



SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES

Date:10.01.2021

From

Dr, Padma,
Professor and HOD,
Department of Obstetrics and Gynaecology,
Sri Lakshmi narayana Institute of Medical Sciences,
Bharath Institute of Higher Education and Research,
Chennai.

To

The Dean,
Sri Lakshmi Narayana Institue Of Medical Sciences,
Bharath Institute of Higher Education and Research,
Chennai.

Sub: Permission to conduct value-added course : Nutrition in Pregnancy and Lactation Dear Sir,
With reference to the subject mentioned above, the department proposes to conduct a value-added course
titled : **Nutrition in Pregnancy and Lactation** on MAR 2021 - MAY 2021 . We solicit your kind
permission for the same.

Kind Regards

Dr. Padma,

FOR THE USE OF DEANS OFFICE

Names of Committee members for evaluating the course:

The Dean: Dr. Jayakumar

The HOD: Dr. Padma

The Expert: Dr, Nivedhana

The committee has discussed about the course and is approved.

dean

Dr. P. JAYAKUMAR, M.S., M.CH.,
DIRECTOR / DEAN
Sri Lakshmi Narayana Institute of Medical Sciences
Osudu, Agaram Post, Pondicherry-60502.

Subject Expert

ASSISTANT PROFESSOR
DEPT. OF OBSTETRICS & GYNAEC
Sri Lakshmi Narayana Instit
Medical Sciences
OSUDU, PONDICHERRY

HOD

PROFESSOR
DEPT. OF OBSTETRICS & GYNAE
Sri Lakshmi Narayana Insti
Medical Sciences



OFFICE OF THE DEAN

Sri Lakshmi Narayana Institute of Medical Sciences

OSUDU, AGARAM VILLAGE, VILLIANUR COMMUNE, KUDAPAKKAM POST,
PUDUCHERRY - 605 502.

[Recognised by Medical Council of India, Ministry of Health letter No. U/12012/249/2005-ME (P-II) dt. 11/07/2011]
[Affiliated to Bharath University, Chennai - TN]

Circular

15.02.2021

Sub: Organising Value-added Course: : NUTRITION IN PREGNANCY AND LACTATION

With reference to the above mentioned subject, it is to bring to your notice that Sri Lakshmi Narayana Institute of Medical Sciences, **Bharath Institute of Higher Education and Research**, is organising “**NUTRITION IN PREGNANCY AND LACTATION**”. The course content and registration form is enclosed below.”

The application must reach the institution along with all the necessary documents as mentioned. The hard copy of the application should be sent to the institution by registered/ speed post only so as to reach on or before 1.03.2021. Applications received after the mentioned date shall not be entertained under any circumstances.

Dean

Dr. P. JAYAKUMAR, M.S., M.CH.,
DIRECTOR/DEAN
Sri Lakshmi Narayana Institute of Medical Sciences
Osudu, Agaram Post, Pondicherry-605502.

Encl: Copy of Course content and Registration form.

Course Proposal

Course Title: Nutrition in Pregnancy and Lactation

Course Objective:

Overview in Nutrition

Energy expenditure during pregnancy

Lab tests during pregnancy

Nutrients

Gestational weight gain

Special considerations

Obesity

Eating disorders

Lactation

Bariatric surgery

Summary and future considerations

Course Outcome: Knowledge about Nutrition in Pregnancy and Lactation

Course Audience: Final MBBS Undergraduates

Course Coordinator: Dr. Akansha agarwal

Course Faculties with Qualification and Designation:

Dr. Padma, Prof. and HOD, OBGY

Dr. Akansha agarwal , Assistant Professor, OBGY

Course Curriculum/Topics with schedule (Min of 30 hours)

Sl No	Date	Topic	Time	Hours
1	3.03.2021	Overview in Nutrition	4.00pm -5.00pm	1
2	10.03.2021	Energy expenditure during pregnancy	4.00pm -7.00pm	3
3	16.03.2021	Lab tests during pregnancy	4.00pm -7.00pm	3
4	24.04.2021	Nutrients	4.00pm -6.00pm	2
5	2.04.2021	Gestational weight gain	4.00pm -7.00pm	3
6	12.04.2021	Special considerations	4.00pm- 7.00pm	3
7	28.04.2021	obesity	4.00pm -6.00pm	2
8	2.05.2021	Eating disorders	4.00pm -7.00pm	3
9	8.05.2021	Lactation	4.00pm -7.00pm	3
10	14.05.2021	Bariatric surgery	4.00pm -6.00pm	2
11	20.05.2021	Summary and future considerations	4.00pm -7.00pm	3
12	24.05.2021	Do's and DONT's	4.00pm -6.00pm	2
			Total Hours	30

REFERENCE BOOKS: (Minimum 2)

Willaims Obstetrics Edition 21

Strat OG

VALUE ADDED COURSE

1. Name of the programme & Code

Nutritional recommendations in Pregnancy and Lactation OBGY 3

2. Duration & Period

30 hrs & MARCH 2021- MAY 2021

3. Information Brochure and Course Content of Value Added Courses

Enclosed as Annexure- I

4. List of students enrolled

Enclosed as Annexure- II

5. Assessment procedures:

Short questions- *Enclosed as Annexure- III*

6. Certificate model

Enclosed as Annexure- IV

7. No. of times offered during the same year:

1 Time MARCH 2021- MAY 2021

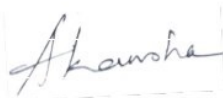
8. Year of discontinuation: 2021

9. Summary report of each program year-wise

Value Added Course-					
Sl. No	Course Code	Course Name	Resource Persons	Target Students	Strength & Year
1	OBGY 3	Nutritional recommendations in Pregnancy and Lactation	Dr. Akansha agarwal	Final Year MBBS	MARCH 2021- MAY 2021

10. Course Feed Back

Enclosed as Annexure- V



RESOURCE PERSON

ASSOCIATE PROFESSOR
DEPT. OF OBSTETRICS & GYNAECI
Sri Lakshmi Narayana Instit
Medical Sciences
OSUDU, PUDUCHERRY



COORDINATOR

Dr. P. JAYAKUMAR, M.S., M.CH.,
DIRECTOR / DEAN
Sri Lakshmi Narayana Institute of Medical Sciences
Osudu, Agaram Post, Pondicherry-605502

NUTRITION RECOMMENDATIONS IN PREGNANCY AND LACTATION

PARTICIPANT HAND BOOK

BIHER

SLIMS

Particulars	Descriptions
--------------------	---------------------

Course Title	Nutrition Recommendations in Pregnancy and Lactation	
Course Code	OBG-03	
Objectives	<ol style="list-style-type: none"> 1. Introduction 2. Energy expenditure during pregnancy 3. Lab tests during pregnancy 4. Nutrients 5. Gestational weight gain 6. Special considerations 7. Obesity 8. Eating disorders 9. Lactation 10. Bariatric surgery 11. Summary and future considerations 12. References and feedback 	
Further learning Opportunities	Nutritional requirements in newborn	
Key Competencies	On successful completion of course the students will have knowledge in nutrition requirements	
Target Students	Final Year MBBS Students	
Theory Session	30 hours	COURSE DETAILS April 2021 to August 2021 and September to January 2021 30 Hours
Assessment Procedure		Short Questions
Durations		

Nutrition Recommendations in Pregnancy and Lactation

Introduction

Nutrition counselling is a cornerstone of prenatal care for all women during pregnancy. A woman's nutritional status not only influences her health, but also pregnancy outcomes and the health of her fetus-neonate. Physicians and other healthcare providers need to be cognizant of nutritional needs during pregnancy, as they differ significantly compared to non-pregnant populations. Furthermore, an individualized approach to nutritional counseling that considers a woman's access to food, socioeconomic status, race-ethnicity and cultural food choices, and body mass index (BMI) is recommended. In addition, many of the recommendations are geared for uncomplicated pregnancies, so adjustments need to be made when complications, such as gestational diabetes, arise. A nutritionist or registered dietitian can help facilitate dietary counselling and interventions. In this

chapter, the maternal physiological adaptations as well as macronutrient and micronutrient requirements during pregnancy and lactation will be reviewed. Other discussions on these topics will include multiple gestations, obesity in pregnancy, pregnancies after bariatric surgery, special diets, and common exposures during pregnancy.

PREGNANCY

Energy Expenditure during Pregnancy

Caloric intake should increase by approximately 300 kcal/day during pregnancy. This value is derived from an estimate of 80,000 kcal needed to support a full-term pregnancy and accounts not only for increased maternal and fetal metabolism but for fetal and placental growth. Dividing the gross energy cost by the mean pregnancy duration (250 days after the first month) yields the 300 kcal/day estimate for the entire pregnancy.^{1,2} However, energy requirements are generally the same as non-pregnant women in the first trimester and then increase in the second trimester, estimated at 340 kcal and 452 kcal per day in the second and third trimesters, respectively. Furthermore, energy requirements vary significantly depending on a woman's age, BMI, and activity level. Caloric intake should therefore be individualized based on these factors.

Laboratory Testing during Pregnancy

Physiological changes during pregnancy alter the normal ranges of several laboratory values. Both total red blood cell mass and plasma volume increase, but plasma volume increases to a greater extent resulting in hemodilution and anemia during pregnancy. Consequently, a hemoglobin

<10.5 g/dl or a hematocrit <32% is considered anemic during the second trimester ([Table 1](#)). Serum total protein and albumin also decrease by approximately 30% compared to non-pregnant values.³ Additionally, because estrogen increases the hepatic production of certain proteins, there is greater protein binding of corticosteroids, sex steroids, thyroid hormones, and vitamin D during pregnancy, resulting in lower free levels.

Table 1

Definitions of anemia during pregnancy

Trimester	Hemoglobin (g/dl)	Hematocrit (%)
First	<11.0	<33
Second	<10.5	<32
Third	<11.0	<33

Normal values for non-pregnant women	12.1 to 15.1	37-48%
--------------------------------------	--------------	--------

Nutrients

Macronutrients

Recommended protein intake during pregnancy is 60g/day, which represents an increase from 46g/d in non-pregnant states. In other words, this increase reflects a change to 1.1g of protein/kg/day during pregnancy from 0.8g of protein/kg/day for non-pregnant states.² Carbohydrates should comprise 45-64% of daily calories and this includes approximately 6-9 servings of whole grain daily. Total fat intake should comprise 20-35% of daily calories, similar to non-pregnant women.

Micronutrients

The recommendations for daily micronutrient intake for a pregnant woman are determined by the “Recommended Dietary Allowances” or RDA data. In general, these RDA refer to the levels of intake of essential nutrients that are judged by the Food and Nutrition Board of the Institute of Medicine (IOM) to be adequate to meet the known nutrient needs of practically all healthy persons. The RDA have been modified for pregnant women. [Table 2](#) shows the dietary allowances for most vitamins and minerals during pregnancy and they are reviewed in further detail below.

Table 2

Recommended daily dietary allowances for pregnant and lactating women

Nutrient	Non-Pregnant	Pregnant*	Lactation*
Vitamin A (µg/d)	700	770	1300
Vitamin D (µg/d)	5	15	15
Vitamin E (mg/d)	15	15	19
Vitamin K (µg/d)	90	90	90
Folate (µg/d)	400	600	500
Niacin (mg/d)	14	18	17
Riboflavin (mg/d)	1.1	1.4	1.6
Thiamin (mg/d)	1.1	1.4	1.4
Vitamin B ₆ (mg/d)	1.3	1.9	2
Vitamin B ₁₂ (µg/d)	2.4	2.6	2.8

Vitamin C (mg/d)	75	85	120
Calcium (mg/d)	1,000	1,000	1,000
Iron (mg/d)	18	27	9
Phosphorus (mg/d)	700	700	700
Selenium (µg/d)	55	60	70
Zinc (mg/d)	8	11	12

*Applies to women >18 years old

Data from Otten JJ, Pitzel Hellwig J, Meyers LD, Editors. Dietary reference intakes. The essential guide to nutrient requirements. Washington, DC.

A daily prenatal multivitamin is generally recommended before conception and during pregnancy. [Table 3](#) describes the typical composition of a prenatal vitamin. The critical difference compared to other multivitamins is the folic acid dose, which is necessary to support rapid cell growth, cell replication, cell division, and nucleotide synthesis for fetal and placental development. While there is data to support additional folic acid and iron supplementation during pregnancy, there is no high quality evidence

demonstrating that all women require the increased levels of nutrients in a prenatal vitamin.

Table 3

Typical composition of micronutrients in a prenatal vitamin

Component	Amount	% Daily Value for Pregnant and Lactating Women
Vitamin A	4,000 IU as beta carotene	50%
Vitamin D ₃	400 IU as Cholecalciferol	100%
Vitamin E	11 IU as dl-Alpha Tocopheryl acetate	37%
Folic acid	800 µg	100%

Niacin	18 mg as niacinamide	90%
Riboflavin	1.7mg as thiamin mononitrate	85%
Thiamin	1.5 mg	88%
Vitamin B ₆	2.6 mg as pyridoxine hydrochloride	104%
Vitamin B ₁₂	4 µg as cyanocobalamin	50%
Vitamin C	100 mg as ascorbic acid	167%
Calcium	150 mg as calcium carbonate	12%
Iron	27 mg as ferrous fumarate	150%
Zinc	25 mg as zinc oxide	167%

Folic acid is the synthetic form of the naturally occurring B vitamin, folate. Folic acid is the form used in most vitamin supplements and food fortification. As mandated by the Food and Drug Administration, commonly fortified foods include bread, cereal, and pasta. Folate-rich food sources are citrus fruits,

dark-green leafy vegetables, nuts, and liver. Folate requirements increase during pregnancy as a result of rapidly dividing cells related to fetal growth. Notably, folic acid supplements (400-800µg daily) taken prior to conception can reduce the risk for neural tube defects in the fetus.⁴ Since the FDA mandate, blood folate levels have increased and neural tube defects have declined.⁴ In order to reduce the risk for neural tube defects in their offspring, women are recommended to take folic acid from fortified food or supplements daily in addition to consuming a diet rich in food sources of folate.⁵ Women with a history of a neural tube defect in a prior pregnancy should take a higher dose (4mg) of folic acid daily for subsequent pregnancies. Deficiencies in folate have been associated with megaloblastic anemia in pregnancy, though not with other pregnancy outcomes such as preterm birth or stillbirths.⁶

Iron supplements have routinely been recommended in pregnancy because iron needs nearly double during pregnancy. A standard prenatal vitamin contains 27 mg of elemental iron. Vitamin C supplements can assist with iron absorption, whereas milk and tea can inhibit iron supplementation. Women with iron deficiency, defined by a ferritin level <15 µg/L, can increase their hemoglobin by 2 g/dL over a one month period with a daily replacement of 60-120 mg of elemental iron. Common side effects of iron, such as stomach pain, constipation, nausea, and vomiting are often reasons why women are not compliant with iron supplementation. Iron-rich foods include red meat, pork, fish, and eggs.

Vitamin D is a fat-soluble vitamin that is primarily found in fortified milk or juice; natural sources include eggs and fish such as salmon. The skin also manufactures vitamin D when it is exposed to sunlight. Regardless of the

source – oral ingestion vs. skin absorption – further processing in the liver and then the kidney is required to create the active form, 1,25-dihydroxyvitamin D, which promotes calcium absorption from the intestines and thereby allows appropriate bone mineralization and growth. Vitamin D deficiency is common in pregnancy, especially in high-risk groups such as vegetarians, women who live in cold climates, and ethnic minority women with darker skin. Severe vitamin D deficiency has been associated with congenital rickets and fractures, but this is less common in the United States. While Vitamin D levels can be measured via a serum level of 25-hydroxy vitamin D, an optimal level during pregnancy has not been established. Furthermore, there is insufficient evidence to recommend screening all pregnant women for vitamin D deficiency. If vitamin D deficiency is discovered during pregnancy, then supplements (1000-2000 IU per day) can be given.⁷ In addition, routine vitamin D supplementation during pregnancy to prevent preeclampsia is also not recommended.⁸

Vitamin A is essential for cell differentiation and proliferation as well as development of the spine, heart, eyes, and ears. Offspring of mothers with vitamin A deficiency, which is rare in the United States, have a higher mortality rate, which may be associated with decreased immune function. Although most micronutrients have a wide safety margin with little concern for teratogenic effects, vitamin A is one exception.⁹ Excessive doses of Vitamin A (>10,000 IU/day) have been associated with cranial-facial (face, palate, ears) and cardiac birth defects. The maximal supplement in pregnancy is 8000 IU/day. It is the retinol form of Vitamin A that is associated with teratogenic effects, not the carotenoid version found in food sources such as carrots.

Studies regarding the risks and benefits of fish during pregnancy can often seem contradictory.¹⁰ This is in part due to that that most fish contain competing benefits and risks in the forms of omega-3 fatty acids and mercury.^{11,12} Omega-3 fatty acids are critical for fetal brain development and have been associated with improved vision in preterm infants, as well as better cardiovascular health later in life.¹³ Higher mercury levels in children, however, have been associated with deficits in memory, learning, and behavior.¹⁴ Ideally, pregnant women would consume those fish that are low in mercury and high in omega-3 fatty acids such as salmon, sardines, and anchovies. (Table 4) High mercury fish such as shark, swordfish, tilefish, and king mackerel should be avoided. The Federal Drug Administration (FDA) and the Environmental Protection Agency (EPA) websites offer information regarding local fish and their mercury content.¹⁵ Available data suggest that fish-oil supplements do not confer the same health benefits as consumption of the actual fish.

Table 4

Fish to Avoid During Pregnancy and Lactation

Shark

Swordfish

Tilefish

King Mackerel

Gestational Weight Gain

Pregnancy has traditionally been considered a time for weight gain, not weight loss. The obligatory weight gain during pregnancy is approximately 8 kg which accounts for the fetus, the placenta, amniotic fluid volume, and adaptations to maternal tissues (e.g., uterus, breast, blood volume). A weight gain less than this amount implies that existing maternal adipose and protein stores would be mobilized in order to support the pregnancy. Metabolic changes of women who lose weight during pregnancy are not well-described, but ketonemia, increased urinary nitrogen excretion, and decreased gluconeogenic amino acid production result after a period of fasting during pregnancy.¹⁷ Pregnancy is often considered a time of “accelerated starvation” due to the increase in insulin resistance, with an increased risk for developing ketonuria and ketonemia.¹⁸ This physiologic change is important to consider in the setting of weight loss during pregnancy because maternal ketonemia or ketonuria may subsequently be associated with abnormal fetal growth or later neurocognitive development.¹⁹⁻²¹

A woman's pre-pregnancy BMI determines the total amount of weight gain and rate of weight gain during pregnancy ([Table 5](#)).²² Of note, the gestational weight gain guidelines that IOM published in 2009 differ from their original 1990 recommendations in that women with a pre-pregnancy BMI $\geq 30\text{kg/m}^2$ should gain 5-9 kg or 11-20 pounds during pregnancy.^{22,23} Women who are overweight or have obesity have lower ranges for recommended

total gestational weight gain compared to normal-weight women, yet >50% of all women exceed the gestational weight gain recommendations.²⁴ The IOM 2009 guidelines also recommend that women should conceive at a normal weight so as to achieve optimal maternal and neonatal outcomes.²² One study found that women who gain weight in the appropriate range for their BMI during pregnancy have fewer adverse perinatal outcomes than those gaining above the described thresholds.²⁵

Table 5

Gestational weight gain recommendations

Pre-pregnancy BMI	Total weight gain at term	Rate of weight gain in the 2nd and 3rd trimester; Mean (range)
Underweight ($<18.5 \text{ kg/m}^2$)	12.5-18 kg 28-40 lbs.	0.51 (0.44-0.58) kg/week 1 (1-1.3) lbs./week
Normal weight ($18.5\text{-}24.9 \text{ kg/m}^2$)	11.5-16 kg 25-35 lbs.	0.42 (0.35-0.50) kg/week 1 (0.8-1) lbs./week
Overweight ($25.0\text{-}29.9 \text{ kg/m}^2$)	7-11.5 kg 15-25 lbs.	0.28 (0.23-0.33) kg/week 0.6 (0.5-0.7) lbs./week
Obesity	5-9 kg	0.22 (0.17-0.27) kg/week

($\geq 30.0 \text{ kg/m}^2$)	11-20 lbs.	0.5 (0.4-0.6) lbs./week
--------------------------------	------------	-------------------------

Data from Institute of Medicine. Weight gain during pregnancy: reexamining the guidelines. Washington, DC: Institute of Medicine; 2009.

Special considerations

Multiple gestations

In twins, the maternal metabolic rate is approximately 10% greater than in singletons.²⁶

Furthermore, the physiological changes in a singleton pregnancy are exacerbated in multiple gestations. This includes an increase in plasma volume which results in further decreases in hemoglobin, albumin, and water soluble vitamins.²⁷ There are no standardized nutritional guidelines for multiple gestations, but they have been inferred from singletons. One recommendation for macronutrient composition is 20% protein, 40% fat, and 40% carbohydrates.^{28,29} It is estimated that a 40% higher-calorie diet may maintain a woman's nutritional state during a twin pregnancy. Rates of iron deficiency anemia are 2.4-4 times higher in twins than in singletons.²⁸ Anemia due to folate deficiency is 8 times more common in twins compared to singletons.²⁷ As such, a 1 mg folic acid daily supplement has been recommended for twin gestations.³⁰ Some experts recommend 1000IU of vitamin D and 2000-2500mg/d of calcium daily for twins.²⁸ Multiple gestations have a higher risk of complications such as premature birth and low birth weight. The IOM 2009 guidelines for gestational weight gain in twin gestations are presented in [Table 6](#). Of note, these guidelines are considered provisional, as the evidence to support them is not as strong as it

is for singletons. Interestingly, a weight gain of 24 pounds by 24 weeks has been associated with higher rates of birth weights >2500g.^{31,32} Evidence for nutritional management of higher order multiples (triplets, quadruplets, etc.) is lacking, but they can be managed similarly to twin gestations.

Table 6

Gestational weight gain recommendations for twins

Pre-pregnancy BMI	Total weight gain at term
Underweight ($<18.5 \text{ kg/m}^2$)	17-25 kg 37-54 lbs.
Normal weight ($18.5\text{-}24.9 \text{ kg/m}^2$)	17-25 kg 37-54 lbs.
Overweight	14-23 kg

(25.0-29.9 kg/m ²)	31-50 lbs.
Obesity (≥ 30.0 kg/m ²)	11-19 kg 25-42 lbs.

Data from Institute of Medicine. Weight gain during pregnancy: reexamining the guidelines. Washington, DC: Institute of Medicine; 2009.

Obesity

The World Health Organization and the National Institutes of Health define normal weight as a BMI of 18.5–24.9 kg/m², overweight as a BMI of 25–29.9 kg/m², and obesity as a BMI of 30 kg/m² or greater. Obesity is further categorized by BMI into Class I (30–34.9 kg/m²), Class II (35–39.9 kg/m²), and Class III or extreme obesity (≥ 40 kg/m²).^{33,34} Trends in adult weight over the past couple of decades highlight the escalating role that obesity plays in women’s health; 31.8% of reproductive age women (20-39 years) had obesity in 2011-2012.³⁵ Women with a higher pre-pregnancy BMI have a greater risk for adverse perinatal outcomes.^{36,37} These include both maternal complications such as gestational diabetes, pregnancy-related hypertension, and cesarean deliveries along with adverse fetal effects such as birth defects, stillbirth, and abnormal fetal growth. As such, weight loss prior to pregnancy is strongly recommended in order to reduce the risk of these complications.³⁸

Table 7

Risks of Obesity in Pregnancy

During Pregnancy	During Labor & Delivery	Postpartum complications
Spontaneous miscarriage	Difficult fetal monitoring	Postpartum hemorrhage
Birth defects	Cesarean delivery	Wound infection
Limitations ultrasound	to Decreased success of a vaginal birth after cesarean delivery	Obesity in offspring
Gestational diabetes	Difficult anesthesia	
Hypertensive disease		
Stillbirth		

Fetal growth abnormalities		
----------------------------	--	--

Guidelines for the management of obesity during pregnancy differ among countries; those practices endorsed by the American Congress of Obstetricians and Gynecologists are listed below:³⁸

- Gestational weight gain recommendations should be individualized by the BMI at the first prenatal visit and based on the IOM 2009 guidelines (11-20 pounds).
- Early screening for glucose intolerance (gestational diabetes or overt diabetes) is recommended. If the initial early diabetes screening result is negative, a repeat diabetes screening generally is performed at 24–28 weeks of gestation.
- Behavioral interventions employing changes to diet and exercise can improve postpartum weight reduction in contrast to exercise alone.

With respect to health behavior interventions, randomized and non-randomized studies of interventions to promote optimal gestational weight gain have emphasized combinations of dietary counseling, weight monitoring, and exercise programs. Although a few studies have shown a reduction in gestational weight gain for women with obesity after exposure to a health behavior intervention, the majority have found no benefit. For example, in one study in which women were randomized to a low glycemic index diet, the majority of women with obesity exceeded the gestational weight gain goals regardless of the study arm (57% control vs. 60% intervention, $p=0.8$).³⁹ When the results of multiple studies have been

examined cumulatively in meta-analyses, the interventions for women who are overweight or obese have been shown to have moderate or no influence at all on gestational weight gain or other perinatal outcomes.⁴⁰⁻⁴⁴ Further research is indicated to determine how to promote adherence to gestational weight gain guidelines with health behavior interventions. Another concern is the influence maternal obesity has on childhood weight, resulting in a propagation of the cycle of obesity. It is likely that environmental and epigenetic influences and not just genetic mechanisms play a role in the obesity epidemic. Several theories suggest that in utero nutrition may impact chronic diseases such as diabetes, hypertension, and other metabolic diseases later in life in the offspring.^{45,46} As this research continues to evolve, clinicians should consider that maternal nutrition during pregnancy may have life-long consequences for the offspring.

Pregnancy after bariatric surgery

Pregnancy after bariatric surgery is not uncommon as fertility often improves after a bariatric surgery procedure.⁴⁷⁻⁴⁹ Given that bariatric procedures can create deficiencies of micro- and macronutrients, a pregnancy occurring after a bariatric surgery procedure requires particular attention to nutritional status. As stated previously, requirements for calories, vitamins, and minerals increase during pregnancy, so nutritional deficiencies in the bariatric surgery patient can be exacerbated during pregnancy. The most common deficiencies that occur after bariatric surgery are vitamin B₁₂, folate, and iron.⁵⁰ Because malabsorptive procedures (e.g., Roux-en-y gastric bypass [RYGB], biliopancreatic diversion) have a higher risk for nutritional deficiencies, closer surveillance in pregnancies that occur after these types of surgeries is appropriate.⁵¹ However, derangements in nutrients can also

occur after restrictive-type procedures (e.g., laparoscopic adjustable gastric banding), so it may be reasonable to screen all women who are pregnant post-bariatric surgery for nutritional deficiencies.⁵² Guidelines for screening and management of nutritional deficiencies during pregnancy are adapted from those designed for non-pregnant states and include laboratory testing once a trimester or every 3 months if the levels are normal ([Table 8](#)).^{53,54} Iron deficiency anemia is frequently a long-term complication of bariatric surgery, occurring in 6% to 50% of patients after RYGB.⁵⁵⁻⁵⁸ In pregnancies after bariatric surgery, iron deficiency anemia can be diagnosed in the usual manner with a low mean corpuscular volume, and abnormal iron studies (e.g., low serum iron, high total iron-binding capacity, and a low serum ferritin) keeping in mind the physiologic anemia that occurs during pregnancy ([Table 1](#)). Treatment of vitamin and mineral deficiencies during pregnancy, in terms of dose and duration, is similar to that of non-pregnant states.

Table 8

Diagnostic testing along with prophylaxis and treatment of micro and macronutrient deficiencies in pregnancies after bariatric surgery

Component	Diagnostic testing (serum)	Prophylaxis	Treatment if deficient
Protein	Serum albumin and prealbumin	60g protein/day	Protein supplements

Vitamin A	Vitamin A, if clinically indicated	4000 IU/day in prenatal vitamin	Vitamin A not to exceed 8000 IU/day
Vitamin D	25-hydroxy vitamin D, if clinically indicated	400-800 IU/day in prenatal vitamin	Calcitriol (vitamin D) 1000 IU/day
Vitamin K	Vitamin K ₁ , if clinically indicated	Not routinely given	Vitamin K ₁ 1 mg/day Consult with hematologist
Folic acid	Complete blood count, red blood cell folate	600-800 µg/day in prenatal vitamin	Folic acid 1000 µg/day
Vitamin B ₁₂	Complete blood cell count, Vitamin B ₁₂	4 µg/day in prenatal vitamin	Oral vitamin B12 350 µg/day or Intramuscular 1000 µg/month Consult with hematologist
Calcium	Total and ionized	250 mg/day in	Calcium citrate 1000 mg/day with Vitamin

	calcium	prenatal vitamin	D
Iron	Complete blood count, iron, ferritin, total iron binding capacity	30 mg/day in prenatal vitamin	Ferrous sulfate 325mg twice-three times/day with vitamin C

[Open in a separate window](#)

Data from Mechanick JI, Youdim A, Jones DB, et al. Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient--2013 update: cosponsored by American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic & Bariatric Surgery. *Obesity* (Silver Spring) 2013;21(Suppl 1):S1-27; and American Academy of Pediatrics and the American College of Obstetricians and Gynecologists. Guidelines for perinatal care. 7th ed. Washington, DC: American Academy of Pediatrics and the American College of Obstetricians and Gynecologists; 2012.

Eating disorders

For women with either a history of or current eating disorder (e.g., anorexia nervosa, bulimia), additional questions regarding their weight should be asked including how they feel about weight gain, being weighed at every prenatal visit (which is customary in prenatal care practices in the United States), and the ongoing changes in their body.⁵⁹ With respect to weighing, a woman's preference about weighing (i.e., whether or not she prefers to see the numbers) should be assessed and documented in the chart. Counseling on gestational weight gain goals is still important for these women as weight

influences the growth and development of the fetus. Similar to management prior to pregnancy, a collaborative team of experts in eating disorders should continue to manage and treat these women during the pregnancy.

Vegetarians

There are varying types of vegetarian diets such as ovolactovegetarian (includes dairy and egg products), ovovegetarian (includes eggs), lactovegetarian (includes dairy products), and vegan (excludes eggs, dairy, and any other animal products). Alternative protein sources for these women include beans, peas, soy, nuts, nut butter, and milk and egg products. Minerals that may be deficient in their diets include iron, calcium, zinc, and vitamin B₁₂. Laboratory testing for these specific nutrients may be indicated.

Common Exposures

Historically, pregnant women were advised to abstain from caffeine. However, those earlier studies that demonstrated an increased risk of adverse obstetric outcomes such as miscarriage, poor fetal growth, and stillbirth were subject to substantial bias.⁶⁰ Additionally, the risk of those outcomes occurring generally increased with fairly substantive doses of caffeine, such as greater than 4 cups of coffee a day.^{61,62} Most current research suggests that smaller amounts of caffeine intake, less than 200-300mg daily, are not associated with increased perinatal risk.

It is particularly important that general food safety precautions such as ensuring meat and dairy-containing foods are appropriately refrigerated are followed during pregnancy because pregnant women are more susceptible to the effects of infections from certain microorganisms. Ensuring foods are

pasteurized and/or appropriately cooked can lower the risk of acquiring infections such as Listeria and Toxoplasmosis. Listerial infections are associated with increased risk for pregnancy complications such as preterm delivery and stillbirth.⁶³ Toxoplasmosis infections can result in ventriculomegaly and other fetal-neonatal complications.⁶⁴ Wearing gloves when gardening may also reduce the risk of exposure to toxoplasmosis.⁶⁵

While current recommendations from professional organizations do not recommend universal screening for lead exposure, risk assessment should be performed at the first prenatal visit and testing of lead levels performed if any risk factors are identified. High lead levels have been associated with a greater risk of obstetric complications such as miscarriage, poor fetal growth, and neurodevelopmental impairment.⁶⁶

LACTATION

Physiology and Production

Breastfeeding and breast milk are the global standard for infant feeding. The World Health Organization, the U.S. Surgeon General, the American Academy of Pediatrics, the American Congress of Obstetricians and Gynecologists, the American Academy of Family Practice, and the Academy of Breastfeeding Medicine all support this statement. The American Academy of Pediatrics further recommends exclusive breastfeeding for the first 6 months and breastfeeding at least through the first year of life.⁶⁷ Similar to pregnancy, energy and nutritional requirements also differ during lactation and breastfeeding.

Women who breastfeed require approximately 500 additional kcal/day beyond what is recommended for non-pregnant women.⁶⁸ The estimate is derived from the mean volume of breast milk produced per day (mean 780 mL, range 450-1200 mL) and the energy content of milk (67 kcal/100 mL).⁶⁹ During pregnancy, most women store an extra 2 to 5 kg (19,000 to 48,000 kcal) in tissue, mainly as fat, in physiologic preparation for lactation. If women do not consume the extra calories, then body stores are used to maintain lactation. It is not unusual for lactating women to lose 0.5-1.0 kg/month after the first postpartum month.⁷⁰

There are even less evidence-based recommendations for nutrient intake during breastfeeding compared to pregnancy. Lactation is considered successful when the breast-fed infant is gaining an appropriate amount of weight. The recommended daily allowance for protein during lactation is an additional 25 g/day. Requirements of many micronutrients increase compared to pregnancy, with the exception of vitamins D and K, calcium, fluoride, magnesium, and phosphorus. As such, it is recommended that women to continue to take a prenatal vitamin daily while they are breastfeeding ([Tables 2,,3\).3](#)). Weight loss during lactation does not usually impact the quantity or quality of breast milk, but maternal deficiencies in magnesium, vitamin B₆, folate, calcium, and zinc have been described during lactation.^{69,71} Both fat (vitamins A, D, K) and water-soluble vitamins (vitamins C, B₁, B₆, B₁₂, and folate) are secreted into breast milk and their levels are reduced in breast milk when there is a maternal vitamin deficiency.⁷²⁻⁷⁴ Fortunately, these vitamin deficiencies in breast milk respond to maternal supplementation. On the other hand, calcium, phosphorus, and magnesium levels in breast milk are independent of maternal serum levels

and diet.⁷⁵ Maternal factors such as stress, anxiety, and smoking can decrease milk production, but the quantitative and caloric value of breast milk does not change with dieting and exercise.⁷⁶⁻⁸³ Moreover, a woman's weight, BMI, body fat percentage, and weight gain during pregnancy do not influence milk production.⁸⁴⁻⁸⁶

Special Considerations

Multiple Gestations

Approximately 40-90% of mothers of twins initiate breastfeeding.⁸⁷ The production of milk is primarily determined by infant demand rather than the maternal capacity to lactate. As such, for women attempting to breastfeed twins and triplets, the supply will meet the demand. Continuation of micronutrient supplementations given antenatally in the form of a prenatal vitamin is appropriate for women who are breastfeeding twins. Twins can breastfeed either simultaneously or separately.

Obesity

Several studies have demonstrated that women with obesity have decreased rates of initiating breastfeeding and breastfeed for shorter durations compared to normal weight women.⁸⁸ Biological (i.e. delayed lactation), psychological (i.e., embarrassment related to body size and difficulty in breastfeeding discreetly), mechanical (i.e., larger breasts and nipples that create difficulties with latching), and medical (i.e., cesarean deliveries, diabetes, thyroid dysfunction) factors have been theorized to explain these findings, but the exact etiology is likely a combination of factors. To combat this trend and increase the likelihood that women with obesity attain their breastfeeding goals, they need additional support and

encouragement to breastfeed, including assistance with appropriate latching techniques and demonstration of appropriate infant positions, to aid with initiation and continuation of lactation.

Bariatric surgery

Women who have had bariatric surgery are also advised to follow the recommendation of breastfeeding for at least 6 months. Laboratory evaluation of micronutrient levels, as described in [Table 8](#) for pregnant women, is also recommended for breastfeeding women after bariatric surgery, with one group suggesting they be tested as frequently as every 3 months.⁸⁹ The infant's provider also should be aware of the mother's history of bariatric surgery as well as any of her specific dietary restrictions or identified nutrient deficiencies. For women who have a gastric banding procedure, one recommendation is to keep the band deflated until the successful establishment of breastfeeding.⁹⁰ Though few studies have evaluated the nutritional content of breast milk produced by lactating women after bariatric surgery, it is likely similar to other women. While infants who are born to women with obesity have a higher rate of early childhood obesity, this may be offset by the reduced risk of early childhood obesity in infants who are predominantly breastfed.⁹¹⁻⁹³

Vegetarians

Recommended dietary guidelines for vegetarians during lactation are lacking. Vitamin D supplements are recommended for women who do not drink milk or other food fortified with vitamin D. A vitamin B₁₂ supplement (2.6 µg/d) is also recommended for women who consume ovo-lacto-vegetarian and vegan diets.⁹⁴ Another recommendation is to consume 1200-1500

mg/day of calcium because of the possible decreased intake and absorption from a plant-based diet.⁹⁵ The FDA recommends similar precautions regarding avoiding higher mercury fish during lactation. Adverse neonatal effects have not been demonstrated with ordinary maternal fish consumption during breastfeeding.

ONLINE RESOURCES FOR CLINICIANS

www.phenxtoolkit.org Screening questions to identify nutritional issues or deficiencies in patients.

http://resources.iom.edu/Pregnancy/WhatToGain.html?_ga=1.247807815.195235449.1445895119 BMI calculator

<http://fnic.nal.usda.gov/interactiveDRL>. Calculators for daily energy needs and interactive dietary reference intakes for healthcare professionals

<http://www.choosemyplate.gov/supertracker-tools/daily-food-plans/moms.html> Allows health care professionals to estimate energy and nutrient requirements during pregnancy and lactation

www.marchofdimes.com/pregnancy/nutrition_indepth.html Resource for general prenatal dietary guidelines from the March of Dimes

http://iom.nationalacademies.org/Activities/Children/PregnancyWeightDissemination/2013-SEP-09/~//media/Files/About%20the%20IOM/Pregnancy-Weight/ProvidersBro-Final.pdf?_ga=1.148168439.195235449.1445895119 Review on how to implement the IOM gestational weight gain guidelines

<http://iom.nationalacademies.org/Activities/Children/PregnancyWeightDissemination/2013-SEP-09/ToolKit.aspx> Webinar that reviews a toolkit on implementing the IOM gestational weight gain guidelines

<http://iom.nationalacademies.org/Activities/Children/PregnancyWeightDissemination/2013-SEP-09/~//media/Files/About%20the%20IOM/Pregnancy-Weight/IOMPregnancyMythsFactsEnglish.pdf> Myths for providers to dispel during the course of prenatal care

http://www.foodsafety.gov/risk/pregnant/chklist_pregnancy.html Checklist of foods to avoid during pregnancy

<http://www.fda.gov/food/foodborneillnesscontaminants/metals/ucm393070.htm> Resource from the FDA on fish consumption during pregnancy

<https://www.breastfeeding.asn.au/bf-info/common-concerns%E2%80%93mum/diet> Breastfeeding information and nutrition

Summary and Future Considerations

Nutrition counseling is a cornerstone of prenatal care for all women during pregnancy and it also extends to lactation. Clinicians should be aware of the physiological adaptations that occur during pregnancy and lactation and how these changes influence the nutritional needs of pregnant and lactating women. One area of research that would assist providers and women in meeting their nutritional requirements and gestational weight gain goals is the measurement of diet and physical activity that is specific to pregnancy. Effective interventions that target health behaviors are also needed to improve a woman's nutritional status and assist her in meeting the gestational weight gain goals.

Key points

1. Energy, macronutrient, and micronutrient requirements increase during both pregnancy and lactation.
2. Gestational weight gain goals vary according to the pre-pregnancy body mass index. Women who meet the weight gain goals have improved perinatal outcomes.
3. Special attention is required in the nutritional management of multiple gestations, obesity, and pregnancies after bariatric surgery.

Synopsis

The nutritional status of a woman during pregnancy and lactation is not only critical for her health, but for future generations. While a nutritionist or registered dietitian can help facilitate dietary counseling and interventions, physicians also need to be cognizant of nutritional needs during pregnancy, as they differ significantly compared to non-pregnant populations. Furthermore, an individualized approach to nutritional counseling that considers a woman's nutritional status and body mass index is recommended.

[Go to:](#)

Acknowledgments

This work was supported by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institutes of Health under Award Number K23HD076010 (MAK).

[Go to:](#)

Footnotes

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

The authors have no conflicts of interest related to the material in this chapter to disclose.

[Go to:](#)

References

1. Forsum E, Lof M. Energy metabolism during human pregnancy. *Annu Rev Nutr.* 2007;27:277–292. [[PubMed](#)] [[Google Scholar](#)]
2. Trumbo P, Yates AA, Poos M. Food and Nutrition Board, Institute of Medicine: Dietary Reference Intakes for Energy, Carbo-hydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. National Academies Press; Washington, DC: 2002. SS. [[PubMed](#)] [[Google Scholar](#)]
3. Hytten F. *Clinical Physiology in Obstetrics*. Blackwell Scientific Publications; Oxford: 1991. CG. [[Google Scholar](#)]
4. Pitkin RM. Folate and neural tube defects. *Am J Clin Nutr.* 2007;85(1):285S–288S. [[PubMed](#)] [[Google Scholar](#)]
5. Otten JJ, Meyers LD. Dietary reference intakes. The essential guide to nutrient requirements. National Academies Press; 2006. HJP. [[Google Scholar](#)]

6. Lassi ZS, Salam RA, Haider BA, Bhutta ZA. Folic acid supplementation during pregnancy for maternal health and pregnancy outcomes. *Cochrane Database Syst Rev.* 2013;3:CD006896. [[PubMed](#)] [[Google Scholar](#)]
7. Siega-Riz AM, Mehta U. Clinical Updates in Women's Health Care. In: Artal R, editor. *Nutrition*. Vol. 13. American College of Obstetricians and Gynecologists; Washington, D.C.: 2014. [[Google Scholar](#)]
8. Practice ACoO ACOG Committee Opinion No. 495: Vitamin D: Screening and supplementation during pregnancy. *Obstetrics and gynecology.* 2011;118(1):197–198. [[PubMed](#)] [[Google Scholar](#)]
9. Humphrey JH, West KP, Jr., Sommer A. Vitamin A deficiency and attributable mortality among under-5-year-olds. *Bull World Health Organ.* 1992;70(2):225–232. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
10. Wenstrom KD. The FDA's new advice on fish: it's complicated. *American journal of obstetrics and gynecology.* 2014;211(5):475–478. e471. [[PubMed](#)] [[Google Scholar](#)]
11. Myers GJ, Davidson PW, Cox C, et al. Prenatal methylmercury exposure from ocean fish consumption in the Seychelles child development study. *Lancet.* 2003;361(9370):1686–1692. [[PubMed](#)] [[Google Scholar](#)]
12. Hibbeln JR, Davis JM, Steer C, et al. Maternal seafood consumption in pregnancy and neurodevelopmental outcomes in childhood (ALSPAC study): an observational cohort study. *Lancet.* 2007;369(9561):578–585. [[PubMed](#)] [[Google Scholar](#)]
13. Genois SJ, Schwalfenberg GK. Time for an oil check: the role of essential omega-3 fatty acids in maternal and pediatric health. *Journal of*

perinatology : official journal of the California Perinatal Association. 2006;26(6):359–365. [[PubMed](#)] [[Google Scholar](#)]

14. Grandjean P, Weihe P, White RF, et al. Cognitive deficit in 7-year-old children with prenatal exposure to methylmercury. *Neurotoxicology and teratology*. 1997;19(6):417–428. [[PubMed](#)] [[Google Scholar](#)]

15. Administration USFaD Fish: What Pregnant Women and Parents Should Know. 2015 <http://www.fda.gov/Food/FoodborneIllnessContaminants/Metals/ucm393070.htm> 2014. Accessed October 15.

16. Makrides M, Gibson RA, McPhee AJ, Yelland L, Quinlivan J, Ryan P. Effect of DHA supplementation during pregnancy on maternal depression and neurodevelopment of young children: a randomized controlled trial. *JAMA : the journal of the American Medical Association*. 2010;304(15):1675–1683. [[PubMed](#)] [[Google Scholar](#)]

17. Felig P. Maternal and fetal fuel homeostasis in human pregnancy. *Am J Clin Nutr*. 1973;26(9):998–1005. [[PubMed](#)] [[Google Scholar](#)]

18. Freinkel N. Banting Lecture 1980. Of pregnancy and progeny. *Diabetes*. 1980;29(12):1023–1035. [[PubMed](#)] [[Google Scholar](#)]

19. Stehbens JA, Baker GL, Kitchell M. Outcome at ages 1, 3, and 5 years of children born to diabetic women. *Am J Obstet Gynecol*. 1977;127(4):408–413. [[PubMed](#)] [[Google Scholar](#)]

20. Rizzo T, Metzger BE, Burns WJ, Burns K. Correlations between antepartum maternal metabolism and child intelligence. *N Engl J Med*. 1991;325(13):911–916. [[PubMed](#)] [[Google Scholar](#)]

21. Silverman BL, Rizzo T, Green OC, et al. Long-term prospective evaluation of offspring of diabetic mothers. *Diabetes*. 1991;40(Suppl 2):121–125. [[PubMed](#)] [[Google Scholar](#)]
22. Institute of Medicine . Weight gain during pregnancy: reexamining the guidelines. Washington, DC: 2009. [[Google Scholar](#)]
23. Nutrition during pregnancy. Institute of Medicine; Washington, DC: 1990. [[Google Scholar](#)]
24. Deputy NP, Sharma AJ, Kim SY. Gestational Weight Gain - United States, 2012 and 2013. *MMWR Morb Mortal Wkly Rep*. 2015;64(43):1215–1220. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
25. Johnson J, Clifton RG, Roberts JM, et al. Pregnancy outcomes with weight gain above or below the 2009 Institute of Medicine guidelines. *Obstetrics and gynecology*. 2013;121(5):969–975. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
26. Casele HL, Dooley SL, Metzger BE. Metabolic response to meal eating and extended overnight fast in twin gestation. *Am J Obstet Gynecol*. 1996;175(4):917–921. Pt 1. [[PubMed](#)] [[Google Scholar](#)]
27. Rosello-Soberon ME, Fuentes-Chaparro L, Casanueva E. Twin pregnancies: eating for three? Maternal nutrition update. *Nutr Rev*. 2005;63(9):295–302. [[PubMed](#)] [[Google Scholar](#)]
28. Goodnight W, Newman R, Society of Maternal-Fetal M Optimal nutrition for improved twin pregnancy outcome. *Obstetrics and gynecology*. 2009;114(5):1121–1134. [[PubMed](#)] [[Google Scholar](#)]

29. Luke B. Nutrition in multiple gestations. *Clin Perinatol.* 2005;32(2):403–429. vii. [[PubMed](#)] [[Google Scholar](#)]
30. Young BC, Wylie BJ. Effects of twin gestation on maternal morbidity. *Seminars in perinatology.* 2012;36(3):162–168. [[PubMed](#)] [[Google Scholar](#)]
31. Luke B, Gillespie B, Min SJ, Avni M, Witter FR, O'Sullivan MJ. Critical periods of maternal weight gain: effect on twin birth weight. *Am J Obstet Gynecol.* 1997;177(5):1055–1062. [[PubMed](#)] [[Google Scholar](#)]
32. Luke B, Minogue J, Witter FR, Keith LG, Johnson TR. The ideal twin pregnancy: patterns of weight gain, discordancy, and length of gestation. *Am J Obstet Gynecol.* 1993;169(3):588–597. [[PubMed](#)] [[Google Scholar](#)]
33. Health Nlo The Practical Guide: Identification, Evaluation, and Treatment of Overweight and Obesity in Adults; Paper presented at: NIH Publication No. 98-40832000. [[Google Scholar](#)]
34. Obesity: preventing and managing the global epidemic. Report of a WHO consultation World Health Organ Tech Rep Ser. 2000;894:i–xii. 1-253. [[PubMed](#)] [[Google Scholar](#)]
35. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. *JAMA.* 2014;311(8):806–814. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
36. Hauger MS, Gibbons L, Vik T, Belizan JM. Prepregnancy weight status and the risk of adverse pregnancy outcome. *Acta Obstet Gynecol Scand.* 2008;87(9):953–959. [[PubMed](#)] [[Google Scholar](#)]

37. Cnattingius S, Bergstrom R, Lipworth L, Kramer MS. Prepregnancy weight and the risk of adverse pregnancy outcomes. *N Engl J Med*. 1998;338(3):147–152. [[PubMed](#)] [[Google Scholar](#)]
38. *Obstetrics and gynecology*. 2015;126(6):e112–126. [[PubMed](#)] [[Google Scholar](#)]
39. Walsh JM, McGowan CA, Mahony R, Foley ME, McAuliffe FM. Low glycaemic index diet in pregnancy to prevent macrosomia (ROLO study): randomised control trial. *BMJ*. 2012;345:e5605. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
40. Dodd JM, Grivell RM, Crowther Ca, Robinson JS. Antenatal interventions for overweight or obese pregnant women: a systematic review of randomised trials. *BJOG : an international journal of obstetrics and gynaecology*. 2010;117:1316–1326. [[PubMed](#)] [[Google Scholar](#)]
41. Campbell F, Johnson M, Messina J, Guillaume L, Goyder E. Behavioural interventions for weight management in pregnancy: a systematic review of quantitative and qualitative data. *BMC Public Health*. 2011;11:491. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
42. Tanentsapf I, Heitmann BL, Adegboye AR. Systematic review of clinical trials on dietary interventions to prevent excessive weight gain during pregnancy among normal weight, overweight and obese women. *BMC pregnancy and childbirth*. 2011;11:81. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
43. Oteng-Ntim E, Varma R, Croker H, Poston L, Doyle P. Lifestyle interventions for overweight and obese pregnant women to improve

pregnancy outcome: systematic review and meta-analysis. *BMC Med.* 2012;10:47. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

44. Thangaratnam S, Rogozinska E, Jolly K, et al. Effects of interventions in pregnancy on maternal weight and obstetric outcomes: meta-analysis of randomised evidence. *BMJ.* 2012;344:e2088. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

45. Barker DJ, Osmond C, Kajantie E, Eriksson JG. Growth and chronic disease: findings in the Helsinki Birth Cohort. *Ann Hum Biol.* 2009;36(5):445–458. [[PubMed](#)] [[Google Scholar](#)]

46. Barker DJ. The developmental origins of adult disease. *European journal of epidemiology.* 2003;18(8):733–736. [[PubMed](#)] [[Google Scholar](#)]

47. Paulen ME, Zapata LB, Cansino C, Curtis KM, Jamieson DJ. Contraceptive use among women with a history of bariatric surgery: a systematic review. *Contraception.* 2010;82(1):86–94. [[PubMed](#)] [[Google Scholar](#)]

48. Teitelman M, Grotegut CA, Williams NN, Lewis JD. The impact of bariatric surgery on menstrual patterns. *Obes Surg.* 2006;16(11):1457–1463. [[PubMed](#)] [[Google Scholar](#)]

49. Gosman GG, King WC, Schrope B, et al. Reproductive health of women electing bariatric surgery. *Fertil Steril.* 2010;94(4):1426–1431. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

50. Shankar P, Boylan M, Sriram K. Micronutrient deficiencies after bariatric surgery. *Nutrition.* 2010;26(11-12):1031–1037. [[PubMed](#)] [[Google Scholar](#)]

51. Mechanick JI, Youdim A, Jones DB, et al. Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient-2013 update: Cosponsored by American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic & Bariatric Surgery*. *Obesity* (Silver Spring) 2013;21(Suppl 1):S1–S27. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

52. Gudzone KA, Huizinga MM, Chang HY, Asamoah V, Gadgil M, Clark JM. Screening and Diagnosis of Micronutrient Deficiencies Before and After Bariatric Surgery. *Obesity surgery*. 2013 [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

53. Bariatric surgery and pregnancy. Practice Bulletin #105; Gynecologists ACoOa.2009. [[Google Scholar](#)]

54. Mechanick JI, Youdim A, Jones DB, et al. Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient--2013 update: cosponsored by American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic & Bariatric Surgery. *Obesity* (Silver Spring) 2013;21(Suppl 1):S1–27. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

55. Simon SR, Zemel R, Betancourt S, Zidar BL. Hematologic complications of gastric bypass for morbid obesity. *South Med J*. 1989;82(9):1108–1110. [[PubMed](#)] [[Google Scholar](#)]

56. Heber D, Greenway FL, Kaplan LM, et al. Endocrine and nutritional management of the post-bariatric surgery patient: an Endocrine Society

Clinical Practice Guideline. The Journal of clinical endocrinology and metabolism. 2010;95(11):4823–4843. [[PubMed](#)] [[Google Scholar](#)]

57. Alvarez-Cordero R, Aragon-Viruet E. Post-operative Complications in a Series of Gastric Bypass Patients. *Obes Surg*. 1992;2(1):87–89. [[PubMed](#)] [[Google Scholar](#)]

58. Halverson JD. Micronutrient deficiencies after gastric bypass for morbid obesity. *Am Surg*. 1986;52(11):594–598. [[PubMed](#)] [[Google Scholar](#)]

59. American Psychiatric Association. A Treatment of patients with eating disorders, third edition. American Psychiatric Association. *Am J Psychiatry*. 2006;163(7 Suppl):4–54. [[PubMed](#)] [[Google Scholar](#)]

60. Bracken MB. Potential confounding still clouds the possible association of maternal caffeine intake and low birth weight. *Evidence-based medicine*. 2015;20(1):37. [[PubMed](#)] [[Google Scholar](#)]

61. Maternal caffeine intake during pregnancy and risk of fetal growth restriction: a large prospective observational study. *BMJ*. 2008;337:a2332. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

62. Bech BH, Nohr EA, Vaeth M, Henriksen TB, Olsen J. Coffee and fetal death: a cohort study with prospective data. *American journal of epidemiology*. 2005;162(10):983–990. [[PubMed](#)] [[Google Scholar](#)]

63. *Obstetrics and gynecology*. 2014;124(6):1241–1244. [[PubMed](#)] [[Google Scholar](#)]

64. Neu N, Duchon J, Zachariah P. TORCH infections. *Clinics in perinatology*. 2015;42(1):77–103. viii. [[PubMed](#)] [[Google Scholar](#)]

65. Prevention

CfDCa Parasites

-

Toxoplasmosis. 2015 <http://www.cdc.gov/parasites/toxoplasmosis/prevent.html> 2013. Accessed October 15.

66. Obstetrics and gynecology. 2012;120(2):416–420. Pt 1. [[Google Scholar](#)]

67. Pediatrics. 2012;129(3):e827–841. [[PubMed](#)] [[Google Scholar](#)]

68. Guidelines for perinatal care. 7th American Academy of Pediatrics and the American College of Obstetricians and Gynecologists; Washington, DC: 2012. [[Google Scholar](#)]

69. Nutrition during lactation. Institute of Medicine, National Academy Press; Washington, DC: 1991. [[Google Scholar](#)]

70. Weekly SJ. Diets and eating disorders: implications for the breastfeeding mother. NAACOG's clinical issues in perinatal and women's health nursing. 1992;3(4):695–700. [[PubMed](#)] [[Google Scholar](#)]

71. Gartner LM, Greer FR, Section on B, Committee on Nutrition American Academy of P. Prevention of rickets and vitamin D deficiency: new guidelines for vitamin D intake. Pediatrics. 2003;111(4):908–910. Pt 1. [[PubMed](#)] [[Google Scholar](#)]

72. Butte NF, Calloway DH. Evaluation of lactational performance of Navajo women. Am J Clin Nutr. 1981;34(10):2210–2215. [[PubMed](#)] [[Google Scholar](#)]

73. Hollis B, Lambert PW, Horst RL. Factors affecting the antirachitic sterol content of native milk. In: Holick MF, Anast CS, editors. Perinatal Calcium

and Phosphorous Metabolism. Elsevier Science Publishers BV; Amsterdam: 1983. p. 157. GT. [[Google Scholar](#)]

74. von Kries R, Shearer M, McCarthy PT, Haug M, Harzer G, Gobel U. Vitamin K1 content of maternal milk: influence of the stage of lactation, lipid composition, and vitamin K1 supplements given to the mother. *Pediatr Res*. 1987;22(5):513–517. [[PubMed](#)] [[Google Scholar](#)]

75. Prentice A. Calcium supplementation during breast-feeding. *N Engl J Med*. 1997;337(8):558–559. [[PubMed](#)] [[Google Scholar](#)]

76. Schanler RJ, Hurst NM. Human milk for the hospitalized preterm infant. *Seminars in perinatology*. 1994;18(6):476–484. [[PubMed](#)] [[Google Scholar](#)]

77. Hopkinson JM, Schanler RJ, Fraley JK, Garza C. Milk production by mothers of premature infants: influence of cigarette smoking. *Pediatrics*. 1992;90(6):934–938. [[PubMed](#)] [[Google Scholar](#)]

78. Vio F, Salazar G, Infante C. Smoking during pregnancy and lactation and its effects on breast-milk volume. *Am J Clin Nutr*. 1991;54(6):1011–1016. [[PubMed](#)] [[Google Scholar](#)]

79. Andersen AN, Lund-Andersen C, Larsen JF, et al. Suppressed prolactin but normal neurophysin levels in cigarette smoking breast-feeding women. *Clin Endocrinol (Oxf)* 1982;17(4):363–368. [[PubMed](#)] [[Google Scholar](#)]

80. Dewey KG. Effects of maternal caloric restriction and exercise during lactation. *J Nutr*. 1998;128(2 Suppl):386S–389S. [[PubMed](#)] [[Google Scholar](#)]

81. Dewey KG, Lovelady CA, Nommsen-Rivers LA, McCrory MA, Lonnerdal B. A randomized study of the effects of aerobic exercise by lactating women on breast-milk volume and composition. *N Engl J Med*. 1994;330(7):449–453. [[PubMed](#)] [[Google Scholar](#)]
82. Dusdieker LB, Hemingway DL, Stumbo PJ. Is milk production impaired by dieting during lactation? *Am J Clin Nutr*. 1994;59(4):833–840. [[PubMed](#)] [[Google Scholar](#)]
83. McCrory MA, Nommsen-Rivers LA, Mole PA, Lonnerdal B, Dewey KG. Randomized trial of the short-term effects of dieting compared with dieting plus aerobic exercise on lactation performance. *Am J Clin Nutr*. 1999;69(5):959–967. [[PubMed](#)] [[Google Scholar](#)]
84. Dewey KG, Heinig MJ, Nommsen LA, Lonnerdal B. Maternal versus infant factors related to breast milk intake and residual milk volume: the DARLING study. *Pediatrics*. 1991;87(6):829–837. [[PubMed](#)] [[Google Scholar](#)]
85. Butte NF, Garza C, Stuff JE, Smith EO, Nichols BL. Effect of maternal diet and body composition on lactational performance. *Am J Clin Nutr*. 1984;39(2):296–306. [[PubMed](#)] [[Google Scholar](#)]
86. Michaelsen KF. Nutrition and growth during infancy. The Copenhagen Cohort Study. *Acta Paediatr Suppl*. 1997;420:1–36. [[PubMed](#)] [[Google Scholar](#)]
87. Flidel-Rimon O, Shinwell ES. Breast feeding twins and high multiples. *Arch Dis Child Fetal Neonatal Ed*. 2006;91(5):F377–380. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

88. Wojcicki JM. Maternal prepregnancy body mass index and initiation and duration of breastfeeding: a review of the literature. *J Womens Health (Larchmt)* 2011;20(3):341–347. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
89. Kaska L, Abacjew-Chmylko A, et al. Nutrition and Pregnancy after bariatric surgery. *ISRN Obesity*. 2013;2013:6. KJ. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
90. Dixon JB, Dixon ME, O'Brien PE. Pregnancy after Lap-Band surgery: management of the band to achieve healthy weight outcomes. *Obesity surgery*. 2001;11(1):59–65. [[PubMed](#)] [[Google Scholar](#)]
91. Arenz S, Ruckerl R, Koletzko B, von Kries R. Breast-feeding and childhood obesity--a systematic review. *Int J Obes Relat Metab Disord*. 2004;28(10):1247–1256. [[PubMed](#)] [[Google Scholar](#)]
92. Owen CG, Martin RM, Whincup PH, Smith GD, Cook DG. Effect of infant feeding on the risk of obesity across the life course: a quantitative review of published evidence. *Pediatrics*. 2005;115(5):1367–1377. [[PubMed](#)] [[Google Scholar](#)]
93. Ip S, Chung M, Raman G, et al. Breastfeeding and maternal and infant health outcomes in developed countries. *Evid Rep Technol Assess (Full Rep)* 2007;(153):1–186. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
94. Picciano MF. Pregnancy and lactation: physiological adjustments, nutritional requirements and the role of dietary supplements. *The Journal of nutrition*. 2003;133(6):1997S–2002S. [[PubMed](#)] [[Google Scholar](#)]


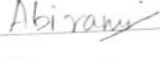



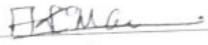
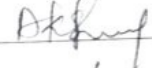
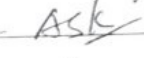
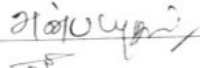
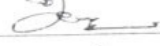
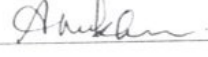

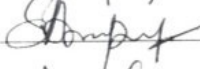
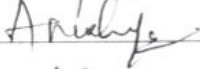



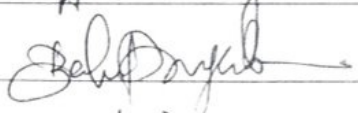
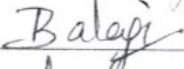
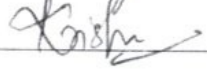
95. Venti CA, Johnston CS. Modified food guide pyramid for lactovegetarians and vegans. The Journal of nutrition. 2002;132(5):1050–1054. [[PubMed](#)] [[Google Scholar](#)]

VALUE ADDED COURSE

NUTRITIONAL RECOMMENDATIONS IN PREGNANCY AND LACTATION

COURSE CODE : OBGY 03

List of Students Enrolled MARCH 2021 - MAY 2021

NO	UNIVERSITY REG.NO	STUDENT NAME ADDRESS	SIGNATURE
1	U13MB151	ABDUL RAHMAN.A.	
2	U13MB152	ABIRAMI KAMBAN K.S	
3	U13MB153	ABIRAMILA.	
4	U13MB154	AFRAA.S.	
5	U13MB155	AHILA. M.	
6	U13MB156	AKMAR JEBIN.V.P.	
7	U13MB157	AKSHAYA. S.	
8	U13MB158	ALLADI SANATH KUMAR	
9	U13MB159	ANBAZHAGAN. D	
10	U13MB160	ANGELIN JEEVA PUSHPAM.S	
11	U13MB161	ANIK GHORAI	
12	U13MB162	ANUPRIYA. B.	
13	U13MB163	ANUPRIYA.S.	
14	U13MB164	ANUSUYA.V.,	
15	U13MB165	ARIKO IMCHEN	
6	U13MB166	ARULMOZHI. T.	
	U13MB167	ARUN KUMAR. K.	
	U13MB170	BALA PRIYADHARSHINI. P	
	U13MB168	BALAJI. S.	
	U13MB169	BALAKRISHNAN.R.	

NUTRITIONAL RECOMMENDATIONS IN PREGNANCY AND LACTATION

MCQs

Course Code: OBGY03

1. Recommended Protein during Pregnancy period is.....

- a) 60 mg b) 14 mg c) 32 mg d) 75 mg

2. what is the adequate intake of calcium for pregnant mother ?

- a) 1100mg b) 1000mg c) 1200mg d) 1300mg

3. How many calories are recommended for breast feeding mother ?

- a) 2500 b) 3000 c) 2000 d) 1500

4. Pregnant mother should follow a which diet ?

- a) consisting mainly of dairy products b) That contains no fat
c) That Nutritious consisting of variety of food d) that includes twice a many calories

5. How many times a day do newborns generally need a food ?

- a) 5-6 times b) 3-4 times c) 8-12 times d) 9-10 times

6. How does breast feeding help mothers ?

- a) to get back normal weight b) reduces risk of ovarian cancer
c) increases bone strength d) both A and B

7. Getting enough vit c in pregnancy will help in absorbing.....

- a) Ca⁺⁺ b) K⁺ c) Fe d) Zn

8. How much you need to put on atleast while pregnant to cover the growth of your baby ?

- a) 7kg b) 9kg c) 11kg d) 5kg

9. Which fatty acid is essential for development of CNS of fetus ?

- a) Linolevic acid b) Omega 3 c) Gamma - linolenic acid d) LDH

Reg No: -
③ U13 MBIS

NUTRITIONAL RECOMMENDATIONS IN PREGNANCY AND LACTATION

1/80

MCQs

Course Code: OBGY03

1. Recommended Protein during Pregnancy period is.....

- a) 66 mg b) 14 mg c) 32 mg d) 75 mg

2. what is the adequate intake of calcium for pregnant mother ?

- a) 1100mg b) 1000mg c) 1200mg d) 1300mg

3. How many calories are recommended for breast feeding mother ?

- a) 2500 b) 3000 c) 2000 d) 1500

4. Pregnant mother should follow a which diet ?

- a) consisting mainly of dairy products b) That contains no fat
c) That Nutritious consisting of variety of food d) that includes twice a many calories

5. How many times a day do newborns generally need a food ?

- a) 5-6 times b) 3-4 times c) 8-12 times d) 9-10 times

6. How does breast feeding help mothers ?

- a) to get back normal weight b) reduces risk of ovarian cancer
c) increases bone strength d) both A and B

7. Getting enough vit c in pregnancy will help in absorbing.....

- a) Ca⁺⁺ b) K⁺ c) Fe d) Zn

8. How much you need to put on atleast while pregnant to cover the growth of your baby ?

- a) 7kg b) 9kg c) 11kg d) 5kg

9. Which fatty acid is essential for development of CNS of fetus ?

- a) Linolevic acid b) Omega 3 c) Gamma - linolenic acid d) LDH

10. how much extra calories needed for pregnant women per day ?

- a) 400 b) 300 c) 500 d) 1000



Sri Lakshmi Narayana Institute of Medical Sciences

Affiliated to Bharath Institute of Higher Education & Research
(Deemed to be University under section 3 of the UGC Act 1956)



CERTIFICATE OF MERIT

This is to certify that **AKSHAYA. S** has actively participated in the Value Added Course on **NUTRITIONAL RECOMMENDATIONS IN PREGNANCY AND LACTATION** held during March 2021 – May 2021 Organized by Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry- 605 502, India.

RESOURCE PERSON

ASSISTANT PROFESSOR
DEPT. OF OBSTETRICS & GYNAECOLOGY
Sri Lakshmi Narayana Institute of
Medical Sciences
OSUDU, PUDUCHERRY.

COORDINATOR

Dr. P. JAYAKUMAR, M.S., M.CH.,
DIRECTOR / DEAN
Sri Lakshmi Narayana Institute of Medical Sciences
Osudu, Agaram Post, Pondicherry-605502.



Sri Lakshmi Narayana Institute of Medical Sciences

Affiliated to Bharath Institute of Higher Education & Research
(Deemed to be University under section 3 of the UGC Act 1956)



CERTIFICATE OF MERIT

This is to certify that **ARUN KUMAR. K** has actively participated in the Value Added Course on **NUTRITIONAL RECOMMENDATIONS IN PREGNANCY AND LACTATION** held during March 2021 – May 2021 Organized by Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry- 605 502, India.

RESOURCE PERSON

ASSISTANT PROFESSOR
DEPT. OF OBSTETRICS & GYNAECOLOGY
Sri Lakshmi Narayana Institute of
Medical Sciences
OSUDU, PONDICHERRY.

COORDINATOR

Dr. P. JAYAKUMAR, M.S., M.CH.,
DIRECTOR / DEAN
Sri Lakshmi Narayana Institute of Medical Sciences
Osudu, Agaram Post, Pondicherry-605502.

Annexure 4

Course/Training Feedback Form

Course:

Date:

Name:

Reg NO.

Department: Obstetrics and Gynaecology

Q 1: Please rate your overall satisfaction with the format of the course:

- a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 2: Please rate course notes:

- a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 3: The lecture sequence was well planned

- a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 4: The lectures were clear and easy to understand

- a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 5: Please rate the quality of pre-course administration and information:

- a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 6: Any other suggestions:

Comments:

Thank you for taking the time to complete this survey, your comments are much appreciated.

OPTIONAL Section: Name _____

Signature _____ Date _____

Annexure 4

Course/Training Feedback Form

Course: NUTRITION IN PREGNANCY AND LACTATION
Date: 24/01/2021
Name: ABDUL RAHMAN-A
Reg NO. 013 MB151
Department: Obstetrics and Gynaecology

Q 1: Please rate your overall satisfaction with the format of the course:

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 2: Please rate course notes:

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 3: The lecture sequence was well planned

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 4: The lectures were clear and easy to understand

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 5: Please rate the quality of pre-course administration and information:

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 6: Any other suggestions: NILL

Comments:

Thank you for taking the time to complete this survey, your comments are much appreciated.

OPTIONAL Section: Name _____

Signature _____ Date _____

Annexure 4

Course/Training Feedback Form

Course: **NUTRITION IN PREGNANCY AND LACTATION**
Date: **21/08/2021**
Name: **ANUSU YA. V**
Reg NO. **013 MB 164**
Department: **Obstetrics and Gynaecology**

Q 1: Please rate your overall satisfaction with the format of the course:

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 2: Please rate course notes:

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 3: The lecture sequence was well planned

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 4: The lectures were clear and easy to understand

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 5: Please rate the quality of pre-course administration and information:

a. Excellent b. Very Good c. Satisfactory d. unsatisfactory

Q 6: Any other suggestions: **NILL**

Comments:

Thank you for taking the time to complete this survey, your comments are much appreciated.

OPTIONAL Section: Name _____

Signature _____ Date _____

Date: 24.05.2021

From
Dr. Padma,
Professor,
Obstetrics and Gynaecology,
Sri Lakshmi Narayana institute of Medical sciences,
Bharath Institute of Higher Education and Research,
Chennai.

Through Proper Channel

To
The Dean,
Sri Lakshmi Narayana institute of Medical Sciences,
Bharath Institute of Higher Education and Research,
Chennai.

Sub: Completion of value-added course: Nutrition in Pregnancy and Lactation

Dear Sir,

With reference to the subject mentioned above, the department has conducted the value-added course titled: **Nutrition in Pregnancy and Lactation** on MARCH 2021-MAY 2021. We solicit your kind action to send certificates for the participants, that is attached with this letter. Also, I am attaching the photographs captured during the conduct of the course.

Kind Regards



Dr. Padma

PROFESSOR & HEAD
DEPT. OF OBSTETRICS & GYNAECOLOGY
Sri Lakshmi Narayana Institute of
Medical Sciences
OSIUDU, PUDUCHERRY.

Encl: Certificates

Photographs

VALUE ADDED COURSES

OBGY 3 NUTRITIONAL RECOMENDATIONS IN PREGNANCY AND LACTATION

