in formula (AAP, 1999).

Premature formulas and human milk fortifiers

Premature formulas and human milk fortifiers are formulated to meet the vitamin and mineral needs of premature infants. They are designed to be used in the hospital. Post-discharge formulas, which provide higher amounts of energy at 22 kcal/oz, protein, calcium and phosphorous than standard formulas. There is insufficient evidence to support routine use of these products. (Zerzan and Chabra, 2017) This is covered in Module 7 –Medical Nutrition Therapy for Specific Conditions – Infants. Post-discharge formulas include Similac NeoSure (Abbott)* and EnfaCare (Mead Johnson)*.

*WA WIC approved formula

Read more: Feeding selection, the baby-friendly hospital initiative

The World Health Organization (WHO) suggests changes to promote breastfeeding, “The Ten Steps to Successful Breastfeeding.” These are included in the WHO Baby Friendly Hospital Initiative designation.

- 1. Have a written breastfeeding policy that is routinely communicated to all health care staff and parents. Comply fully with the International Code of Marketing Breast-milk Substitutes and relevant World Health Assembly resolutions. Establish ongoing monitoring and data-management systems.*
- 2. Ensure that staff have sufficient knowledge, competence and skills to support breastfeeding.*
- 3. Discuss the importance and management of breastfeeding with pregnant women and their families.*
- 4. Facilitate immediate and uninterrupted skin-to-skin contact and support mother to initiate breastfeeding as soon as possible after birth*
- 5. Support mothers to initiate and maintain breastfeeding and manage common difficulties.*
- 6. Do not provide breastfed newborns any food or fluids other than breast milk, unless medically indicated.*
- 7. Enable mothers and their infants to remain together and to practice good rooming-in 24 hours a day.*
- 8. Support mothers to recognize and respond to their infants’ cues for feeding.*
- 9. Counsel mothers on the use and risks of feeding bottles, teats and pacifiers.*
- 10. Coordinate discharge so that parents and their infants have timely access to ongoing support and care.*

More information on the guidelines and criteria for evaluation are available at <http://www.who.int/nutrition/bfhi/en/>.

Food safety

Breastmilk Storage

Mothers may choose to express their breast milk (pump) and store for later feedings due to prolonged separations of the mother and infant for various reasons. It is recommended that families use the following safe storage techniques for expressed breast milk: (Holt et al, 2011)

- Storage in an insulated cooler bag for up to 24 hours
- Refrigerator storage for 5 days
- Freezer compartment of a refrigerator for 2 weeks

- Freezer compartment of a refrigerator with separate doors for 3 to 6 months
- In a chest or upright deep freezer for 6 to 12 months

Formula Preparation

A number of client-education materials have been developed to provide families with information about preparation of infant formula. A few are listed in the resource list. In general, it is recommended that families (FDA, 2018; Holt et al, 2011):

- Use safe handling techniques when preparing formula:
 - Wash hands with soap and hot water before preparing formula.
 - Sterilize bottles and nipples in a dishwasher or pot of boiling water; OR wash them in clean water and dish soap; use a bottle brush and wash nipples well if washing by hand; allow to air dry on a clean rack.
 - Clean the top of the formula can, if the formula is canned.
 - Use fresh water from the cold water tap (not hot) or distilled water, if using powdered formula or liquid concentrate. Let the water run for a short period of time first.
 - If using boiled water, cool first before mixing with powdered formula or liquid concentrate.
 - Have well water tested before using to prepare infant formula; use distilled water if the nitrite level is unknown. (The health department or Cooperative Extension service can identify resources for testing.)
- Mix powdered formula or liquid concentrate with the exact amount stated on the label, or prescribed by the health care provider
- Use safe handling techniques when storing formula:
 - Store prepared formula in the refrigerator for up to 24 hours and at room temperature for no more than 2 hours
 - Store open cans of liquid concentrate or ready-to-feed formula in the refrigerator; use within 48 hours of opening
 - Store cans of powdered formula in a cool, dry place; use within 1 month of opening
- Warm bottles of formula (or expressed breastmilk) in a pot of hot water, not in the microwave; test the temperature of the formula before feeding
- If the formula is not used up within an hour, throw it away. Once a baby has nursed from a bottle, microorganisms are introduced into the formula.
- Mix up small amounts for each feeding (1-3 ounces), especially for newborns. This will help avoid over-feeding and waste.

Common concerns

Constipation

Constipation refers to hard, dry stools that are painful or difficult to pass. Constipation in young infants can be caused by inadequate fluid intake (e.g., not enough formula or improperly prepared formula).

After the first few weeks of life, most formula-fed infants have at least 1 bowel movement each day. Older breastfed infants may go several days without a bowel movement. Signs of constipation can include the following:

- Signs of pain and discomfort with bowel movements
- Formed, hard stool
- Swollen belly

Recommendations for young infants include:

- Ensuring that the infant's intake is adequate (e.g., by evaluating number of wet diapers and adequacy of breastfeeding or amount of formula consumed)
- Ensuring that formula is prepared properly
- “Bicycling” with infant's legs or a gentle tummy massage

The amount of iron in infant formula is not enough to cause constipation, and generally, a switch to a different formula is not an effective treatment. Families should seek medical attention when they see blood in their infant's stool, if the infant has a fever or is vomiting, or if constipation does not improve within 2-3 days.

Gas

Gas, and the resulting crankiness and crying, is a common concern of families. It is important for families to remember that it is a normal, usually temporary problem. Gas can result from normal digestion and from air that is swallowed during feeding, crying, and vigorous sucking on a pacifier.

Cues can include:

- Crying
- Pulling legs up and lying in a curled position
- Abdominal bloating/distension

Suggestions for minimizing problems with gas include:

- Good positioning during feeding: far back on areola during breastfeeding or on wide base of bottle nipple, holding infant during feedings instead of propping the bottle
- Appropriate pacing of feedings

- Burping the infant midway through feeding and afterward; encourage burping at natural pauses to minimize feeding disruption
- Warm bath or warm compress on baby’s tummy
- Tummy massage (use long strokes in a clockwise direction)
- “Bicycling” the infant’s legs – lift knees by holding ankles
- Other soothing methods

A very small number of infants may be intolerant to specific components (usually protein) in formula or breastmilk. For these infants, gas is usually a minor problem and other symptoms include vomiting, diarrhea, or poor feeding. If families suspect an intolerance, encourage them to consult with a physician or dietitian who specializes in this field. Changes to the diet of a breastfeeding mother rarely make a difference in gas or fussiness.

Over-the-counter medications (e.g., Mylicon ® Gas relief drops – simethicone, gripe water, and probiotics) are sometimes recommended. These medications have limited or unproven effectiveness, and families should talk with their child’s pediatrician before starting these medications.

Vomiting

Vomiting is another common concern of families. It is important to understand the difference between a true problem with vomiting and “spitting up,” which may or may not be normal.

Vomiting is a forceful action where the stomach contents are forced up through the esophagus and out of the mouth. Repeated vomiting is usually caused by illness.

Spitting up occurs in about half of all infants and is normal. It generally occurs without warning and is usually not linked to signs of illness (e.g., fever, nausea, retching, diarrhea).

Spitting up is a problem when it is associated with slow weight gain (or weight loss) or gastroesophageal reflux and esophagitis. In these cases, families should seek medical attention to address the cause. Switching to a different brand or type of formula is not usually effective. For some infants, use of rice cereal to thicken formula may minimize problems with reflux. One commercially-available formula with added rice is also approved for participants in the WIC program.

Medical attention should also be sought when an infant:

- Has repeated episodes of vomiting
- Has a fever
- Vomit contains blood or bile
- Shows signs of dehydration
- Has abdominal distension

KNOWLEDGE CHECK

True or False

Soy based formulas are indicated for premature infants. T or F

Prepared formula can be kept for stored in the refrigerator for up to 24 hours T or F

Human milk composition changes T or F

Constipation may be caused by infant formula iron content T or F

Spitting up is concerning when associated with slow weight gain or weight loss T or F

Considerations in the Nutrition Assessment

The publication *Bright Futures: Nutrition* includes lists of questions that health care providers can use to elicit nutrition-related information. Some of these lists are summarized at the end of this section. A screening questionnaire is also available. The Bright Futures materials can be available online: <http://www.brightfutures.aap.org>.

Anthropometrics

Carefully measure the infant's length, weight, and head circumference, and plot the measurements, along with weight-for-length on the WHO growth charts. Detailed instructions for measurement technique and interpretation are published on the WHO website <http://who.int/childgrowth/training/en/> and also at https://www.cdc.gov/growthcharts/who_charts.htm<http://who.int/childgrowth/training/en/> and also at https://www.cdc.gov/growthcharts/who_charts.htm

Deviation from the expected pattern (i.e., changes in percentiles) should be evaluated. They may be normal, as the infant's growth begins to match his or her genetic potential, or they may indicate a nutrition-related problem. (Holt et al, 2011; IOM, 1992)

Expected growth pattern

Infants lose approximately 10% of their body weight due to fluid loss and some tissue breakdown immediately following birth. After that period, the rate of weight gain depends on the initial size of the infant, the feeding method (breast- or formula-fed), and other environmental and physiologic factors. Birthweight is generally regained in the first 7 days of life. (Holt et al, 2011)

Rule of Thumb (Holt et al, 2011)

In general, infants usually:

- Regain their birthweight by 7 days after birth
- Double their birthweight by 4-6 months, gaining about 5-7 ounces per week

- Triple their birthweight by 1 year, gaining about 3-5 ounces per week from 6 to 18 months

Growth charts

The World Health Organization (WHO) has released growth charts based on infants and children (ages 0-5 years) who were primarily breastfed. The WHO Multicentre Growth Reference Study, conducted between 1997 and 2003, includes primary growth data from 8500 children from Brazil, Ghana, India, Norway, Oman, and the US. The charts, references, and training materials, including videos about measuring technique are available on the WHO website: <http://www.who.int/childgrowth/en/> and material is also available on the CDC website: https://www.cdc.gov/growthcharts/who_charts.htm. Charts for infants include length-for-age, weight-for-age, weight-for-length, arm circumference, head circumference, and subscapular and triceps skinfold. WIC implemented the use of the WHO growth charts for infants and children 0-2 years old on October 1, 2012. (WIC, 2018)

Charts that describe incremental growth (e.g., weight gain over 1 month) are also available. Growth velocity charts must be interpreted in conjunction with attained growth charts to assess if the growth velocity is adequate or concerning, e.g. low weight velocity if the child is overweight and catching down, high weight velocity reflecting catch up when recovering from illness. (WHO, 2009)

There are additional weight charts that have been developed for use in preterm infants for use while in the hospital. The WHO growth charts are used upon discharge with corrected age. Corrected age is the number of weeks old the baby is minus the number of weeks early the baby was born (40 weeks – number of weeks gestation at birth).

Read more: Preterm Growth Charts

Infants who were born prematurely have different growth patterns than term infants born within INTERGROWTH-21st Newborn Size Standards. (Villar, 2014) Growth outside the uterine environment does not match intrauterine growth for infants of the same gestational age. The use of size-at-birth charts to monitor postnatal growth in preterm neonates is strongly discouraged. WHO growth charts can be used beginning at 64 weeks postmenstrual age. The Postnatal Growth of Preterm Infants and Size for Very Preterm Infants charts have been selectively adopted by health care institutions within the United States. (Villar et al, 2015)

A variety of growth charts are available to monitor the growth of infants born preterm; these are primarily used in hospital. After discharge, use of the WHO charts is appropriate, using the infant's corrected age.

Biochemical indicators

Unless an infant has a condition that requires biochemical monitoring, lab work is not generally indicated.

Dietary intake

Obtain a feeding history, including how many times per day the infant is feeding and the length of each feeding (or how much formula is consumed). It can be helpful to ask how formula is prepared and how much formula is used (e.g., number of cans per day/week/month), especially when there are concerns about formula preparation, intake, or growth. Information about feeding behaviors can also be elicited during this part of the interview:

- What are the infant’s hunger cues? (e.g., hand-to-mouth activity, rooting, pre-cry facial grimaces, fussing sounds, and crying)
- What cues does the infant give to indicate fullness? (e.g., turning head away from nipple, showing interest in things other than eating, closing mouth) Does the mother try to have the baby eat past fullness?
- Is feeding generally a pleasant experience, or is it stressful?
- Does the mother (or rest of the family) have any concerns about feeding?
- Does the mother hold the baby when bottle feeding?

Any barriers to the continuation of breastfeeding can also be identified. (IOM, 1992; Holt et al, 2011)

Observing the mother breastfeeding her infant provides information about the infant’s ability to suck, as well as the mother’s comfort level, interaction with her infant, and the dyad’s responses to distractions in the environment. (Holt et al, 2011)

Most infants who are bottle-fed can finish a bottle in 15-20 minutes. Evaluation by a feeding specialist is indicated if feeding consistently take longer than this. General expectations for the number and volume of bottle feedings are listed in the table below.

Age	Volume/Feeding	Number of Bottles
0-4 months	2-6 ounces	8-12 per day
4-6 months	6-7 ounces	5-8 per day
6-8 months	7-8 ounces	3-5 per day
8-12 months	7-8 ounces	3-4 per day
Adapted from Akers and Groh-Wargo, 2012		

Table 6-3. Suggested Number and Volume of Bottle Feedings for a Healthy Infant

Like formula-fed infants, breastfed infants should be fed on demand. Most breastfed infants nurse 8-12 times per day.

Clinical and Medical Data

The dietitian can evaluate the infant's general appearance, including skin, hair, gums, tongue and eyes. Asking questions about the number of wet diapers and bowel movements can provide information about adequacy of the infant's nutrient intake.

Infant elimination patterns

Elimination patterns for breastfed infants include:

- 5-8 urine diapers per day and 3-4 stools per day by 5-7 days of age
- Bowel movements decrease to as infrequently as every 3 days by 6 due to increased absorption of nutrients from breastmilk. (Holt et al, 2011, Akers and Groh-Wargo, 2012)

After the first few weeks of life, most formula-fed infants have at least 1 bowel movement each day.

Medical conditions

Any acute or chronic conditions that the infant might have should also be incorporated into the nutrition assessment. Questions to consider include:

- How does the condition affect the infant's nutrient needs?
- How does the condition affect the infant's ability to nurse or take a bottle?
- Does the condition require any medications that might interact with nutrients, or affect intake or elimination patterns?

Psycho-social Issues

Psycho-social issues can be identified during the interview and also by observing the parent-infant interaction. Does the parent appear affectionate? Comfortable? Distant? Anxious? (Holt et al, 2011) Barriers to breastfeeding can have a psycho-social basis. The clinician can help to develop a constructive plan of care by identifying the care providers' strengths and the available resources. (Holt et al, 2011; IOM, 1992)

Interview Questions for Parents of Young Infants

Bright Futures: Nutrition offers some questions to ask during the interview process. Some general questions are summarized below. Questions specific to breastfeeding and formula-feeding, as well as to the age of the infant are compiled. Questions and guidelines for the 4 month, 6 month, 9 month, and 12 month visits (plus early childhood, middle childhood, late childhood, and adolescence) are also available.

- How is feeding going? What questions or concerns do you have?

- How does your baby let you know when she is hungry? How do you know when she has had enough to eat?
- How often does your baby feed? How long does it generally take for a feeding?
- How does your baby like to be held when you feed her?
- Are you comfortable that your baby is getting enough to eat?
- How does she behave during a feeding? Pulls away, arches back, is irritable, or calm?
- How does your baby behave after feedings? Satisfied baby look, still rooting, anxious?
- Has she received any other fluids from a bottle?
- Is anyone helping you feed your baby?
- How many wet diapers and stools does he have each day?
- What is the longest time he has slept at one time?

Nutrition Counseling Messages for Parents of Young Infants

In addition, *Bright Futures: Nutrition* includes age-specific nutrition counseling messages. General messages for families of young infants are summarized below. Messages specific to breastfeeding and formula-feeding, as well as to the age of the infant are compiled. Messages for the 4 month, 6 month, 9 month, and 12 month visits (plus early childhood, middle childhood, late childhood, and adolescence) are also available.

- Feed your baby when she is hungry, typically 10 to 12 times in 24 hours for the initial weeks of life, and 8-12 times in 24 hours for the next several months. Signs of hunger include hand-to-mouth activity, rooting, pre-cry facial grimaces, fussing sounds, and crying.
- During the first two weeks, your baby should be awakened for feeding if he sleeps more than 4 hours at a time.
- Feed your baby until he seems full. Signs of fullness are turning his head away from the nipple, showing interest in things other than eating, and closing his mouth.
- Burp your baby at natural breaks (e.g., midway through or after a feeding) by gently rubbing or patting her back while holding her against your shoulder and chest or supporting her in a sitting position on the lap.
- Your baby may be distracted by lights and noise and may need help to focus on feeding. A calm, gentle approach, using repetitive movements such as rocking, patting, or stroking, is usually most helpful. Some babies may need to be swaddled or fed in a room with less light and noise.
- Babies should not be offered food other than breastmilk or infant formula until they can sit with support and have good control of the head and neck, at about 4 to 6 months. Babies should not be fed cow's milk, goat's milk, soy milk or low-iron formulas during the first year of life.

KNOWLEDGE CHECK

Four-week old Franny is nursing 20 times in 24 hours; is this what would be expected for an infant her age?

Brad is 10 weeks old and breastfed. His mother is concerned because he has not had a bowel movement in almost 3 days but does not exhibit any signs of constipation. Is this cause for concern?

Bobby was born weighing 8 pounds 1 ounce. Upon follow up, Bobby weighed 6 pounds 15 ounces. Is this a typical amount of weight loss following birth?

Which growth chart should be used for a healthy full-term infant?

Five-month old Susie was 7 pounds 8 ounces at birth. How much would you expect her to weigh now assuming she gained weight at a typical rate?

James is a bottle fed infant; his caregiver reports that he typically takes 35 minutes to finish a bottle. Is this a typical timeframe for feeding?

Nutrition Questionnaire for Infants

You may also download a printable version of this table from *Bright Futures: Nutrition Tools* document.

(https://brightfutures.aap.org/Bright%20Futures%20Documents/BFNutrition3rdEdition_tools.pdf)

The nutrition questionnaire for infants (*Bright Futures: Nutrition*) provides a useful starting point for identifying areas of nutrition concern and the need for additional screening. When reviewing the responses to the questionnaire, use the interpretive notes (included below) to identify areas of concern and determine follow-up questions or actions. Some of these questions are not applicable for young infants.

1. How would you describe feeding time with your baby? (Check all that apply)

- Always pleasant
- Usually pleasant
- Sometimes pleasant
- Never pleasant

Feeding is crucial for the development of a healthy relationship between parents and their infant. A parent's responsiveness to an infant's cues of hunger and satiation and the close physical contact during feeding facilitate healthy social and emotional development.

2. How do you know when your baby is hungry or has had enough to eat?

Signs of hunger include hand-to-mouth activity, rooting, pre-cry facial grimaces, fussing sounds, and crying. Signs of fullness are turning the head away from the nipple, showing interest in things other than eating, and closing the mouth.

3. What type of milk do you feed your baby? (Check all that apply)

- Breastmilk
- Iron-fortified infant formula
- Evaporated milk
- Whole milk
- Reduced-fat (2%) milk
- Low-fat (1%) milk
- Fat-free (skim) milk
- Goat's milk
- Soy milk

Infants should be fed breastmilk or iron-fortified infant formula, even in infant cereal. If infants are weaned from breastmilk before 12 months, they should be fed iron-fortified infant formula rather than cow's milk. Cow's milk, goat's milk, and soy milk are not recommended during the first 12 months of life, and reduced-fat (2 percent), low-fat (1 percent), and fat-free (skim) milk are not recommended during the first 2 years of life.

4. What types of things can your baby do? (Check all that apply)

- Open mouth for breast or bottle
- Drink liquids
- Follow objects and sounds with eyes
- Put hand in mouth
- Sit with support
- Bring objects to mouth and bite them
- Hold bottle without support
- Drink from a cup that is held

Developmental readiness for eating different textures of food and the acquisition of self-feeding skills are important in establishing realistic feeding goals for infants.

5. Does your baby eat complementary foods? If so, which ones?

By 4 to 6 months, infants need more nutrients than can be supplied by breastmilk or infant formula alone; they should gradually be introduced to complementary foods when they are developmentally ready. After the infant has accepted iron-fortified infant cereal, then pureed or soft fruits, vegetables, and meats can be offered. Only one new food should be introduced at a time; parents should wait 3-5 days or more days to see how the infant tolerates the food.

Between 6 and 12 months, infants master chewing, swallowing, and manipulation of finger foods. They begin to use cups and utensils, and while they are experimenting with new tastes and textures, their sensory and perceptual development are stimulated.

6. Does your baby drink juice? If so, how much?

Juice should not be given to infants younger than 6 months. After age 6 months, 100% fruit juice may be served in a cup instead of a bottle and limit it to 4 to 6 oz per day. It should be offered in small amounts (more than 6 oz per day is excessive), because too much juice may reduce the infant's appetite for other foods and increases the risk of loose stools and diarrhea.

7. Does your baby take a bottle to bed at night or carry a bottle around during the day?

Infants permitted to suck on a bottle of any fluid that contains carbohydrates, including juice and milk, for prolonged periods are at risk for developing early childhood caries (baby bottle tooth decay). Infants should not be put to bed at night or at naptime with a bottle or allowed unlimited access to a bottle (i.e., permitting the infant to carry a bottle around whenever he wants).

8. Do you add honey to your baby's bottle or dip your baby's pacifier in honey?

Honey should not be added to food, water, or formula that is fed to infants because it can be a source of spores that cause botulism poisoning in infants. Processed foods containing honey should not be given.

9. What is the source of the water your baby drinks? Sources include public, well, commercially bottled, and home system-processed water.

Starting at 6 months, infants receiving breastmilk or infant formula prepared with water need fluoride supplementation if the water is severely deficient in fluoride. To assess fluoride levels, ask about all sources of water used by the family, including municipal, well, commercially bottled, and home system-processed water. In addition, find out whether any ready-to-feed infant formula used is manufactured with water that has little or no fluoride. Refer an infant who is not getting enough fluoride to a dentist or primary care health professional for follow-up.

10. Do you have a working stove, oven, and refrigerator where you live?

11. Were there any days last month when your family didn't have enough food to eat or enough money to buy food?

If inadequate cooking or food-storage facilities adversely affect a family's nutrient intake, refer the family to social services. If a family does not have adequate resources to obtain food, refer them to food assistance and nutrition programs such as WIC and the Food

Stamp Program, or to a community food shelf or pantry. (See Tool K: Federal Food Assistance and Nutrition Programs.)

12. What concerns or questions do you have about feeding your baby?

Reprinted from Holt K, Wooldridge N, Story M, Sofka D, eds. Bright Futures: Nutrition. Third ed: American Academy of Pediatrics; 2011. Available at https://brightfutures.aap.org/Bright%20Futures%20Documents/BFNutrition3rdEdition_tools.pdf

Referral Resources

When nutrition issues are beyond your scope of practice, consider referral, including to resources listed below:

- Other First Steps providers
See Module 1
- Special Supplemental Nutrition Program for Women, Infants and Children (WIC)
<http://www.doh.wa.gov/YouandYourFamily/WIC/>

This website also include information about authorized WIC formulas and procedures for getting non-standard formulas provided by Medicaid

- Medical assistance/Medicaid
<https://www.doh.wa.gov/YouandYourFamily/WIC/WICFoods/InfantFormula>
- Early Support
<https://www.dcyf.wa.gov/services/child-development-supports/esit>

Infants and children with special health care needs who are enrolled in early intervention programs in their communities should have access to dietitians, occupational therapists, physical therapists, and speech and language pathologists with expertise in pediatrics who can address nutrition and feeding issues.

Early support services provide community-based interdisciplinary evaluations and therapy services for infants and children and children under age 3 years, with developmental delays. Services are provided in-home, or at a community-based center. Providers include dietitians, occupational therapist, physical therapists, and speech and language pathologists. Nutrition outcomes and objectives should be incorporated into the Individualized Family Service Plan (IFSP) for those children with feeding and nutrition issues. Information about early support in Washington State (also called the Early Intervention Services) can be found at:

<https://www.dcyf.wa.gov/services/child-development-supports/esit/early-intervention-services>.

- Children with Special Health Care Needs Nutrition Network
<http://depts.washington.edu/cshcnnut>

The CSHCN Nutrition Network in Washington State is a group of registered dietitians who provide nutrition services for children with special health care needs. Dietitians come from a variety of employment settings, including local health departments, community clinics, hospitals, early intervention centers and home health agencies.

- Washington State Community Feeding Teams
<http://depts.washington.edu/cshcnnut/feeding/index.html>

The Washington State Community Feeding Teams provide an interdisciplinary approach to address feeding/nutrition concerns for children with special health care needs in a comprehensive, cost-effective manner. They work directly with families to help parents/caregivers resolve important issues related to feeding and nutrition. Professionals that may be members of feeding teams include: dietitians, occupational therapists, speech therapists, physical therapists,

public health nurses, school nurses, physicians, social workers, feeding behavior therapists and others.

- Hospitals (tertiary or community)

Case Example: Cheyenne

Cheyenne is a 6-week old infant. She is exclusively breastfed, and her mother plans to continue breastfeeding for at least 2 more months. Cheyenne spits up sometimes, so her mother has stopped drinking milk, in case she has a milk allergy. Cheyenne nurses every 2-3 hours, usually for about 15-30 minutes, depending on the time of day.

Cheyenne's rate of growth is appropriate – her birthweight was at about the 50th percentile, and her weight today is between the 50th and 75th percentiles. Length-for-age is around the 25th percentile, and weight-for-length is around the 90th percentile.

Do you have concerns about Cheyenne's nutrient intake? About her feeding pattern?

Based on Cheyenne's growth pattern, it appears that her overall nutrient intake is adequate. The feeding pattern described by her mother is also appropriate for an infant Cheyenne's age.

What anticipatory guidance and/or nutrition education might you provide?

Anticipatory guidance and nutrition education might include:

- encourage Cheyenne's mother to discuss the difference between protein intolerance and normal spitting up with Cheyenne's pediatrician
- ensuring an adequate calcium intake for Cheyenne's mother
- vitamin D supplement for Cheyenne
- preliminary discussion of introduction of complementary foods
- discussion of hunger and satiety cues

Are any referrals indicated?

If she is not already enrolled in the WIC program, a referral might be indicated. Also, the dietitian could make sure that Cheyenne has medical insurance.

Case Example: Ricky

Ricky is a 6-week old infant who is receiving standard infant formula. His mother notes that he has been very fussy lately, so she is considering a switch to soy formula. Ricky takes about 4 ounces, 6 times per day. His mother is concerned because his weight has dropped from the 90th percentile at birth, to the 75-90th percentile at his last pediatrician

visit. Ricky's length-for-age is between the 50th and 75th percentiles, and weight-for-length is at the 50th percentile.

Do you have concerns about Ricky's rate of growth?

Ricky's growth is probably appropriate. This is a good opportunity for a discussion about infant growth rates with Ricky's mother. The dietitian could also recommend monitoring of Ricky's weight and length, to ensure that his growth pattern continues to be appropriate.

Do you have concerns about Ricky's nutrient intake? About his feeding pattern?

Ricky's intake and feeding pattern appear to be appropriate for an infant his age

What anticipatory guidance and/or nutrition education might you provide?

Anticipatory guidance and nutrition education might include:

- a discussion of the reason for switching formulas
- a discussion of causes of "fussiness"
- a preliminary discussion of introduction of complementary foods

References and Resources

References

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Resources

First Steps Nutrition Training Modules – <http://depts.washington.edu/pwdlearn/firststeps>
Module 6 – Nutrition and the Young Infant

Bright Futures

<http://www.brightfutures.aap.org>

The Bright Futures website includes links to the Bright Futures, Bright Futures Guidelines, and Bright Futures Tool and Resource Kit. Tools for practitioners, including publications, distance education, training tools, and materials for consumers, are also available.

Child of Mine, Feeding with Love and Good Sense

Child of Mine, Feeding with Love and Good Sense, by Ellyn Satter. (2000). Available in most libraries and bookstores (\$16.95). This book reviews the division of responsibility between parents and children – the parent’s responsibility is to offer a variety of safe foods in a nurturing environment, and the child’s responsibility is to decide how much and what to eat. The materials cover infancy through age 5 years.

Quiz

1. For infants under 6 months of age, total fat provides about ____% of total energy intake.
 - a. 25
 - b. 35
 - c. 55
 - d. 75

2. Iron deficiency anemia is associated with which of the following impairments in infants:
 - a. cognitive and motor
 - b. growth
 - c. all of the above
 - d. none of the above

3. Breastfeeding is always contraindicated when:
 - a. the mother has hepatitis B
 - b. the mother has cytomegalovirus
 - c. the mother has HTLV-1 infection
 - d. the infant has phenylketonuria

4. In general, human milk has _____ protein than standard commercial infant formulas.
 - a. more
 - b. less
 - c. the same amount of
 - d. the same whey to casein ratio
 - e. c and d

5. Well water:
 - a. should not be used to prepare infant formula
 - b. should be boiled for at least 15 minutes before being used to prepare infant formula
 - c. should be tested before being used to prepare infant formula
 - d. should be used to prepare formula from concentrate, but not from powder

6. Prepared formula can be stored in the refrigerator for up to ____ hours.
 - a. 12
 - b. 24
 - c. 36
 - d. 48

7. Which of the following behaviors is developmentally appropriate for a 5 month old infant:
 - a. puts his hand in his mouth a lot

- b. brings objects to his mouth
- c. moves objects from one hand to another
- d. explores foods with his mouth

8. Although growth rates vary depending on feeding method and other environmental and physiologic factors, birthweight is usually regained in the first ____ days(s) of life:

- a. 5
- b. 7
- c. 10
- d. 14

9. For a young infant, signs of hunger include:

- a. rooting
- b. fussing sounds
- c. hand-to-mouth activity
- d. pulling legs up and lying in a curled position
- e. a, b, and c
- f. all of the above

10. A 4-week old infant who is taking about 3 ounces every 3 hours, and who takes about 30 minutes to finish a bottle should receive further assessment because:

- a. she should be taking more formula at each feeding
- b. she should be feeding more frequently than every 3 hours
- c. she should be feeding less frequently than every 3 hours
- d. she should be taking less than 30 minutes to finish a bottle

11. The intake of a 6-week old infant who is consuming 24 ounces formula (standard dilution) per day is:

- a. excessive
- b. adequate
- c. inadequate

12. Like formula-fed infants, breastfed infant should be fed on demand. Most breastfed infants nurse ____ times per day.

- a. 2-3
- b. 5-7
- c. 8-12
- d. 14-16

13. AAP guidelines related to elimination patterns and evaluating adequacy of breastfeeding include the following expectations for an infant by 5-7 days of age:

- a. 2-3 urines, 1-2 stools per day, stools changing from meconium to mustard yellow
- b. 4-6 urines, 1-2 stools per day
- c. 5-8 urines, 3-4 stools per day

d. 7-10 urines, 8-10 stools per day

First Steps Nutrition Modules

Module 7 – Medical Nutrition Therapy for Specific Conditions – Infants

Introduction

In this module, some conditions that are common in early infancy are reviewed, along with some of the interventions that dietitians can recommend. It begins with a discussion of special health care needs in general and some community resources that are available for children with special health care needs.

Estimated time to complete this module: 60 minutes.

Learning Objectives

Participants will be able to:

- Identify some nutrition-related issues associated with some conditions that commonly occur during early infancy (prematurity, low birthweight, failure-to-thrive, allergies, over- and under-feeding related to feeding cues)
- Describe basic medical nutrition therapy for some conditions that commonly occur during early infancy
- Describe resources for infants with some conditions that commonly occur during early infancy

Outline

XI. INTRODUCTION

XII. SPECIAL HEALTH CARE NEEDS

- a. Definition and common nutrition-related concerns
- b. Screening parameters and criteria for referral
- c. Resources
- d. Case example

XIII. PREMATURITY AND LOW BIRTHWEIGHT

- a. Definition
- b. Specific issues: Nutrition assessment and intervention
- c. Formulas
- d. Collaboration
- e. Resources
- f. Case example

XIV. FAILURE-TO-THRIVE

- a. Definition
- b. Contributors to failure-to-thrive
 - *Read more: Development of Child-Caregiver Interactions*
 - *Read more: Infant Feeding Disorders*
- c. Evaluation and treatment
- d. Collaboration
- e. Resources
- f. Case example

XV. FOOD ALLERGIES

- a. Treatment
- b. Counseling
 - *Read more: The Food Allergen Labeling and Consumer Protection Act*
- c. Collaboration
- d. Prevention
- e. Resources

XVI. OVER- AND UNDER-FEEDING RELATED TO FEEDING CUES

- a. Hunger and Satiety Cues
- b. Continuum of infant feeding responses
- c. Assessment and treatment
- d. Resources

XVII. REFERENCES AND RESOURCES

XVIII. QUIZ

Special Health Care Needs

Definition and common nutrition-related concerns

Children with special health care needs are those "who have or are at increased risk for chronic physical, developmental, behavioral, or emotional conditions and who require health and related services of a type or amount beyond that required by children generally." (McPherson et al, 1998).

Children with special health care needs are at increased risk for nutrition-related health problems. Common problems include the following:

- Altered energy and nutrient needs
- Delayed or altered growth patterns
- Feeding delays or oral-motor dysfunction
- Elimination problems
- Medication-nutrient interactions
- Appetite disturbances
- Unusual food habits (e.g., pica, restrictive food choices, rumination)
- Early childhood caries, gum disease

Screening parameters and criteria for referral

Young children with special health care needs are particularly vulnerable to nutrition problems. A screening project of infants and young children with developmental delays in the Massachusetts Early Head Start Program found that 9% of infants and children had at least one nutrition risk factor, and 67% met more than one of the criteria for referral to nutrition services. It is estimated that 40-50% of children with special health care needs have nutrition specific risk factors that warrant a referral to a registered dietitian. (Holt et al, 2011)

A table of nutrition-screening parameters and criteria for referral for children with special health care needs is found in Bright Futures in Practice: Nutrition. The criteria that might apply to young infants are listed below. The entire table is also available for download on the Bright Futures website.

Nutrition-Screening Parameters and Criteria for Referral for Children and Adolescents with Special Health Care Needs	
Screening Data	Criteria for Referral to a Dietitian
Anthropometric	
Birthweight (for infants and children <18 months) Weight/[length or height]	Birthweight \leq 1500 g Weight/[length or height] \leq 5th percentile Weight/[length or height] \geq 95th percentile

Height/Length	Inappropriate growth or weight change [Length or height]/age \leq 5th percentile
BMI (age >2)	BMI <5th percentile or >85th percentile
Biochemical	
Hemoglobin	Hemoglobin \leq 11gm/ dL (or outside reference range for age)
Hematocrit	Hematocrit \leq 34% (or outside reference range for age)
Clinical/Medical	
Medical condition known to affect nutrition (e.g., vomiting, reflux), elimination problems, medications, and appetite or dental problems	A diagnosis of heart disease, cancer, diabetes mellitus, HIV/AIDS, cerebral palsy, inborn error of metabolism, cleft lip and palate, malabsorption syndrome, cystic fibrosis, renal disease, or spina bifida Recurring vomiting or reflux, chronic diarrhea or constipation, severe dental caries, early childhood caries, long-term use of medications that could affect nutrition, megavitamin use, or prolonged decrease in appetite, with weight loss or growth failure
Diet/Feeding	
Feeding method (e.g., mouth, tube, parenteral)	Tube feeding or parenteral nutrition
Therapeutic diet	Therapeutic diet
Feeding delays or problems	Inability to self-feed by age 2 years
Significant allergies	Limited diet because of food aversion, allergies, or socioeconomic constraints
Other	
Parental or professional concern	Unresolved concerns regarding diet, nutrition, or growth
Adapted from Holt K, Wooldridge N, Story M, Sofka D, eds. Bright Futures: Nutrition. Third ed: American Academy of Pediatrics; 2011.	

Table 7-1. Nutrition-screening parameters and criteria for referral for children and adolescents with special health care needs

Medical nutrition therapy for some of these situations can be provided by dietitians with some pediatric nutrition training. For others, specialty care by a dietitian with specific training and/or who is able to follow the child on a long-term basis may be required.

Resources

Resource related to nutrition services

Resources for food assistance, special feeding equipment, and supplies for tube feedings or parenteral feedings vary from state to state. Selected resources in Washington State are list briefly below.

Nutrition services for children with special health care needs in Washington State are described on the following website:

<http://depts.washington.edu/cshcnut/nutserv/index.html>.

Agencies and organizations include:

- **Title V Maternal and Child Health (MCH) program and Children with Special Health Care Needs (CSHCN) program**
<https://www.doh.wa.gov/YouandYourFamily/InfantsandChildren/HealthandSafety/ChildrenwithSpecialHealthCareNeeds>
- **Special Supplemental Nutrition Program for Women, Infants and Children (WIC)** <https://www.doh.wa.gov/YouandYourFamily/WIC>
- **Medical assistance/Medicaid**
<https://www.doh.wa.gov/YouandYourFamily/WIC/WICFoods/InfantFormula>
<https://www.hca.wa.gov/billers-providers-partners/prior-authorization-claims-and-billing/provider-billing-guides-and-fee-schedules#e>
- **Early Intervention** <http://www.dcyf.wa.gov/services/child-development-supports/esit>

Infants and children with special health care needs who are enrolled in early intervention programs in their communities may have access to dietitians, occupational therapists, physical therapists, and speech and language pathologists with expertise in pediatrics who can address nutrition and feeding issues.

Early intervention services provide community-based interdisciplinary evaluations and therapy services for infants and children and children under age 3 years, with developmental delays. Services are provided in-home, or at a community-based center. Providers vary from center to center, but can include dietitians, occupational therapists, physical therapists, and speech and language pathologists. Nutrition outcomes and objectives should be incorporated into the Individualized Family Service Plan (IFSP) for those children with feeding and nutrition issues. Information about early intervention in Washington State (also called the Infant Toddler Early Intervention Program – ITEIP) can be found at: <http://www1.dshs.wa.gov/iteip/>.

- **Children with Special Health Care Needs Nutrition Network**
<http://depts.washington.edu/cshcnut/nutnet/index.html>

The CSHCN Nutrition Network in Washington State is a group of registered dietitians who provide nutrition services for children with special health care needs. Dietitians come from a variety of employment settings, including local health departments, community clinics, hospitals, early intervention centers and home health agencies.

- **Washington State Community Feeding Teams**

<http://depts.washington.edu/cshcnnut/feeding/locating.html>

The Washington State Community Feeding Teams provide an interdisciplinary approach to address feeding/nutrition concerns for children with special health care needs in a comprehensive, cost-effective manner. They work directly with families to help parents/caregivers resolve important issues related to feeding and nutrition. Professionals that may be members of feeding teams include: dietitians, occupational therapists, speech therapists, physical therapists, public health nurses, school nurses, physicians, social workers, feeding behavior therapists and others.

Training is available for dietitians who wish to learn more about nutrition and special health care needs. In addition to traditional MCHB-sponsored training programs, several online curricula exist. (See the resource list at the end of this module for more information.)

- Academy of Nutrition and Dietetics Pocket Guide to Children with Special Health Care Nutritional Needs (PNPG/BHNDPG) Ordering information at: <https://www.eatrightstore.org/product-subject/pediatric-nutrition>
- Nutrition Interventions for CSHCN (WA DOH) - Available for download and ordering information at <https://www.doh.wa.gov/Publications/DisabilitiesandSpecialHealthcareNeeds>
- MCH Trainings for Children and Youth with Special Health Care Needs <https://www.mchnavigator.org/trainings/cyshcn.php>

Case example: Michael

Michael is a 2-month old who has trisomy 21 (Down syndrome). He has a cardiac defect that will need surgical repair when he is about 6 months old. He receives standard infant formula in a bottle. His family works hard to make sure he gets enough; sometimes feedings will last 45 minutes.

What are Michael's nutrition risk factors?

Risk factors for Michael include: trisomy 21, difficult to get adequate intake, and length of feedings

What referrals might be warranted?

Referrals to the following might be warranted:

- a dietitian (at a tertiary care facility and/or early intervention program) - the Washington State Nutrition Network for CSHCN might be a good resource to locate a dietitian
- other therapists, depending on Michael's skills - an early intervention program might be able to provide services

KNOWLEDGE CHECK

What are three screening parameters or criteria could indicate a need for a referral to nutrition services?

Answer: Screening criteria for nutritional services include anthropometric data such as birthweight under 1500g, weight/(length or height) less than the 5th percentile or greater than the 95th percentile, inappropriate growth or weight change, BMI less than the 5th percentile or greater than the 85th percentile, and hemoglobin or hematocrit outside the reference range for the age. Medical conditions that are known to effect nutrition, elimination problems, medications and appetite or dental problems, a patient on tube feeding or parenteral nutrition, therapeutic diet use, significant allergies or food aversions may all indicate a need for a referral to nutrition services.

Prematurity and Low Birthweight

An in-depth discussion of the specific nutrition-related issues for infants who were born prematurely is beyond the scope of these modules. Some of the key issues are reviewed below. In addition, a number of resources are available for community providers who see premature infants. These are included at the end of this section.

Definition

Premature infants are those who were born before 37 weeks gestational age. Even infants who were born “late and moderately preterm” are at medical and developmental risk. Infants born between 32 and 37 weeks gestational age are considered moderate to late preterm. Very preterm infants are born between 28 to 32 weeks gestational age and prior to 28 weeks gestational age is considered extremely preterm. Further classification is made, based on the infant’s birthweights:

- Small for gestational age (SGA) – birthweight less than the 10th percentile for gestational age
- Low birthweight (LBW) – birthweight less than 2500 grams (5.5 pounds)
- Very low birthweight (VLBW) – birthweight less than 1500 grams (3.3 pounds)
- Extremely low birthweight (ELBW) – birthweight less than 1000 grams (2.25 pounds)

Specific issues

Prematurity is associated with a number of medical complications, many of which have long-term implications. Some of the more common medical conditions include the following:

- Bronchopulmonary dysplasia (BPD) – persistent chronic pulmonary problems. Some infants with BPD may need supplemental oxygen, mechanical ventilation, and multiple medications at home
- Intraventricular hemorrhage (IVH) – bleeding occurring in the brain
- Necrotizing enterocolitis – damage to the bowel wall due to ischemic injury, immaturity, and/or bacterial overgrowth; may result in need for surgical resection that may result in short bowel syndrome
- Patent ductus arteriosus (PDA) – an open blood vessel between the pulmonary artery and the descending aorta, which normally closes shortly after birth
- Retinopathy of prematurity (ROP) – changes in the retina’s blood vessels which may affect visual acuity and if unchecked, lead to retinal detachment and blindness

In addition to complex medical issues, a number of factors affect the health and needs of premature infants. They include: genetics, intrauterine environment, medical history, growth and nutrition history, current medical status, behavioral and neurological issues, and psychosocial and family issues. (Zerzan and Chabra, 2017) The figure below depicts the interactions that affect feeding, growth, and development for the premature infant.

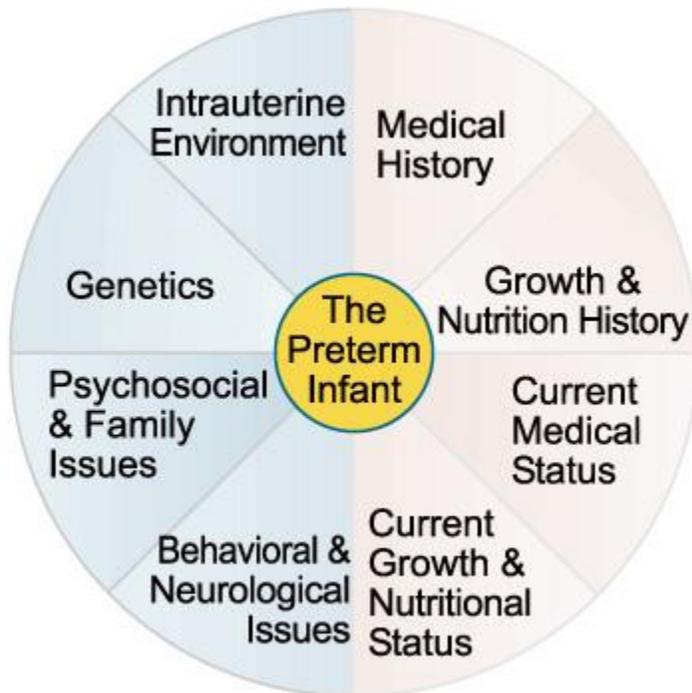


Figure 7-1. Interactions that affect feeding, growth and development for the premature infant

The goals of nutrition assessment for the premature infant include (Zerzan and Chabra, 2017):

1. Ensure maintenance of growth and weight gain during periods of transition and to optimize growth during periods of stability
2. Provide guidance and support to parents regarding appropriate feeding methods (particularly during periods of transition)
3. Identify feeding problems and assist in resolution of these issues
4. Educate parents regarding goals for growth and feeding to “normalize” the feeding experience

To reach these goals, the dietitian must consider how the individual infant is affected by prematurity and associated primary and secondary medical conditions. Questions to ask include the following:

- What is the infant’s expected growth pattern? Influences include medical conditions and genetic potential, and percentiles, patterns of growth, weight gain, and velocity should be evaluated.
- Is the infant’s intake adequate to meet her needs for growth and development? Consider the influence of medical conditions and medications (e.g., lung disease, short gut, reflux, neurological impairments).
- Is the volume of breastmilk or formula adequate? Is it appropriate? Are vitamin and/or mineral supplements necessary?
 - Energy needs of preterm infants are often higher than for term infants (often 110-130 kcal/kg/d is needed to support growth)
 - A formula-fed infant taking less than 1.5 ounces formula per pound (100-120 mL/kg/day) is at risk for dehydration. (Signs of dehydration are included in Module 6).
 - In addition to supplemental vitamin D, a standard infant liquid multivitamin is recommended for breastfed and formula-fed infants until their intakes are 24-30 ounces per day and/or they weight 10-12 pounds
 - Supplemental iron (2-4 mg/kg/day) is recommended, either from a supplement or from infant formula with iron (AAP 2010)
 - Solid foods should not be introduced until the infant is developmentally ready. This is often around 4-6 months corrected age.
- Does the infant have problems that interfere with feeding? Consider nipple skills, coordination of suck-swallow-breathing, hunger and satiety cues (and parents’ responses). Other feeding-related problems can include:
 - Low muscle tone
 - Immature maintenance of physiologic stability
 - Weak flexor muscle strength
 - Decreased strength and endurance
 - Physical abnormalities in the oral cavity
- Is the feeding method developmentally appropriate?

Formulas

Breastmilk, plus supplemental formulas as needed, are the optimal feeding for most preterm infants. Human milk fortifiers and premature formulas are designed to be used in the hospital and to meet the vitamin and mineral needs of premature infants during the time that they are in the hospital. Use beyond this time period can result excessive intakes of vitamins A and D.

Post-discharge formulas are also available. These formulas typically provide 22 calories per ounce and have more protein, calcium, and phosphorus than standard infant formulas. However, post-discharge formulas have not consistently demonstrated growth and developmental benefits over standard formulas. Soy formulas are contraindicated for preterm infants due to decreased bioavailability of protein, calcium and phosphorous when compared to cow's milk-based formula. (Zerzan and Chabra, 2017)

Collaboration

Infants are often followed by high risk follow-up clinics at tertiary care centers. These clinics may use a team approach that involves a developmental pediatrician, dietitian, and therapists, including physical, occupational, and/or speech therapists, all with experience with preterm infants. Other service providers can include public health nurses and early intervention therapists. Coordination of all of these “players” can be difficult, and good communication is critical.

Resources

- Gaining and Growing Website. Information for community health professionals who work with premature infants. <http://depts.washington.edu/growing/>
- Article: Nutrition and Feeding for the Premature Infant after Hospital Discharge
Zerzan J, Chabra S. Nutrition and Feeding for the Premature Infant after Hospital Discharge. *Nutrition Focus*. 2017; 32(3). Information about ordering back issues: <http://depts.washington.edu/nutrifoc/webapps/>
- Nutrition Interventions for CSHCN (WA DOH). Available for download and ordering information at <https://www.doh.wa.gov/Publications/DisabilitiesandSpecialHealthcareNeeds>

Case Example: Juan

Juan was born at 32 weeks gestation. He is now 2 months, corrected age (4 months chronologic). Juan had some medical complications and required gavage feedings and oxygen in the hospital. He was discharged on oral feedings, with post-discharge formula. He will be seen at a high-risk infant follow-up clinic in about 4 months.

What are some short-term nutrition concerns? What resources might address these concerns?

Short-term concerns for Juan include ensuring that his intake is adequate and appropriate:

- how long to continue to use post-discharge formula

- how to evaluate that he is getting enough

Potential resources include:

- community providers (e.g., WIC, early intervention dietitians, Nutrition Network members)
- the dietitian who cared for Juan while he was in the NICU
- the dietitian with the high-risk infant follow-up clinic

What are some long-term nutrition concerns? What resources might address these concerns?

Long-term concerns for Juan include ensuring that his intake is adequate and appropriate:

- adequacy and appropriateness of formula (type and amount)
- assessing developmental readiness for solid foods

Potential resources include:

- community providers (e.g., WIC, early intervention dietitians, Nutrition Network members)
- the dietitian who cared for Juan while he was in the NICU
- the dietitian with the high-risk infant follow-up clinic

KNOWLEDGE CHECK

How would you assess or what questions would you ask to ensure the four goals of nutrition assessment are met in a premature infant?

1. Ensure maintenance of growth and weight gain during periods of transition and to optimize growth during periods of stability
2. Provide guidance and support to parents regarding appropriate feeding methods (particularly during periods of transition)
3. Identify feeding problems and assist in resolution of these issues
4. Educate parents regarding goals for growth and feeding to “normalize” the feeding experience

Answers:

- Monitor growth via growth charts trends to ensure the infant is maintaining percentiles for height and weight during times of transition and experiencing catch up growth during periods of stability.
- Ask the caregiver how often and approximately how much or how long the infant is feeding to determine if energy needs are being met.
- Observe the caregiver feeding the infant to observe the caregiver-infant relationship, if the infant has feeding related problems, and if an appropriate feeding method is being used.

Failure to Thrive

Definition

There are not universally-accepted criteria for failure-to-thrive. Some suggest using one or more of the following indicators:

- Weight-for-age <3rd or <5th percentile
- Weight-for-length <3rd or <5th percentile
- Decreased weight gain velocity (weight-for-age falls more than 2 major percentiles over 3-6 months; for infants, some suggest using maximum weight percentile achieved between 4-8 weeks of age, not birthweight)
- Decrease of more than 2 standard deviations (weight-for-age or length-for-age) on growth chart over 3-6 month period

For young infants, however, these may not be appropriate due to the time required to observe trends. For example, growth problems in early infancy may have serious long-term consequences if not identified and corrected prior to 3-6 months of trend observation.

Care should be taken when interpreting growth data and identifying failure-to-thrive. For example, these two infants may be incorrectly identified (based on the above criteria) as having failure-to-thrive, may actually be growing appropriately:

An infant whose weight crosses percentile channels may have had inadequate in utero growth and may simply be demonstrating his genetic potential for growth. A complete assessment should include evaluation of in utero growth patterns.

The corrected weight-for-age of an infant who was born prematurely is below the 5th percentile, but this infant's rate of weight gain is adequate. A complete assessment should include evaluation of growth velocity.

Sorting through these issues makes evaluation of failure-to-thrive in a young infant particularly difficult. It may be more helpful, then, to ask whether or not an infant's growth pattern might be explained by one of the potential causes of failure-to-thrive.

Contributors to failure to thrive

At a basic level, there are a finite number of explanations for inadequate weight gain. The reasons behind these "simple" causes can be quite complicated. Often a combination of factors contributes to an infant's overall growth problems.

Inadequate Intake

- Problems with breastfeeding (e.g., insufficient milk supply, inadequate let-down reflex, infrequent or short feedings, problems with latching on, weak and/or unsustained suck)
- Improperly prepared formula (over-dilute formulas are often indicated by polydipsia/polyuria; concentrated formulas are often indicated by early satiety, vomiting, diarrhea; cereal or other infant foods in formula displace protein and fat)
- Medical conditions that affect the child’s ability to consume an adequate amount of breastmilk or formula
- Impaired parent-child interaction (can be indicated by too-long or too-short feeding times)
- Psychosocial issues (e.g., lack of resources, parental depression, stress, social isolation)

Increased Needs

- Medications
- Chronic medical conditions (e.g., prematurity, short bowel syndrome, gastroesophageal reflux, bronchopulmonary dysplasia)
- Infections
- Losses, including vomiting, diarrhea, malabsorption

Read more: Development of Child-Caregiver Interactions.

Child-caregiver interactions are important throughout infancy. The focus of the interaction changes as the infant develops:

Homeostasis

Ages 0-3 months – During this stage, the focus is on homeostasis, stabilizing biological functions and organizing behavior

Parent Behavior		Effect on Infant
Respond to infant’s hunger cues: <ul style="list-style-type: none"> • Feed the infant before prolonged crying • Maintain eye contact during feeding • Let the infant dictate amount, pace of feedings • Stop feeding when infant refuses nipple or shows lack of interest 		Modulate infant arousal Prevent tense or overly-aroused infant Help with mastery of basic feeding skills Prepare for attachment

Attachment

Ages 2-6 months – One task during these months is attachment, marked by distinct interactions with individual caregivers. Feeding is one important opportunity for social interaction and attachment.

Parent Behavior		Effect on Infant
Respond to infant's hunger cues	→	Strengthen social bond with parent
No engagement during feeding	→	Lack of pleasure with feeding
		Dysfunction and decreased appetite

Interactions are reciprocal, and cues are sometimes misinterpreted:

Infant Behavior		Effect on Parent
Infant pauses for social interaction	→	Parent interprets this as a sign of satiety and stops feeding

Separation/Individuation

Ages 6-36 months – The infant begins to have control over his or her environment and develop a sense of self. The feeding relationship moves from a one-on-one relationship (infant and caregiver) to a social event, the family meal.

Adapted from Arvedson, 1997.

Observational scales for parent-child interactions have been developed and include the NCAST Feeding Scale (see <http://www.ncast.org> for information) and a tool developed by Chatoor, et al. (Chatoor, 1997) The Parent-Child Play Scale was developed for use in conjunction with the NCAST feeding scale for use in children with feeding disorders. By determining if dysfunction play in conjunction with dysfunctional feeding is occurring, clinicians can determine if there are more pervasive maladaptive interactional patterns. (Chatoor 2018)

Read more: Infant Feeding Disorders

According to the *Diagnosis and Statistical Manual of Mental Disorders, 5th Edition (DSM-5)* there are three Feeding and Eating Disorders that may have onset in infancy or early childhood: Pica, Rumination Disorder, and Avoidant/Restrictive Food Intake Disorder.

Pica may occur in childhood, adolescence or adulthood, with childhood onset most commonly reported. This diagnosis may occur in otherwise normally developing children. The diagnostic criteria for pica includes persistent eating of nonnutritive, nonfood substances over a period of at least 1 month, the eating of nonnutritive, nonfood substances is inappropriate to the developmental level of the individual, the eating behavior is not part of a culturally supported or socially normative practice, if the eating behavior occurs in the context of another mental disorder or medical condition and it is sufficiently severe to warrant additional clinical attention.

Age of onset for **Rumination Disorder** in infancy is 3 to 12 months of age. Rumination disorder in infants may spontaneously remit frequently however its continued onset can result in medical emergencies. The regurgitation and rumination behavior appear to have a self-soothing or self-stimulating function in infancy. Diagnostic criteria include: repeated regurgitation of food over a period of at least 1 month and repeated regurgitation is not attributable to an associated gastrointestinal or other medical condition.

Avoidant/Restrictive Food Intake Disorder replaces and extends the DSM-IV diagnosis of feeding disorder of infancy or early childhood. The main diagnostic feature is avoidance or restriction of food intake that is associated with significant weight loss or nutritional deficiency, dependence on enteral feeding or oral supplements or marked interference with psychosocial functioning. Additional diagnostic criteria includes availability of food, the avoidant or restrictive behavior is not related to cultural practices and the eating disturbance is not explained by excessive concern about body weight or shape or concurrent medical conditions or mental disorders.

Source: DSM-V Criteria

Evaluation and treatment

Treatment of failure-to-thrive begins with a complete evaluation:

- Medical history and physical to identify medical causes and contributors
- Psychosocial evaluation
- Diet history: Intake, evaluation of breastfeeding, formula preparation
- Feeding history

The goals of medical nutrition therapy for growth problems are straightforward. Again, identifying strategies to meet these goals is often more complicated and requires an individualized (and often concrete) plan.

- Achieve rate of weight gain and weight-for-length that is appropriate for individual infant
- Provide adequate amounts of macro- and micro-nutrients

Catch-up growth is defined as a rate of growth that is faster than expected and is seen when adequate energy and protein is provided to a child who has stunted growth because of a nutritional insult. Catch-up growth can require energy and protein intakes greater than the DRI. Some strategies for achieving catch-up growth include:

- Identify and treat medical contributors to failure-to-thrive

- Address psychosocial issues that contribute to growth problems
- Evaluate and provide support around breastfeeding
- Increase the energy density of breastmilk or formula, for example:
 - concentrating to 22 or 24 calories per ounce – monitor for signs of intolerance (vomiting, diarrhea)
 - then, fortifying with carbohydrate, fat, or protein “modular” products

Whichever interventions are used, the plan should include guidelines for monitoring the infant’s response and re-evaluating.

Read more: Concentrating / Fortifying feedings

Concentrating infant formula or fortifying expressed breastmilk is a common practice for increasing an infant's nutrient intake. While this is helpful for some infants, problems can arise when formulas are prepared improperly or there is not careful monitoring.

Risks associated with concentrated or fortified feedings can include: (Sharda, 2012)

- *dehydration due to excessive renal solute load (see below)*
- *hypervitaminosis*
- *intestinal blood loss – similar effect to consuming whole milk instead of formula*
- *allergenic properties – similar effect to consuming whole milk instead of formula, higher concentration of cow's milk proteins may have allergenic responses*
- *improper nutrient composition*
- *improper bone mineralization*
- *insufficient fluid intake*

Renal solute load is the amount of nitrogenous waste and minerals that must be excreted by the kidneys. When renal solute load exceeds the capacity of the kidneys, dehydration can lead to serious complications, including neurologic deterioration. Acute illness (especially febrile), increased water losses, and medical conditions can decrease an infant's ability to concentrate urine and excrete solutes.

Potential renal solute load (PRSL) is the concentration of solute provided by diet (if none were used for new tissue or lost through non-renal routes). Human milk has a PRSL of about 14 mOsm/100 kcal. Infant formulas typically have PRSL of 20-26 mOsm/100 kcal.

It has been suggested that an upper limit of 30-35 mOsm/100 kcal be used to decrease an infant's risk of hypertonic dehydration. (Fomon and Ziegler, 1999)

Collaboration

Obviously, many of the strategies for treatment will require collaboration with other health care providers, especially when problems are significant. A team approach, whether formal (e.g., at a center with an inter- or multi-disciplinary team) or informal (e.g., community health providers working with the same family) is ideal. Collaboration between the dietitian, primary care provider, public health nurse, social worker or mental

health care provider, therapists, and family is needed. In-home visits are often more effective than conventional “clinic-based” interventions alone. (Wright, 1998)

Resources

Nutrition Interventions for CSHCN (WA DOH)

Available for download and ordering information at
<https://www.doh.wa.gov/Publications/DisabilitiesandSpecialHealthcareNeeds>

KNOWLEDGE CHECK

List four potential contributors to failure to thrive and how you would address that factor.

Answer:

Inadequate intake may result from improperly prepared formula which could be addressed by asking how the parent makes the formula, determining that it is over-diluted. Sometimes education on how to properly prepare formula is adequate or a referral to Social Work may be required if there is food insecurity and formula is being intentionally diluted to make it last longer.

Problems with breastfeeding may lead to inadequate intake as well, working with a lactation consultant to determine the difficulty and possible solutions. Many difficulties may arise with breastfeeding and each should be addressed individually.

Increased needs from illness may result in decreased growth, depending on the lack of growth or weight loss the infant may be able to rebound after recovering from the illness. If weight loss or illness is ongoing supplementation or breastmilk/formula fortification may be required.

Loss of nutrients from vomiting or diarrhea may also result in failure to thrive. Addressing the cause of the vomiting or diarrhea to resolve the loss is the first step. If unable to fix the primary issue, fortification or elemental formula may be required to ensure adequate absorption of nutrients.

Indicate how the following providers could aid in the treatment of failure to thrive:

Therapist

Social Worker

Primary Care Provider

Answer:

Therapist may be able to help address psychosocial issues (e.g., parental depression, stress, social isolation) or help impaired parent-child interactions.

Social Worker may be able to help with impaired parent-child interactions, address lack of resources for feeding, or observe if formula is being improperly prepared.

Primary Care Provider may be able to address the effects of medications or chronic diseases, and determine if the infant has increased losses causing the inability to grow.

Food Allergies

An allergy is an immune response to a specific protein; a food allergy is an immune response to a specific protein in a food. Symptoms can include hives, eczema, vomiting, diarrhea, abdominal pain, or swelling of the lips, tongue, and face and can occur immediately after the food is ingested or up to 72 hours later. Because the digestive and immune systems of infants are immature, food allergies are especially prevalent in infants and children. While many infants “outgrow” allergies, allergies can be lifelong for some individuals.

Diagnosis of a food allergy requires a medical history, diet history, and physical examination. Immunologic testing, such as skin tests, RAST, and elimination diets and challenges, are often performed.

Treatment

The goal of treatment of a food allergy is to remove the food from the infant’s diet while ensuring that the diet is nutritionally adequate. Because allergens can be transferred through breastmilk, treatment may require that the breastfeeding mother eliminate foods from her food pattern. For infants who are formula-fed, treatment may involve a switch to a different formula.

Some food allergies that are common among infants are listed in the table below.

Allergen (Common symptoms)	Foods breastfeeding mother should avoid and nutrients that may be at risk when the foods are eliminated	Infant formulas that are not appropriate	Infant formulas that might be indicated
Cow’s milk	Milk, butter, cream, cheese, yogurt, casein, lactalbumin, whey Calcium, vitamin D, protein, vitamin A, riboflavin	Standard infant formulas; soy based formulas*	Casein hydrolysate, amino acid based
Wheat	Bread, baked goods, cereals	None	

	<p>pasta, malted products, sauces, processed meat; bran, farina, durum</p> <p>Iron, thiamin, riboflavin, niacin</p>		
Eggs	<p>Eggs, baked goods, mayonnaise, casseroles, pasta, sauces; albumin, surimi, lecithin</p> <p>Not a primary source of nutrients, but eggs contain vitamin B12, riboflavin, biotin, pantothenic acid, selenium</p>	None	
Soy	<p>Soy, processed grains, processed meats, sauces, soups, miso</p> <p>Not a primary source of nutrients, but soy contains thiamin, riboflavin, pyridoxine, folate, iron, zinc, magnesium</p>	Soy formulas	Standard infant formulas, casein hydrolysate, amino acid based
<p>* 10-14% infants with an IgE cow milk protein allergy will also have a soy protein allergy. Infants with cow milk protein-induced enteropathy or enterocolitis are frequently sensitive to soy protein as well and should not be given isolated soy protein-based formula. Due to the overlap in cow milk protein reactions and soy protein intolerance, the AAP recommendation for these conditions is for a formula that is made from hydrolyzed protein or synthetic amino acids (AAP, 2008)</p>			
<p>References:</p> <p>American Academy of Pediatrics. Use of Soy Protein-Based Formulas in Infant Feeding. Pediatrics 2008;121(5):1062-1068.</p> <p>Christie, L. Food Hypersensitivities. In: Samour PQ, King K. Pediatric Nutrition, 4th ed. Sudbury MA: Jones and Bartlett Learning. 2012.</p>			

Table 7-2. Food allergies that are common among infants

Counseling

Nutrition education for a food allergy should include a discussion about the following:

- Reading labels – help families to identify which ingredients to avoid and encourage them to read labels each time they buy a food, as ingredients can change frequently; new legislation may make this easier. See <https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/Allergens/ucm106890.htm>.
- Avoiding cross-contamination – cross-contact of a “safe” food with an allergen is common, and can occur at places like the deli, where meats and cheese are sliced on the same equipment; help families to understand how cross-contamination can occur and to identify some strategies to avoid it
- Ensuring nutritional adequacy – when a food (or food group) is eliminated from an individual’s food pattern, nutrient deficiency can occur; work with the individual to identify nutrients at risk and to substitute foods to provide missing nutrients

Read more: *The Food Allergen Labeling and Consumer Protection Act.*

The Food Allergen Labeling and Consumer Protection Act of 2004 (PL 108-282), which has been in effect since January 1, 2006, requires food manufacturers to clearly label some ingredients (milk, egg, fish, shellfish, tree nuts, wheat, peanuts, and soybeans) in one of 3 ways:

- *List the allergen on the ingredient list*
- *Use the word “contains” followed by the name of the allergen*
- *Clarify technical terms, for example: casein (milk) on the ingredient list*

Highly refined oils derived from allergenic foods are exempt. The full text of the legislation is online:

<https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/Allergens/ucm106187.htm>.

Collaboration

Collaboration with other health care providers is important in the management of food allergies. Other providers who might be involved include allergists, and physicians with GI clinics. Some clinics have associated dietitians; others do not. If a child is in a day care setting, coordination with his care providers is also necessary.

Prevention

When there is a family history of food allergy (e.g., both parents, one parent and one sibling, or one sibling), an infant is at increased risk for developing a food allergy. Past recommendations have included delaying the introduction of allergenic foods or suggest

nursing mothers follow a restrictive elimination diet. The AAP has updated its recommendations to include the following:

- If the infant has symptoms of a food allergy, the breastfeeding mother should eliminate those foods from her food pattern.
- If infant formula is used, some recommendations call for the use of formulas made with extensively hydrolyzed casein or partially hydrolyzed whey.
- Introduction of solid foods should not be delayed past 6 months of age; however the progression of solid foods might go more slowly (e.g., 1 new, single-ingredient food every 2-7 days) than if there was no history of food allergy. (AAP, 2008)
- Foods that are most allergenic should not be delayed past the normal introduction of new foods at 4-6 months. Cow's milk may be introduced in the form of yogurt, other dairy products, or in baked goods but not as a replacement for breastmilk or formula. (AAP, 2008; DiMaggio, 2017)
- There is insufficient evidence to recommend that nursing mothers of at-risk infants eliminate any potential allergens from their diet. (AAP, 2008)

Resources

American Academy of Allergy Asthma and Immunology

<http://www.aaaai.org>

Food Allergy Research and Education

<http://www.foodallergy.org>

International Food Information Council

<http://www.foodinsight.org>

KNOWLEDGE CHECK

What is the goal of treating food allergies?

Answer: The goal is to remove the allergen from the infant's diet while ensuring nutritional adequacy for both the infant and the mother (if breastfeeding).

What counseling topics would you include to the caregivers of a child with a food allergy?

Answer: Label reading, cross-contamination avoidance, potential nutrients that will need to be supplemented from another food source.

Over- and Under- Feeding Related to feeding cues

Maternal (or parent) responses to infants' feeding cues are important in the short-term (will the infant get the nourishment she needs?) and in the long-term (will eating be a positive experience and healthy responses to hunger and satiety reinforced?). Both overfeeding and underfeeding can result when a caregiver misinterprets an infant's cues. There are three components to parental responsiveness and sensitivity: perception of the child's cue, accurate interpretation of the cue, and appropriate response to the cue.

Hunger and Satiety Cues

Hodges et al (2013) developed the Responsiveness to Child Feeding Cues Scale to observe and measure the dyadic feeding interactions relevant to developing controls of appetite and obesity for caregivers of children under two years of age.

Mothers have been shown to be more responsive to child hunger cues than fullness cues potentially as a part of a conditioned response to survival. In infants active hunger cues are more common than early hunger cues. Teaching parents the common cues to indicate hunger or satiety may help decrease rates of overfeeding and underfeeding. (Hodges et al, 2016)

Age	Hunger Cues	Satiety Cues
Birth – 3 months	Opens and closes mouth	Slows or decreases sucking
	Hand to face	Extends arms and legs
	Flexes arms and legs	Extends/relaxes fingers
	Roots around on the chest of whoever is carrying the infant	Pushes/arches away
	Makes sucking noises/motions	Falls asleep
	Sucks on lips, hands, fingers, toes, toys or clothing	Turns head away from nipple or decreases/stops rate of sucking
4 – 7 months	Smiles, gazes at caregiver, or coos during feeding to indicate wanting more	Releases the nipple
		Seals lips together
	Moves head toward spoon or tries to swipe food towards mouth	May be distracted or pays more attention to surroundings Turns head away from food
8 – 12 months	Reaches for spoon or food	Eating slows down
	Points to food	Clenches mouth shut
	Gets excited when food is presented	Pushes food away
	Expresses desire for specific food with words or sound	Shakes head to say “no more”
WIC, 2016 https://wicworks.fns.usda.gov/sites/default/files/media/document/Infant%20Developmental%20Skills%20and%20Hunger-Satiety%20Cues%20FINAL_508c.pdf		

Continuum of infant feeding responses

Mentro et al (2002) describe a continuum of infant feeding responses and describes examples of model, borderline, related, and contrary cases. (See Figure)

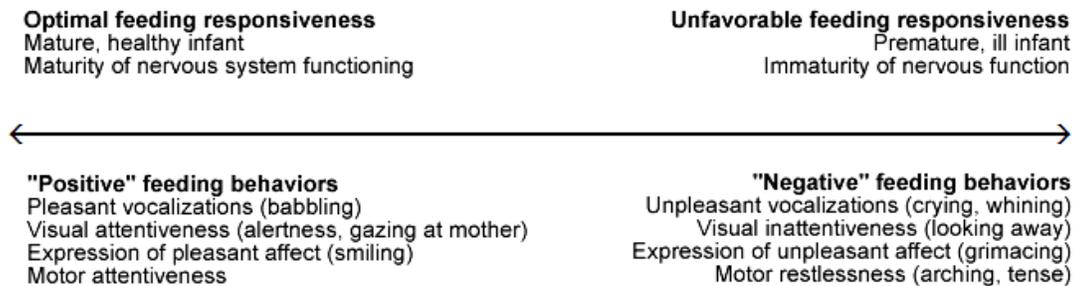


Figure: Continuum of infant feeding responsiveness

Reproduced with permission from Mentro AM, Steward DK, Garvin BJ. Infant feeding responsiveness: a conceptual analysis. *Journal of Advanced Nursing*. 2002, 37(2):208-216.

Model case: Julie

Julie is a healthy female infant of 3 months. After awakening from a long morning nap, she is wide-eyed and alert. Her mother picks her up from the crib, and Julie's body rests comfortably in her arms. She is offered a bottle, and eagerly sucks on the nipple when it is offered, prompting her mother to exclaim, "My, aren't you hungry!" Upon hearing her mother's voice, Julie directs her gaze toward her mother's face and begins to smile. Her body remains relaxed, and she does not attempt to turn away from her mother while receiving the bottle. When her mother pauses to burp her, Julie babbles happily.

Julie reacts to the feeding attempt of her mother, demonstrating positive visual, affective, vocal, and motor behaviors attributed to feeding responsiveness. She is awake and alert, makes eye contact with her mother, sucks eagerly on her bottle, maintains a relaxed posture, and makes pleasant vocalizations.

Borderline case: Daniel

(A borderline case contains some, but not all, of the concept's critical attributes)

Daniel is a 6-month-old infant. Wide-eyed and alert, he is placed in his father's arms. He gazes at his father's face and reaches for his glasses while smiling and making happy babbling sounds. When his father offers Daniel a bottle, he arches his back, turns his head away, and makes repeated upward movements with his arms. When his father removes the bottle, he continues to reach for his father's glasses, making happy squeals and kicking his feet.

This scenario represents a borderline case because not all the defining attributes are present. Although Daniel is revealing appropriate visual, affective and vocal behaviors, as evidenced by alertness, gazing at his father, smiling, and happy vocalizations, he is not exhibiting motor feeding behaviors. He does not attempt to move away from his father; however, he refuses to open his mouth and moves his arms and legs. Daniel is not responding to the feeding but is rather interested in playing with his father's glasses.

Related case: Brian

(A related case is one that is related to the concept, but does not have the critical attributes)

Brian is an 8-month-old healthy infant playing on the floor with his mother. He reaches for a nearby bottle, which is far from his reach. As he points at the bottle, his mother rolls a red car across the floor, which catches his eye. Brian grabs the car and begins to play with it, banging it loudly on the floor. When the telephone rings in a nearby room, his mother runs to answer it, leaving him alone. He drops the car and begins to cry loudly upon his mother's departure.

This is an example of the concept of attachment. (See "Read More" earlier in this module.) Although it is similar in some regards to the concept of responsiveness, it does not have the same defining attributes. The scenario is not a feeding interaction, and the caregiver makes no attempts to feed the infant. Therefore, no visual, affective, vocal, and motor feeding reactions are elicited.

Contrary case: Sarah

(A contrary case provides a clear example of what the concept is not)

Sarah is a 4-month-old infant girl with a diagnosis of failure to thrive. She is in the lower 5th percentile for body weight, and is crying loudly in her mother's arms despite the soothing attempts of her mother. Four hours have passed since her last feeding. Thinking that she may be hungry, her mother offers her a bottle. When Sarah's mother tries to place the nipple in her mouth, she refuses to accept it, and instead screams loudly, arches her back, and faces away from her mother. Exasperated, her mother removes the bottle and returns her to her crib.

The above example illustrates what infant feeding responsiveness is not. Although Sarah may be hungry, she reacts poorly to her mother's feeding attempts. Her behaviors of crying, refusal to suck the nipple, and arching and facing away from her mother are interpreted as lack of interest in feeding. Because Sarah is not exhibiting motor, visual, affective, or vocal attentiveness to her mother, optimal feeding responsiveness is not occurring.

Assessment and treatment

Problems reading cues of hunger and satiety, and of interactions in general can be identified during the interview process and also during a feeding observation. Some of

the questions in the Bright Futures in Practice: Nutrition guidelines will help to identify these types of problems. Formal evaluation tools are also available and some are listed in the resources section. (Many of these tools require special training for use and interpretation.)

To help families to learn to read their infants' cues, provide information about what types of behavior often indicate hunger or satiety, along suggestions for appropriate responses from a parent. Consultation from a mental health professional or other provider (e.g., public health nurse) with experience in parent-infant interaction may be required.

KNOWLEDGE CHECK

What types of behaviors indicate hunger?

What types of behaviors indicate satiety?

Answer:

Hunger behaviors may include sucking, fussing, fidgeting, increased alertness, rooting/nuzzling .

Satiety behaviors may include falling asleep, turning head away from food, increased interest in surroundings, crying, spitting out food or giving it back.

Resources

Parent-Child Interaction NCAST Feeding Scale

This scale is used with infants birth to 1 year of age. (See <http://www.pcrprograms.org/> for information)

Observational scale for mother infant interaction

Chatoor I, Getson P, Menvielle E, Brasseau C, O'Donnell R, Rivera Y, Mrazek DA. A feeding scale for research and clinical practice to assess mother-infant interactions in the first three years of life. *Infant Mental Health Journal* 1997;18(1):76-91.

Nutrition Interventions for CSHCN (WA DOH)

Available for download and ordering information at <https://www.doh.wa.gov/Publications/DisabilitiesandSpecialHealthcareNeeds>

Parent-Child Play Scale

This scale is for use in children with feeding disorders and should be used in conjunction with the Parent-Child Interaction NCAST Feeding Scale.

Chatoor I, Hommel S, Sechi C, Lucarelli L. Development of the Parent-Child Play Scale for use in children with feeding disorders. *Infant Mental Health Journal* 2018;38(2):153-169.

References and Resources

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Zerzan J, Chabra S. Nutrition and Feeding for the Premature Infant after Hospital Discharge. *Nutrition Focus*. 2017; 32(3).

Resources

Special Health Care Needs

Nutrition Interventions for CSHCN (WA DOH)

Available for download and ordering information at <https://www.doh.wa.gov/Publications/DisabilitiesandSpecialHealthcareNeeds> Includes chapters about failure to thrive, prematurity and low birthweight, food allergies, and feeding skills.

Academy of Nutrition and Dietetics Pocket Guide to Children with Special Health Care Nutritional Needs (PNPG/BHNDPG)

Ordering information at: <https://www.eatrightstore.org/product-subject/pediatric-nutrition>

MCH Trainings for Children and Youth with Special Health Care Needs

<https://www.mchnavigator.org/trainings/cyshcn.php>

Title V Maternal and Child Health (MCH) program and Children with Special Health Care Needs (CSHCN) program

<https://www.doh.wa.gov/YouandYourFamily/InfantsandChildren/HealthandSafety/ChildrenwithSpecialHealthCareNeeds>

Special Supplemental Nutrition Program for Women, Infants and Children (WIC)

<https://www.doh.wa.gov/YouandYourFamily/WIC>

Medical assistance/Medicaid

<https://www.doh.wa.gov/YouandYourFamily/WIC/WICFoods/InfantFormula>

Early Intervention

<http://www.dcyf.wa.gov/services/child-development-supports/esit>

Children with Special Health Care Needs Nutrition Network

<http://depts.washington.edu/cshcnut/nutnet/index.html>

Washington State Community Feeding Teams

<http://depts.washington.edu/cshcnut/feeding/locating.html>

Training Opportunities - CSHCN

MCH Nutrition Training Programs - Funded by the federal Maternal and Child Health Bureau, these training programs provide short- and long-term training opportunities.

General information at: <https://nutrition.mchtraining.net/> and

<https://mchb.hrsa.gov/training/projects.asp?program=12>

Nutrition for Children with Special Health Care Needs - Self-study (six 1-hour modules) and Group-study (four 1-hour modules) are available online:

<http://depts.washington.edu/pwdlearn>

Failure to Thrive

Failure to Thrive and Pediatric Undernutrition: A transdisciplinary approach

Failure to Thrive and Pediatric Undernutrition: A transdisciplinary approach. (1999).

Kessler DB and Dawson P. Brookes Publishing. This book explores failure-to-thrive and pediatric undernutrition from a multidisciplinary perspective.

<http://www.brookespublishing.com>

Prematurity

Gaining and Growing Website

Information for community health professionals who work with premature infants.

<http://depts.washington.edu/growing/>

Article: Nutrition and Feeding for the Premature Infant after Hospital Discharge

- J, Chabra S. Nutrition and Feeding for the Premature Infant after Hospital Discharge. Nutrition Focus. 2017; 32(3). Information about ordering back issues: <http://depts.washington.edu/nutrifoc/webapps/>

Food Allergies

American Academy of Allergy Asthma and Immunology

<http://www.aaaai.org>

The Food Allergy and Anaphylaxis Network

<http://www.foodallergy.org>

International Food Information Council

<http://www.foodinsight.org>

Feeding Relationship

NCAST Feeding Scale

This scale is used with infants birth to 1 year of age. (See <http://www.ncast.org> for information)

Observational scale for mother infant interaction

Chatoor I, Getson P, Menvielle E, Brasseau C, O'Donnell R, Rivera Y, Mrazek DA. A feeding scale for research and clinical practice to assess mother-infant interactions in the first three years of life. *Infant Mental Health Journal* 1997;18(1):76-91.

Child of Mine: Feeding with Love and Good Sense

Satter E. *Child of Mine: Feeding with Love and Good Sense*. Bull Publishing. 2000.

Quiz

1. According to the Bright Futures in Practice: Nutrition guidelines, which of the following indicates the need for referral to a dietitian:
 - a. birthweight <1500 g
 - b. recurring vomiting or reflux
 - c. limited diet because of aversions or allergies
 - d. all of the above

2. Premature infants are defined as those who:
 - a. were born before 40 weeks gestational age
 - b. were born before 37 weeks gestational age
 - c. have birthweights less than 2500 grams
 - d. have birthweights less than 1500 grams

3. The goals of nutrition assessment for the premature infant include all of the following EXCEPT:
 - a. maintain growth at the 50th percentile for age
 - b. provide guidance and support to parents regarding appropriate feeding methods
 - c. identify feeding problems and assist in resolution of these issues
 - d. educate parents regarding goals for growth and feeding to “normalize” the feeding experience

4. A formula-fed infant taking less than ____ ounces formula per pound is at risk for dehydration.
 - a. 1.5
 - b. 2.5
 - c. 3.5
 - d. 4.5

5. Premature formulas are designed to meet the needs of premature infants during the time they are in the hospital. Use beyond this time can result in:
 - a. inadequate energy intakes
 - b. inadequate protein intakes
 - c. excessive intakes of vitamins A and D
 - d. excessive intakes of calcium and phosphorus

6. Improperly prepared formula can be one contributor to failure-to-thrive. Over-dilute formulas are often indicated by:

- a. vomiting
- b. diarrhea
- c. early satiety
- d. polydipsia/polyuria

7. Catch-up growth is defined as rate of growth that:

- a. results in weight-for-age at or above the 50th percentile
- b. is similar to the growth rate of the infant's sibling(s)
- c. crosses two percentile channels within 1-2 months
- d. is faster than expected for age

8. Which of the following is appropriate for an individual with an allergy to cow's milk:

- a. lactalbumin
- b. whey
- c. casein hydrolysate formula
- d. standard infant formula

9. Which of the following nutrients may be at risk when foods that contain wheat are eliminated:

- a. iron
- b. protein
- c. calcium
- d. pantothenic acid

10. Which of the following is NOT a positive feeding behavior:

- a. pleasant vocalizations (babbling)
- b. motor attentiveness (relaxed posture)
- c. motor restlessness (arching, tense)
- d. expression of pleasant affect (smiling)

First Steps Nutrition Modules EVALUATION

Rate the curriculum and provide comments. Use this scale:

Strongly Agree = 4	Agree = 3	Disagree = 2	Strongly Disagree = 1
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Module 6: Nutrition and Normal Pregnancy

Learning Objectives

- Describe basic nutrient needs during normal pregnancy
- Identify general risk factors during pregnancy and describe the potential complications and nutritional implications associated with each

_____ This section met its stated learning objective (see above).

_____ The clinical examples provided were consistent with what a learner might encounter in practice.

_____ The clinical examples illustrated the material presented in the module.

_____ Information and procedures presented was technically accurate. (If you disagree, what information and procedures presented were not accurate?) _____

_____ The material was relevant to the practices of the target audience (maternal and child health care providers who address nutrition, including providers in public health settings, practitioners in pre-service training, and practitioners in private practice).

_____ I would have organized the material differently. (If you agree, how would you have organized it?) _____

_____ The language used was clear and easy to understand.

_____ The use of examples was adequate.

_____ It is reasonable to expect a community practitioner to complete one module in 1-2 hours.

Rate the curriculum and provide comments. Use this scale:

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_____ I would have included additional topics and/or objectives. (If you agree, what would you have added or expanded on?)

Comments:

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Module 4: Medical Nutrition Therapy for Specific Conditions – Pregnancy

Learning Objectives

- Describe the medical risks and nutritional implications of some common complications associated with pregnancy
- Describe basic medical nutrition therapy for some common complications associated with pregnancy: gestational diabetes, hypertensive disorders, overweight, underweight

_____ This section met its stated learning objective (see above).

_____ The clinical examples provided were consistent with what a learner might encounter in practice.

_____ The clinical examples illustrated the material presented in the module.

_____ Information and procedures presented was technically accurate. (If you disagree, what information and procedures presented were not accurate?) _____

_____ The material was relevant to the practices of the target audience (maternal and child health care providers who address nutrition, including providers in public health settings, practitioners in pre-service training, and practitioners in private practice).

_____ I would have organized the material differently. (If you agree, how would you have organized it?) _____

_____ The language used was clear and easy to understand.

_____ The use of examples was adequate.

_____ It is reasonable to expect a community practitioner to complete one module in 1-2 hours.

_____ Use of the previous MSS Policy and Procedure Manual is useful and should be

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kept in the module. If not do you have a recommended resource instead?

_____ I would have included additional topics and/or objectives. (If you agree, what would you have added or expanded on?)

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Module 5: Nutrition and the Postpartum Period

Learning Objectives

- Describe basic nutrient needs during the normal postpartum period
- Identify risk factors during the postpartum period and describe the potential complications and nutritional implications associated with each risk
- Complete a nutrition assessment for a woman during the postpartum period (including evaluation of anthropometrics, biochemical indicators, dietary intake, medical data, psychosocial issues)
- Develop an individualized intervention and education plan (including weight goals, treatment/prevention of iron deficiency, general diet quality)
- Refer clients to appropriate members of the First Steps team and/or community providers, as appropriate

_____ This section met its stated learning objective (see above).

_____ The clinical examples provided were consistent with what a learner might encounter in practice.

_____ The clinical examples illustrated the material presented in the module.

_____ Information and procedures presented was technically accurate. (If you disagree, what information and procedures presented were not accurate?) _____

_____ The material was relevant to the practices of the target audience (maternal and child health care providers who address nutrition, including providers in public health settings, practitioners in pre-service training, and practitioners in private practice).

_____ I would have organized the material differently. (If you agree, how would you have organized it?) _____

_____ The language used was clear and easy to understand.

_____ The use of examples was adequate.

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_____ It is reasonable to expect a community practitioner to complete one module in 1-2 hours.

_____ I would have included additional topics and/or objectives. (If you agree, what would you have added or expanded on?)

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Module 6: Nutrition and the Young Infant

Learning Objectives

Describe basic nutrient needs during normal the first 2 months of life

- Identify risk factors during first 2 months of life and describe the potential complications and nutritional implications associated with each
- Complete a nutrition assessment for a young infant (including evaluation of anthropometrics, biochemical indicators, dietary intake, medical data, psycho-social issues)
- Develop an individualized intervention and education plan
- Refer clients to appropriate members of the First Steps team and/or community providers, as appropriate

_____ This section met its stated learning objective (see above).

_____ The clinical examples provided were consistent with what a learner might encounter in practice.

_____ The clinical examples illustrated the material presented in the module.

_____ Information and procedures presented was technically accurate. (If you disagree, what information and procedures presented were not accurate?) _____

_____ The material was relevant to the practices of the target audience (maternal and child health care providers who address nutrition, including providers in public health settings, practitioners in pre-service training, and practitioners in private practice).

_____ I would have organized the material differently. (If you agree, how would you have organized it?) _____

_____ The language used was clear and easy to understand.

_____ The use of examples was adequate.

_____ It is reasonable to expect a community practitioner to complete one module in 1-2

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hours.

_____ I would have included additional topics and/or objectives. (If you agree, what would you have added?) _____

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Module 7: Medical Nutrition Therapy for Specific Conditions – Infants

Learning Objectives

- Identify some nutrition-related issues associated with some conditions that commonly occur during early infancy (prematurity, low birthweight, failure-to-thrive, allergies, over- and under-feeding related to feeding cues)
- Describe basic medical nutrition therapy for some conditions that commonly occur during early infancy
- Describe resources for infants with some conditions that commonly occur during early infancy

_____ This section met its stated learning objective (see above).

_____ The clinical examples provided were consistent with what a learner might encounter in practice.

_____ The clinical examples illustrated the material presented in the module.

_____ Information and procedures presented was technically accurate. (If you disagree, what information and procedures presented were not accurate?) _____

_____ The material was relevant to the practices of the target audience (maternal and child health care providers who address nutrition, including providers in public health settings, practitioners in pre-service training, and practitioners in private practice).

_____ I would have organized the material differently. (If you agree, how would you have organized it?) _____

_____ The language used was clear and easy to understand.

_____ The use of examples was adequate.

_____ It is reasonable to expect a community practitioner to complete one module in 1-2 hours.

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_____ The use of “Failure to Thrive” should still be used as a section title. If you disagree or strongly disagree what term would you use instead?

_____ I would have included additional topics and/or objectives. (If you agree, what would you have added?) _____

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