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PREGNANCY AND DIET: WHAT TO EAT

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ABSTRACT

Eating a well-balanced diet is important for all individuals, but it is even more essential for pregnant women. Diet is an important parameter that determines the well being of both the pregnant women and the baby. A developing baby needs essential nutrients, so mother's diet needs to be balanced and nutritious. It should have right balance of proteins, carbohydrates, fats, vitamins, and minerals. Poor nutrition may lead to a number of problems including anemia, lack of oxygen during delivering baby, low birth weight of baby and still birth. Pregnant women are recommended to have normal nutritional status with Body Mass Index (BMI) ranging from 20-25 kg/m2 in order to have a full term new born infant with an average weight not less than 3 Kilo grams. Most of pregnant women know about the importance of diet; however there are still food deficiencies among the pregnant women. Most foods are safe but there are some foods that should be avoided during pregnancy. Those include raw meat, raw eggs, unpasteurized milk, caffeine, fish containing mercury and unwashed vegetables. To meet the nutritional requirements supplements are recommended but should be taken only after advised by a doctor.

KEYWORDS: Pregnant women, Nutrition, RDA, Supplements.

1. INTRODUCTION

Nutrition is very vital for the well being of pregnant women and the baby. A healthy and nutritious diet will help in smooth pregnancy, however inadequate nutrition, may cause problems like anemia, lack of oxygen during delivery, low birth weight of baby and baby death inside the mother (Pattani Public Health Center, 2010). Most of the pregnant women know about the nutritional importance of food but still there are nutrient deficiencies. Eating well-balanced diet of proteins, carbohydrates, and fats, and consuming a wide variety of plants like vegetables, and fruits are mandatory for pregnant women. Fruits and vegetables should be consumed per day either in the form of juice, dried, canned, frozen, or fresh. Fresh and frozen produce usually have higher levels of vitamins and other nutrients. It is suggested that eating fruit is usually better for you than just drinking the juice, as natural sugar levels in juice are very high. Vegetable juices like carrot or wheatgrass provide dense nutrition. Nutrition determines the birth weight of the baby and in order to have average weight not less than 3,000 gram, pregnant women are recommended to have normal nutritional status with Body Mass Index (BMI) ranging from 20-25 kg./m2 (Goldberg, 2002). Low BMI is more possible to have low birth weight babies (Piammongkol *et al.*, 2004). According to the Institute of Medicine, USA, a woman whose body mass index (BMI) is between 18.5 and 24.9 should gain 25-35 pounds (11.4-15.9 kilograms) during the 9 months. A woman who is overweight at the start of pregnancy should gain between 15-25 pounds (6.8 to 11.4 kg). Weight gain recommendations may also vary, depending on the woman's age, fetal development, and her current health. Excessive or insufficient weight gain can undermine the health of both the fetus and the mother. Because of some religious requirements, or health conditions, checking with a doctor is an important part of planning a pregnancy diet.

2. Macro and micronutrients

2.1 Proteins

Proteins should form the major part of the diet as they are required to maintain maternal tissues and fetal growth, especially during the third trimester. An excessively low intake of protein is associated with potentially negative effects in terms of weight and length at birth; on the other hand, an excessively high proportion of protein could affect fetal development (Kramer and Kakuma, 2003]. International guidelines recommend increased protein intake during pregnancy, especially during the second and third trimesters to ensure the additional 21 grams needed for maternal and fetal tissues and placenta. It is recommended to increase the protein intake accordingly in first, second and third trimester of gestation (Trumbo *et al.*, 2012). Animal

proteins provide all nine essential amino acids having PDCAAS (Protein Digestibility Corrected Amino Acid Score) of 1 including fish, lean meat, and chicken, as well as eggs. Women who ate seafood have lower levels of anxiety compared with those who did not. The vegans should consume combination of two or more protein rich vegetables. The good sources of proteins for vegans are quinoa, tofu, soy products, beans, lentils, legumes, nuts and seeds.

2.2 Fats

Fat in the pregnant women's diet should not be more than 30 percent. It is reported that a high-fat diet may genetically program the baby for future diabetes. Moreover the quality of the fat is also important especially for fetal development and infant growth so a balance is needed. It is advised to take more of unsaturated fat including monounsaturated and polyunsaturated or "healthy fats".: Foods rich in monounsaturated fats include olive oil, peanut oil, sunflower oil, sesame oil, canola oil, avocados, many nuts, and seeds. An adequate intake of docosahexaenoic acid (DHA, of the *n*-3 series), essential for brain and retinal development of the fetus during pregnancy is recommended. It is also known to reduce the risk of premature birth and post-partum depression (Lauritzen and Carlson, 2011; Sallis *et al.*, 2014; Mennitti, 2015). Fish is a good source of DHA.

2.3 Carbohydrates

Carbohydrates are the high energy components and an important part of a good pregnancy diet. Rich sources are potatoes, rice, pasta, and bread.

3.4 Calcium

Calcium is an essential nutrient for fetal growth and development and its requirement increases during pregnancy from 50 mg/day at the halfway point, up to 330 mg/day at the end and lactation. This is because of the mobilization from the maternal skeleton, the greater efficiency of intestinal absorption and the increased renal retention (Theobald, 2005). Adequate calcium intake during pregnancy results in high birth weight, reduced risk of preterm delivery, and better blood pressure control. From the 20th week of pregnancy, calcium levels in the fetal circulation are higher than those detectable in the maternal plasma. Rich sources of calcium are cheese, milk, and yogurt. Cereals and vegetables including soybeans, broccoli, collards, cabbage, okra, mustard greens, beans and kale etc. are also good sources of calcium however, the bioavailability from these foods is different, being highest for milk and derivatives. Conversely, bioavailability from fiber- and phytate-rich vegetables is quite low.

3.5 Fiber

During pregnancy there are higher chances of developing constipation or even the risk of hemorrhoids which become more common as the fetus grows. So it is advised to take plenty of fibrous foods including lentils, fruit and vegetables.

3.6 Zinc

Zinc plays a major role in normal growth and development, cellular integrity, and several biological functions including nucleic acid metabolism and protein synthesis. Since all these functions are involved in growth and cell division, zinc is important for the development of the fetus. Rich sources of zinc are meat, fish, chicken, dairy products, beans, nuts, sunflower seeds, ginger, onions, bran, wheat germ, rice, pasta, cereals, eggs, lentils, and tofu.

3.7 Iron

Iron requirement progressively increases during pregnancy, until the third month, in parallel with the accumulation in fetal tissues. The transfer from the maternal compartment to the fetus is regulated by a complex mechanism of transport that include: release from maternal liver in which it is stored as ferritin into circulation as Fe^{2+}, uptake by the placenta, transfer to the fetus (by a specific protein), oxidation to Fe^{3+}, storage (as ferritin) or transport into the fetal circulation (still bound to transferrin) (Cetin *et al.*, 2011). Inadequate intakes during pregnancy associated with the increase of iron demand makes pregnant mothers at even greater risk of iron deficiency, that may affect growth and development of the fetus and increase the risk of preterm delivery, low birth weight and post-partum hemorrhages (Allen, 2005; Khambalia *et al.*, 2015). Moreover, according to some recent studies, inadequate iron intakes during pregnancy are associated with increased cardiovascular risk for the offspring in adulthood (Alwan *et al.*, 2015). Iron makes up a major part of hemoglobin. Hemoglobin is the oxygen-carrying pigment and main protein in the red blood cells; it carries oxygen throughout the body. During pregnancy, the amount of blood in the mother's body increases by almost 50 percent she needs more iron to make more hemoglobin for all that extra blood. Non-animal sources of iron are less easily absorbed by the body. Mixing some lean meat, fish, or poultry with them can improve their absorption rates.

3.8 Iodine

Iodine is a major component of thyroid hormones and is essential for growth, formation and development of organs and tissues, in addition to the metabolism of glucose, proteins, lipids, calcium and phosphorus, and thermogenesis. In pregnancy, iodine deficiency can increase the risk of spontaneous abortion, perinatal mortality, birth defects and neurological disorders (Trumpff *et al.*, 2015) and is considered by the WHO as the most important preventable cause of brain damage. In the general population, iodine deficiency can be prevented by supplementing the diet with adequate amounts of this mineral, for example by using iodized salt. During pregnancy, when iodine is necessary also for the production of fetal thyroid hormones (as the fetal

thyroid begins to function only around the twelfth week of gestation), women need to increase iodine intake by about 50% (Zimmermann, 2012). Fish and shellfish are the main food sources of iodine, receiving it from the algae they eat, that absorb the mineral from marine water. However, due to water evaporation and rain, iodine is also absorbed by the soil and, consequently, enters into water, fruits, vegetables, and in relevant concentrations in milk, eggs and then meat (to a variable extent).

3.9 Folic Acid

The requirement for folates undergoes a progressive increase throughout the periconceptional period, in association with the use for the development of cells and fetal tissues. Maternal supplementation with folic acid is widely recommended to all women of childbearing age, especially to reduce the risk of neural tube defects. According to recent studies, folic acid supplementation during pregnancy should also reduce the risk of congenital heart disease and support proper development of the placenta (Cawley *et al.*, 2016). The RDA during pregnancy increases by 50% for pregnant as compared with non-pregnant women of childbearing age (600 µg/day vs. 400 µg/day). Ideally, supplementation should begin two months before conceiving and even reach 800 µg/day. The use of folic acid-based supplements is considered as safe (Berti *et al.*, 2012). The benefits of higher amounts are unclear. Folates are mostly found in green leafy vegetables, fruits (such as oranges), cereals and offal. Their bioavailability from foods depends on the presence of anti-nutrients, which can reduce their absorption.

3.10 Vitamin D

In the first stage of pregnancy, vitamin D (mainly Vitamin D3, the predominant form in the maternal blood) is involved in the regulation of cytokine metabolism and in the modulation of the immune system, thereby contributing to the embryo implantation and regulating the secretion of several hormones. High amounts of vitamin D are contained in cod liver oil. Fish (especially fatty fish such as herring and salmon) are also major food sources, while pork liver, eggs, butter, high fat cheeses provide smaller amounts, but relevant to the total intake.

Table 1: Some natural sources of nutrients.

Nutrients	Sources
Vitamin K	Kale, collards, spinach, turnip greens, beet greens, dandelion greens, mustard greens, Brussels sprouts, broccoli
Vitamin C	Oranges, grapefruit, sweet red peppers, papaya, cranberries ,strawberries, broccoli, Brussels sprouts
Vitamin B1 (thiamine)	Ready-to-eat cereals, enriched white rice, wheat flour, oat bran, pork loin, enriched cornmeal
Vitamin B2 (riboflavin)	Turkey giblets, milk, ready-to-eat cereals, duck, yogurt, soybeans, spinach
Niacin	Chicken, fish, duck, wheat flour, barley, ready to eat cereals, tomatoes, turkey, enriched white rice , buckwheat flour, yellow cornmeal, pork loin, ham,bulgur, beef, couscous, lamb, peanuts
Vitamin B6 (pyridoxine)	Ready-to-eat Cereals ,Chickpeas, fish , beef, turkey, enriched white rice, potatoes, chestnuts, buckwheat flour, chicken breast and giblets, pork loin, prune juice , duck ,bananas, plantains
Folate	Enriched white rice, ready-to-eat cereals, cornmeal, turkey giblets, wheat flour, lentils, cowpeas, beans, chickpeas, okra, spinach, asparagus, beef
Vitamin B12 (cyanocobalamin)	Cooked clams, cooked oysters, cooked crab, fish, ready-to-eat Cereals ,beef, lamb
Iron	Beef, turkey, duck, cooked clams, chicken, soybeans, fortified cereals, lentils, spinach, lima beans, refried beans, chickpeas, tomatoes
Iodine	Cheese, bread, milk, salt, cooked seafood
Vitamin D	Salmon, tuna, milk with added vitamin D, ready-to-eat cereals, skin exposure to sunlight (cholecalciferol)
Biotin	Cooked egg , cheddar cheese, whole-wheat bread cooked salmon, pork, avocado
Choline	Egg, salmon, turkey, beef, lamb, soybeans, baked beans, ham, chickpea, kidney beans
Pantothenic Acid	Ready to eat cereals, beef, mushrooms, chicken, turkey, duck, canned condensed or evaporated milk, sunflower seeds, couscous, rice, bulgur, yogurt, corn , peas
Calcium	Ready-to-eat cereals, milk, cheese, cornmeal, yogurt, wheat flour, collards, rhubarb, sardines, spinach, soybeans, turnip greens
Phosphorous	Cornmeal, canned condensed or evaporated milk, raw oat bran, fish, ricotta cheese, duck, barley, clam chowder, soybeans, bulgur
Magnesium	Buckwheat flour, bulgur, oat bran raw, semisweet chocolate, fish, wheat flour, spinach, barley, pumpkin seeds, cornmeal, soybeans, white beans
Copper	Beef, cooked oysters, cooked crab , mushrooms, chocolate, tomato products, nuts, mature soybeans, sunflower seeds, chili con carne, cooked clams

Zinc	Zinc: Cooked oyster, ready to eat cereals, baked beans, turkey, beef, cooked crab, chicken, duck, lamb, pork, kidney beans
Chromium	Broccoli, grape juice, orange juice, English muffin, waffle, potatoes, garlic, basil, beef, turkey breast
Manganese	Raw oat bran, wheat, bulgur, pineapple, barley, nuts, ready to eat cereals, white rice, spaghetti, okra, brown rice, chickpeas, spinach, raspberries, lima beans
Molybdenum	Beans , lentils, peas, nuts, cereals, peas spinach, broccoli
Selinium	Nuts, chicken or turkey giblets, fish, cooked oysters, turkey, duck, wheat flour, enriched white rice, oat bran, pork, ricotta cheese
Fluoride	Fluoride Fluoridated drinking water, cooked seafood, tea.

4. Recommended Dietary Allowances

The caloric requirements for healthy, normal weight women with a moderately active lifestyle, undergoes a moderate increase during pregnancy (dependent on pregnancy stage), which can be met by slightly increasing energy intakes, in a balanced equilibrium between macronutrients within the recommendations of nutritional guidelines. Excess of calories and macronutrients during pregnancy may, in fact, be just as damaging as their deficiency, especially in overweight and obese women, with an increased risk of miscarriage, gestational diabetes, preeclampsia and also of obesity and type 2 diabetes for their children in adulthood (Bruce, 2014: Catalano and deMouzon, 2015). Pregnancy care providers need to be aware of women's low compliance with the national dietary guidelines, particularly regarding the poor intake of vegetables and grain foods; targeted as well as population-based approaches may be required (Lee *et al.*, 2018). The recommended daily allowances for pregnant women are given in table 2.

Table 2: Recommended Dietary Allowances and Adequate Intakes for pregnant women.

Nutrient	Units	Age 18 years and younger	Age 19 to 50 years
Water	liters	3	3
Carbohydrate	grams	175	175
Protein	grams	71	71
Total Fiber	grams	28	28
Linoleic Acid	grams	13	13
Alpha- Linolenic Acid	grams	1.4	1.4
Vitamin A	mcg RAE* (IU as preformed vitamin A)	750 (2,500) UL= 2,800 (9,240	770 (2565) UL= 3,000 (10,000)
Vitamin E	mg	15 UL= 800	15 UL= 1,000
Vitamin K	mcg	75 UL= ND	90 UL= ND
Vitamin C	mg	80 UL= 1,800	85 UL= 2,000
Vitamin B1 (thiamine)	mg	1.4 UL= ND	1.4 UL= ND
Vitamin B2 (riboflavin)	mg	1.4 UL= ND	1.4 UL= ND
Niacin	mg	18 UL= 30	18 UL= 35
Vitamin B6 (pyridoxine)	mg	1.9 UL = 80	1.9 UL= 100
Folate	mcg	600 UL = 800	600 UL = 1,000
		ACOG recommends that women who have had a pregnancy affected by a neural tube defect (e.g. spina bifida or anencephaly) and are planning a pregnancy should receive 4.0 mg of folic acid supplementation per day for 1 month before conception through the first 3 months of pregnancy.[8,9]	
Vitamin B12 (cyanocobalamin)	mcg	2.6 UL= ND	2.6 UL= ND
Iron	mg	27 UL = 45	27 UL = 45
Iodine	mcg	220 UL = 900	220 UL = 1,100
Vitamin D (cholecalciferol)	Mcg (IU)	5 (200) UL= 50 (2000)	5(200) UL= 50 (2000)
Biotin	mcg	30 UL= ND	30 UL= ND
Choline	mg	450 UL = 3,000	450 UL = 3,500

Pantothenic Acid	mg	6 UL= ND	6 UL= ND
Calcium	mg	1,300 UL = 2500	1000 UL = 2500
Phosphorous	mg	1,250 UL = 3,500	700 UL = 3,500
Magnesium	mg	400 UL = 350 (from pharmacological agent)	360 UL = 350 (from pharmacological agent)
Copper	mcg	1,000 UL = 8,000	1,000 UL= 10,000
Zinc	mg	12 UL = 34	11 UL = 40
Chromium	mcg	29 UL= ND	30 UL= ND
Manganese	mg	2 UL = 9	2 UL = 11
Molybdenum	mcg	50 UL = 1,700	50 UL = 2,000
Selenium	mcg	60 UL = 400	60 UL = 400
Fluoride	mg	3 UL = 10	3 UL = 10

**Recommended Dietary Allowances and Adequate Intakes.

***RAE= retinol activity equivalents; 3.33 IU Vitamin A = 1 mcg RAE; 6.66 IU beta carotene from supplement = 1mcg RAE**; UL = The maximum level of daily nutrient intake that is likely to pose no risk of adverse effects. ND = Not determinable.

5. Foods to avoid during pregnancy

While a lot of foods meet the dietary requirements of pregnant women, a lot number needs to be avoided. These foods include uncooked seafood, raw beef or poultry because of the risk of contamination with coliform bacteria, toxoplasmosis, and salmonella. Fish that contains high levels of mercury should also be avoided as they have been linked to developmental delays and brain damage. Raw eggs or any foods that contain raw eggs should be avoided because of the potential exposure to salmonella. Unpasteurized milk and soft cheeses like brie, Camembert, Roquefort, feta and Gorgonzola made from raw milk should also be avoided as they may contain listeria. Caffeine should also be avoided during pregnancy. Caffeine intake has been associated with miscarriage, premature birth, low birth weight, and withdrawal symptoms in infants. Moreover it is suggested to eat washed vegetables to avoid potential exposure to toxoplasmosis.

6. Supplements

Majority of the pregnant women can get adequate amounts of nutrients if they follow a healthy diet but some of them might require supplements. The supplements more commonly consumed are Iron, Zinc, Folic acid and Vitamin D. A pregnant woman should be consuming 27 milligrams of iron per day. Some women may experience heartburn, nausea, or constipation when taking iron supplements. To avoid these problems, they should take their pills with meals, start off with smaller doses and then work their way up to the full dose slowly. The National Health Service (NHS), United Kingdom, recommends that supplements in the form of folic acid should be 400 mcg (micrograms) per day up to the 12th week of pregnancy. Guidelines in the UK say that a pregnant woman should take supplements containing 10 mcg of vitamin D daily. Summer sunlight is a good source of vitamin D (the light does not have the vitamin, but triggers the skin to synthesize it) however exposure should be limited because too much sunlight on the skin can cause burning and raises the risk of developing skin cancer. A study published in the *Food and Nutrition Bulletin* reported that observational studies have shown that "zinc deficiency during pregnancy may cause adverse pregnancy outcomes for the mother and fetus." After assessing several studies they found that pregnant women on zinc supplements were 14 percent less likely to have a premature delivery. Pregnant women should avoid having too much vitamin A, as this may harm their baby.

7. CONCLUSIONS

Consumption of balanced diet from the preconceptional period is essential to ensure maternal well-being and favorable outcomes of pregnancy. However clinical assessments may be required to check the proper balance of macronutrients during pregnancy. Intake of adequate amount of iodine, iron, calcium, vitamin D, folic acid, DHA must be ensured throughout pregnancy and particular attention should be paid to bioavailability from different foods. Maternal diets should be fortified with essential macronutrients or supplements should be recommended in agreement with national and international guidelines.

REFERENCES

1. Sallis, H., Steer, C., Paternoster, L., Davey, Smith G., Evans J. Perinatal depression and omega-3 fatty acids: A Mendelian randomisation study. *J. Affect. Disorde*r, 2014; 166: 124–131.
2. Mennitti, L.V., Oliveira, J.L., Morais, C.A., Estadella, D., Oyama, L.M., Oller do Nascimento C.M., Pisani L.P. Type of fatty acids in maternal diets during pregnancy and/or lactation and metabolic consequences of the offspring. *J. Nutr. Biochem*, 2015; 26: 99–111.
3. Allen, L.H. Anemia and iron deficiency: Effects on pregnancy outcome. *Am. J. Clin. Nutr*., 2005; 71: 1280S–1284S.
4. Khambalia, A.Z., Collins, C.E., Roberts, C.L., Morris, J.M., Powell, K.L., Tasevski, V., Nassar, N. Iron deficiency in early pregnancy using serum ferritin and soluble transferrin receptor concentrations are associated with pregnancy and

birth outcomes. *Eur. J. Clin. Nutr*., 2015; 70: 358–363.
5. Alwan, N.A., Cade, J.E., McArdle, H.J., Greenwood, D.C., Hayes, H.E., Simpson, N.A. Maternal iron status in early pregnancy and birth outcomes: Insights from the Baby's Vascular health and Iron in Pregnancy study. *Br. J. Nutr.*, 2015; 113: 1985–1992.
6. Zimmermann, M.B. The effects of iodine deficiency in pregnancy and infancy. *Paediatr. Perinat. Epidemiol.*, 2012; 26: 108–117.
7. Berti C., Fekete K., Dullemeijer C., Trovato M., Souverein O.W., Cavelaars A., Dhonukshe-Rutten R., Massari M., Decsi I., van't Veer P., et al. Folate intake and markers of folate status in women of reproductive age, pregnant and lactating women: A meta-analysis. *J. Nutr. Metab*., 2012; 470656.
8. Cawley S., Mullaney L., McKeating A., Farren M., McCartney D., Turner M. J. A review of European guidelines on periconceptional folic acid supplementation. Eur. J. Clin. Nutr., 2016; 70: 143–154.
9. Centers for Disease Control and Prevention Cetin I., Berti C., Mandò C., Parisi F. Placental iron transport and maternal absorption. Ann. Nutr. Metab., 2011; 59: 55–58.
10. Eating for Two: The Complete Guide to Nutrition during Pregnancy Abbott-Hess, Mary, et al, 4: 5-7.
11. FDA: Dietary Supplements.
12. https://www.cdc.gov/pregnancy/index.html.
13. https://www.fda.gov/.
14. Kouba, S., Hällström, T., Lindholm, C., & Hirschberg, A. L. Pregnancy and neonatal outcomes in women with eating disorders [Abstract]. *Obstetrics & Gynecology*, 2005; *105*(2): 255-260.
15. Kramer M.S., Kakuma R. Energy and protein intake in pregnancy. Cochrane Database Syst. Rev., 2003. doi: 10.1002/14651858.CD000032
16. Lauritzen L., Carlson S.E. Maternal fatty acid status during pregnancy and lactation and relation to newborn and infant status. Matern. Child Nutr., 2011; 7: S41–S58.
17. Lee, A., Muggli, E., Halliday, J., Lewis, S., Gasparini, E., & Forster, D. What do pregnant women eat, and are they meeting the recommended dietary requirements for pregnancy?. *Midwifery*, 2018; *67*: 70-76.
18. Leung, C. W., Epel, E. S., Bush, N. R., Coleman-Phox, K., Adler, N. E., & Laraia, B. A. Maternal diet quality during pregnancy and fetal growth outcomes: a pilot study of lower-income pregnant women. *The FASEB Journal*, 2016; *30*(1 Supplement): 671-20.
19. Mayo Clinic Guide to a Healthy Pregnancy Harms, Roger W., M.D., et al, Introduction. MyPyramid for Pregnancy & Breastfeeding Olmedo-Requena, R., Fernández, J. G., Prieto, C. A., Moreno, J. M., Bueno-Cavanillas, A., & Jiménez-Moleón, J. J. Factors associated with a low adherence to a Mediterranean diet pattern in healthy Spanish women before pregnancy. *Public health nutrition*, 2014; *17*(03): 648-656.
20. Strakovsky, R. S., Zhang, X., Zhou, D., & Pan, Y. X. Gestational high fat diet programs hepatic phosphoenolpyruvate carboxykinase gene expression and histone modification in neonatal offspring rats. *The Journal of physiology*, 2011; *589*(11): 2707-2717.
21. Trumbo P., Schlicker S., Yates A. A., Poos M. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids. *J. Am. Diet. Assoc*., 2002; 102: 1621–1630.
22. Trumpff C., Vandevijvere S., Moreno-Reyes R., Vanderpas J., Tafforeau J., Van Oyen H., De Schepper J. Neonatal thyroid-stimulating hormone level is influenced by neonatal, maternal, and pregnancy factors. *Nutr. Res.*, 2015; 35: 975–981.
23. U.S. Food and Drug Administration. William's Obstetrics Twenty-Second Ed. Cunningham, F. Gary, et al, Ch., 8.