

A Review on Multivitamins in Pregnancy

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ABSTRACT:

Pregnancy may be a dynamic state that needs accrued nutrient intakes so as to support the growing foetus, placenta and maternal tissues, and therefore a triple-crown physiological condition outcome. Though maternal matter deficiencies throughout physiological condition are usually related to physiological condition complications, still as adverse craniate growth and development, proof to support routine aliment and mineral supplementation is comparatively scarce. This review summarises existing proof and special concerns relating to vitamin B6, vitamin B complex, zinc, iron, element and iodine supplementation on physiological condition outcomes.

Mineral supplementation is usually recommended Multivitamin before and through physiological state to confirm adequate intake of several key nutrients together with vitamin B complex, iron, and more recently ergocalciferol – all of that have importance among pregnant girls, girls of childbearing age, and during fetal development . Folate supplementation has been well documented to cut back the use danger of ectoblast defects (i.e. spina bifida) , and rising proof suggests that folic acid-containing multivitamin pill supplements are related to reducing the danger of alternative malformations and bound medicine cancers. Furthermore, as physiological state progresses, body size increases, aboard the nutritionally necessities of the developing vertebrate, leading to continuous depletion of vitamins and minerals that diet alone might not refill]. Thus, multivitamin-mineral supplementation is considered necessary.

Key Words:- Micronutrients supplementation, vitamin supplementation, pregnancy developing countries,ectoblast, pre-eclampsia,vit B 12.

I. INTRODUCTION:

Pregnancy could be a dynamic state defined by major changes to maternal physiology and anatomy so as to accommodate the expansion of the vertebrate and placenta. Changes in nutrient metabolism square measure key to supporting not solely the vertebrate, however conjointly the it's vital that pregnant girls maintain adequate levels of essential vitamins and minerals.It's together referred to as micronutrients, these dietary parts support nearly all aspects of cellular and metabolic activity, together with cell proliferation, necrobiosis and differentiation, likewise as tissue growth and physiological state¹.Deficiencies in bound micronutrients, either through reduced dietary intake or impaired enteric absorption or excretion, will have dire consequences on maternity².

Pregnancy complications, together with pre-eclampsia, physiological condition high blood pressure, intrauterine growth restriction (IUGR) and preterm birth, have an effect on one in 5 first-pregnancies and predict womb-to-tomb morbidity and mortality for each mother and kid³.The reason behind several of those complications is basically unknown. However, there's lush literature watching associations between physiological state complications and deficiencies in cholecalciferol, folate, B, iodine, iron, metal and chemical element.1 Severe substance deficiencies square measure additional common in developing countries⁴.Significantly in populations United Nations agency avoid meat and/or dairy farm product, likewise as those with diets high in unrefined grains and legumes that contain phytaes

and polyphenols, that limit substance absorption⁵. However, suboptimal substance standing should have an effect on the danger of adverse physiological state outcomes as a result of several

physiological pathways are often noncontinuous by even the littlest perturbations in substance physiological⁶.

Multivitamins	Non-pregnant women	pregnant women	Lactating Women
Folic Acid(microgram)	400	600	500
Iron(mg)	18	27	9-10
VitaminB12(microgram)	2.4	2.6	2.8
Zinc(mg)	8	10-11	11-12

II. MATERIAL AND METHODS:-

These reviews, however, enclosed a restricted range of individual and combination vitamins and minerals (water-soluble vitamins B,c,cyanocobalamine, and “multivitamin preparations”) compared with our review, which has further supplements (e.g., zinc, iron, folic acid). Additionally, the previous reviews enclosed study of vitamins or minerals that according to the incidence on physiological state whereas our review targeted on benefits of multivitamins in pregnancy.

Minerals and trace elements

Concentrations during pregnancy:- Because the growth of red somatic cell mass is proportionately but that of plasma, some organic chemistry indexes

for minerals and trace parts, like Hb⁷,fall in parallel to red somatic cell volume. Others, like metal like zinc^{8,10},decline increasingly throughout maternity, whereas atomic number 12 shows no physiological state dependence till late maternity, once it declines ceaselessly (MJ keirse unpublished observations, 2000). Phosphorus remains constant as a result of maternal adaptation¹¹,and copper will increase in maternity¹². Metallic element absorption will increase early in maternity. At a similar time, the protein-bound fraction in body fluid sometimes declines bit by bit throughout maternity, whereas the free ionic concentration remains comparatively constant¹³.The physiological condition management of ionic metallic element is maintained by a fancy interaction of calciferous, parathormone and thyrocalcitonin¹⁴.

Cynocobalamine:-



Globally, a preterm birth and low birth weight (LBW) cause over an 3rd of the two.9 million babe deaths every year, and a bar of those events is very important to cut back under-five year mortality^{15,16}. The etiology of a preterm birth, however, is complex, and few interventions are made in preventing it¹⁷. Vitamin B12 (B12) is a vitamin with metabolic roles closely related to folate and homocysteine, and is found in animal-derived foods only¹⁸. It is important for the synthesis¹⁹ and methylation²⁰ of DNA, and plays a role in the energy production of the cell²¹. It has been hypothesized that B12 may affect placentation and foetal growth²². B12-deficiency may impact over three quarters of some pregnant populations²³. Few supplementation-studies of B12 in pregnancy have been undertaken to assess possible effects on birth weight and length of gestation. However, a recent meta-analysis concluded that multiple-micronutrient supplementation may reduce the risk of LBW and the number of stillbirths, but not preterm birth or neonatal mortality²⁴. Thus, a more targeted

micronutrient supplementation practice may be warranted. Cynocobalamine (vitamin B12) deficiency is common in several low and middle-income countries.1 a pair of this can be not stunning because the main supply of vitamin B complex is animal supply foods, that area unit dearly-won and for cultural and spiritual reasons usually not devoured the least bit. In many studies of girls and youngsters, we've incontestable that poor vitamin B complex standing is common in South Asia.3-5 there's conjointly compelling proof that vitamin B complex deficiency happens oft throughout physiological condition,267 and case studies have incontestable harmful effects of severe vitamin B complex deficiency on the developing child brain.8 nine the results of delicate or subclinical vitamin B complex deficiency area unit less clear however it's been shown to be related to attenuated psychological feature performance in each the senior and youngsters.²⁵ 3 randomized controlled trials (RCT) have measured the result of vitamin B complex supplementation on neurodevelopmental in children: in an exceedingly

Norwegian trial, Associate in Nursing shot of B12 considerably improved the motor development in 6-week-old infants once,¹⁴ another intervention study in low birth weight kids recently confirmed these findings.²⁷The infants in these studies had proof of suboptimal vitamin B complex standing, however none was severely deficient. We have a tendency to found a useful result of vitamin B complex supplementation for 6 months on neurodevelopmental in young North Indian kids.¹⁶ during this study, wherever the youngsters were supplemented daily with 2 suggested daily allowances (RDA) for 6 months, the result of vitamin B complex supplementation was additional apparent in kids World Health Organization had proof of vitamin B complex deficiency at the beginning of the study. During physiological condition, cobalamin is focused within the vertebrate and keep within the liver. Infants born to antipernicious anaemiafactorcomplex vitamin B complex vitamin B[B vitamin] replete mothers have stores of vitamin B12 that are equal to sustain them for the primary many months postnatal. Consequently, cyanocobalamine deficiency seldom happens before the babe is regarding recent if the mother has adequate cobalamin standing throughout physiological condition. However, infants of nutrition B12-deficient breastfeeding mothers are at risk of B12 deficiency from associate early age. Maternal vitamin B complex deficiency has been related to exaggerated risk of

common physiological state complications, as well as stillbirth, low birth weight, intrauterine growth restriction and ectoderm defects. Kids born to sustenance B12-deficient ladies area unit at exaggerated risk for adverse health outcomes, as well as biological process abnormalities and anemia.²⁷ during a recent RCT in metropolis, India, daily maternal vitamin B complex supplementation (50 µg/day) throughout physiological state through 6 weeks postnatal well improved maternal vitamin B complex standing and exaggerated breast milk and babe plasma vitamin B complex concentrations.²⁴ during this study, the proportion of kids being born tiny for fertilization age was lower within the vitamin B complex cluster than within the placebo cluster (25% vs 34%); but, no distinction was found in neurodevelopmental in infants at nine months more matured.²⁵ Similar enhancements in vitamin B complex standing were found among Bangladeshi mothers and infants once supplemented with twenty five0 µg of vitamin B complex from eleven to fourteen weeks of physiological state through three months postnatal.²⁶ during this study, ladies World Health Organization were irregular to receive Associate in Nursing factor[B-complex vitamin]B complex vitamin B complex vitamin B[B vitamin] additionally had an improved immunologic response to the pandemic contagion A (H1N1) vaccine²⁸.

Iron deficiency anemia:-



Iron deficiency anaemia could be a common form of anaemia — a condition during

which blood lacks adequate healthy red blood cells. Red blood cells carry gas to the body's tissues.

As the name implies, iron deficiency anaemia is because of short iron. While not enough iron, your body cannot manufacture enough of a substance in red blood cells that allows them to hold gas (haemoglobin). As a result, iron deficiency anaemia could leave you tired and in need of breath. You can typically correct iron deficiency anaemia with an iron supplementation. Generally extra tests or treatments for iron deficiency anaemia a square measure necessary, particularly if your doctor suspects that you are a trauma internally²⁹.

Symptoms:-

Initially, iron deficiency anaemia will be thus gentle that it goes overlooked. However because the body becomes additional deficient in iron and anaemia worsens, the signs and symptoms intensify.

Iron deficiency anaemia signs and symptoms could include:

- Extreme fatigue
- Weakness
- Pale skin
- Chest pain, quick heartbeat or shortness of breath
- Headache, symptom or light-headedness
- Cold hands and feet
- Inflammation or soreness of your tongue
- Brittle nails
- Unusual cravings for non-nutritive substances, like ice, dirt or starch
- Poor appetite, particularly in infants and youngsters with iron deficiency anaemia³⁰.

Causes:-

An iron deficiency anaemia happens once your body does not have enough iron to Hb. Hb at the part of red blood cells that provide blood its red colour and allow the red blood cells to hold ventilated blood throughout your body.

A lack of iron in your diet:- Your body often gets iron from the foods you eat. If you consume deficient iron, over time your body will become iron deficient. Samples of iron-rich foods embrace meat, eggs, leafed inexperienced vegetables and iron-fortified foods. For correct growth and development, infants and kids want iron from their diets, too.

An inability to soak up iron:- an iron from food is absorbed into your blood in your bowel. associate enteral disorder, like disorder, that affects your intestine's ability to soak up nutrients from digestible food, will result in iron deficiency anaemia. If a part of your bowel has been bypassed or removed surgically, which will have an effect on your ability to soak up iron and alternative nutrients.³¹

Pregnancy:- While not iron supplementation, iron deficiency anaemia happens in several pregnant ladies as a result of their iron stores got to serve their own redoubled a blood volume likewise as be a supply of Hb for the growing a vertebrate.

Risk factors:-

These teams of individuals might have associate degree augmented risk of iron deficiency anaemia:

Women:- As a result of girls lose blood throughout discharge, girls generally at larger risk of iron deficiency anaemia.

Infants and youngsters:- Infants, particularly people who were low birth weight or born untimely, World Health Organization do not get enough iron from breast milk or formula could also be in danger of iron deficiency. Youngsters would like further iron throughout growth spurts. If your kid is not feeding a healthy, varied diet, he or she could also be in danger of anaemia.

Maternal exposure to dietary factors throughout maternity will influence embryonic development and should modulate the makeup of offspring through epigenetic programming. Vitamin B,c is important for ester synthesis, and preconceptional intake of dietary B-complex vitamin (FA) is attributable with reduced incidences of ectoblast defects in infants. Whereas fortification of grains with sulphur resulted during a positive public-health outcome, concern has been raised for the necessity for any investigation of causeless consequences and potential health hazards arising from excessive sulphur intakes, particularly following reports that sulphur could exert epigenetic effects. The target of this text is to debate the role of sulphur in human health and to review the advantages, considerations and epigenetic effects of maternal sulphur on the premise of recent findings that square measure necessary to style future studies.³²

How will iron deficiency anemia throughout maternity be prevented and treated?

Prenatal vitamins generally contain iron. Taking an antepartum sustenance that contains iron will facilitate stop and treat iron deficiency anemia throughout maternity. In some cases, your health care supplier would possibly advocate a separate iron supplement. Throughout maternity, you would like twenty-seven milligrams of iron daily.

Good nutrition may stop iron deficiency anemia throughout maternity. Dietary sources of iron embody lean white meat, poultry and fish. Different choices embody ironfortified breakfast cereals, dark inexperienced leaved vegetables, dried beans and peas³³.

Folic acid and neural tube defects:-



Birth defects are each of the foremost burdens within the human public health with estimates from Centres for illness management and hindrance (CDC) approaching one in every 33 newborns within the U.S. and accounting for over two hundredth of all child mortalities. Exoderm defects (NTDs) are common advanced complex disorders within the neurulation of the brain and funiculus that happens between 21 and 28 days once conception in humans. Worldwide counting on the ethnic grouping and geographical location, the prevalence has been rumoured to vary wide between land ten in each a thousand births or established pregnancies. Whereas we tend to are setting out to perceive the underlying etiologist, proof gathered to this point implicates each - genetic and non-genetic factors like maternal nutrition standing or maternal blubber within the onset of NTDs. Over the years, varied studies together with community-based trials typically urged NTDs as sustenance deficiency disorders and have shown that the exogenous or preconceptional

supplementation of maternal sulpha syllable will cut back the chance of NTD's in offspring. Indeed, analysis spanning decades suggests vitamin B,c deficiency as a risk issue of NTDs; but the involvement of whole methylation metabolism has additionally been coupled with the etiology of NTDs.³⁴ Contention against the maternal vitamin B,C deficiency model alone, some studies additionally rumoured traditional concentrations of vitamin B,c within the mothers of human foetus with NTDs. Supporting this, studies in genteel rat embryos or sulpha syllable deficient mice were rumoured to not be littered with NTDs as a result of sulpha syllable deficiency. In distinction, studies additionally rumoured that exogenous sulpha syllable and deoxythymidine within the homozygous splotch (Pax3) mouse embryos prevented NTDs and corrected synthesis defects. Therefore, no accord has been reached supported the printed knowledge thus far. However, as sulpha syllable deficiency could also be a risk issue for NTDs further studies are going to be needed to see

the mechanistic role of the sulphur pathway within the onset of exoderm defects.³⁵

Folic Acid will facilitate forestall Birth Defects

All ladies would like folacin as a result of it works best for you and your baby early within the 1st month of gestation, a time after you might not even grasp you are pregnant. Continued use of folacin once the primary month of gestation, and throughout your life, ensures the longer term physiological condition of you and your family.³⁶

Folic acid will cut back bound birth defects of the brain and medulla spinalis by over seventy p.c. These birth defects are referred to as ectoblast defects

(NTDs). NTDs happen once the medulla spinalis fails to shut properly.

The most common ectoblast defect is schistorrhachis. This happens once a part of the baby's medulla spinalis remains outside the body. The baby could have paralytic legs and, later, could develop bladder and intestine management issues. The foremost serious ectoblast defect is congenital abnormality³⁷. The baby is born while not a part of its brain, and eventually dies.

Folic acid conjointly could facilitate lower your possibilities of obtaining cardiovascular disease and a few kinds of cancers. It's going to facilitate shield you from having a stroke, as well³⁸.

Zinc:-



A zinc contains a major role to play in body development and a functioning. It's in straightforward words, a robust mineral that might provide the simplest health edges to the pregnant women and her vertebrate. Zn may be naturally founded in bound food things, or it may be another to your diet within the variety of supplements. Either way, this mineral can provide the meant edges to a pregnant woman.

Why Zinc is Necessary When Pregnant? Zinc is generally known to maintain a healthy immune system, boost normal body growth, helps with DNA metabolism, and also helps in speedy wound healing.³⁹

Zinc advantages for Pregnant ladies

- 1) Zinc helps maintain a robust system.
- 2) Averts intrauterine infection.
- 3) Helps balance the hormones.
- 4) Aids within the production of the placenta.

- 5) Atomic number 30 advantages for Developing Baby.
- 6) Boosts cell growth.
- 7) Boosts DNA production and functioning Provides structural support to the proteins that compose the cells.
- 8) Recommended Daily Intake of atomic number 30 in gestation.
- 9) The daily intake of atomic number 30 for a pregnant lady depends on the age issue, greatly⁴⁰.

Zinc advantages for Developing Baby

- Boosts cell growth
- Boosts deoxyribonucleic acid production and functioning

Provides structural support to the proteins that frame the cells⁴¹

What square measure the signs of deficiency disease once pregnant?

The signs of Zn deficiencies in pregnant women include:

Weakened sense of style and smell

Lack of craving

Lack of immunity to allergies and infections

Impaired growth of the craniate

Now, whenever the question "Can I take Zn whereas pregnant?" involves your mind, you'll be able to answer 'Yes' with confidence. This ensures correct maintenance of traditional health conditions of you and your craniate. Also, detain mind to invariably consult a doctor for correct dietary recommendations and supplement decisions once Zn is what you're involved regarding⁴².

Now, whenever the question "Can I take zinc while pregnant?" comes to your mind, you'll be able to answer 'Yes' confidently. This ensures proper maintenance of normal health conditions of you and your foetus. Also, keep in mind to always consult a doctor for proper dietary recommendations and supplement choices when zinc is what you are concerned about.⁴³

Symptoms of zinc deficiency:

Symptoms of zinc deficiency tend to be linked to the roles that zinc performs in the body. Some of the most common zinc deficiency symptoms include:

1. appetite loss
2. slower than expected growth
3. poor immune system function
4. Severe zinc deficiency can cause even more concerning symptoms. Examples include: delayed sexual maturity
5. diarrhoea
6. eye and skin lesions
7. feeling lethargic
8. funny-taste sensations
9. hair loss
10. poor wound healing
11. unexplained weight loss
12. Men and boys can also experience impotence and hypogonadism, which is when a male's body does not produce enough testosterone.⁴⁴

Uses of multivitamins:- In an attempt to deal with potential individual substance deficiencies, many

ladies take complicated physiological condition multivitamins. Despite high-frequency use and widespread selling and promotion, there's a scarcity of proof that routine supplementation with multivitamins or supplements containing multiple micronutrients either in pre- or preconception is helpful to physiological condition outcome^{45, 46} In several cases, supplementation with such multivitamins could give amounts of assorted vitamins and minerals higher than what's truly required. Such supplements might not be utterly while not hurt. For instance, though supplementation with water-soluble vitamin alone doesn't seem to be helpful,^{4, 7} supplementation with combined vitamins C and E from twelve to eighteen weeks gestation has been shown to extend the danger of vertebrate loss or perinatal death^{4, 8} what is more, fat-soluble vitamin could be an agent, with high intake throughout physiological condition being related to associate augmented risk of non heritable malformations.^{4, 9, 5, 0}

thus, limits to the quantity of fat-soluble vitamin pregnant girls ought to take area unit suggested. A scarcity of high-quality, large, irregular controlled trials considerably limits our ability to gauge the advantages, or potential harms, of routine alimentation and mineral supplementation in physiological condition. Therefore, a point of caution concerning widespread routine supplementation practices is guaranteed.

Multivitamins side effects:-

1. Get emergency medical help if you have signs of an allergic reaction: hives; difficulty breathing; swelling of your face, lips, tongue, or throat.
 2. When taken as directed, multivitamins are not expected to cause serious side effects. Common side effects may include:
 3. upset stomach;
 4. headache; or
 5. unusual or unpleasant taste in your mouth.
- What other drugs will affect multivitamin?
 - Multivitamins can interact with certain medications, or affect how medications work in your body. Ask a doctor or pharmacist if it is safe for you to use multivitamins if you are also using:
 - tretinoin or isotretinoin;
 - an antacid;
 - an antibiotic;
 - a diuretic or "water pill";

- heart or blood pressure medications;
- a sulpha drug; or
- NSAIDs (nonsteroidal anti-inflammatory drugs)--ibuprofen (Advil, Motrin), naproxen (Aleve), celecoxib, diclofenac, indomethacin, meloxicam, and others.

III. CONCLUSION:-

Micronutrient and nutrient supplementation could be a key intervention to push maternal and kid nutrition, health and well-being, and implementation ought to be continued particularly throughout physiological condition amongst mothers living in LMICs in spite of maternal organic process standing. Specifically, this comprehensive review indicates that MMN supplementation ought to be thought-about because the most well-liked choice for traditional prenatal care, compared to IFA, particularly for outcomes like stillbirths, SGA and low birth weight infants. Single matter and nutrient supplementation additionally show enhancements for specific outcomes, like Ca on the chance of pre-eclampsia/eclampsia, and A on serum/plasma vitamin A concentration in mothers. LNS supplementation, compared to MMN, concerned

few studies during this review, light the requirement for any analysis to higher perceive variations between the 2 kinds of supplementation. At present, solely vitamin B complex and iodine are counseled for routine supplementation for all girls. Intake of different vitamins and minerals, like iron, metallic element and cholecalciferol, are obsessed with a woman's skills to fulfill counseled dietary intakes supported biological process intake alone, or on known biological process deficiencies. Though vitamin pill use is common in physiological state, there's a scarcity of knowledge supporting widespread use. Pharmacists ought to bear in mind of special issues relating to alimentation and mineral supplementation in physiological state and be ready to supply balanced and up-to-date info to girls.

REFERENCES:-

- [1]. 1.Gernand AD, Schulze KJ, Stewart CP, West KP Jr, Christian P. Micronutrient deficiencies in pregnancy worldwide: health effects and prevention. *Nat Rev Endocrinol* 2016; 12: 274– 89.Crossref | CAS | PubMed | Web of science®| Google scholar
- [2]. 2.Black RE. Micronutrients in pregnancy. *Br J Nutr* 2001; 85(Suppl 2): S193– 7.Crossref | CAS | PubMed | Web of science®| Google scholar
- [3]. 3.Robey Lecture: complicated interactions between genes and the environment in placentation, pregnancy outcome and long term health. *Placenta* 2010; 31(Suppl): S47– 53. Crossref | CAS | PubMed | Web of science®| Google scholar
- [4]. Woodside JV, McCall D, McGartland C, Young IS. Micronutrients: dietary intake v. supplement use. *Proc Nutr Soc* 2005; 64: 543– 53. Crossref | CAS | PubMed | Web of science®| Google scholar
- [5]. Institute of Medicine. Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. Washington, DC: The National Academies Press; 2001. Crossref | CAS | PubMed | Web of science®| Google scholar.
- [6]. National Health and Medical Research Council. Nutrient reference values for Australia and New Zealand. Canberra: National Health and Medical Research Council; 2005.Google Scholar
- [7]. Bothwell TH. Iron requirements in pregnancy and strategies to meet them. *Am J Clin Nutr* 2000;72(suppl):257S–64S.Google ScholarPubMed
- [8]. Hunt IF, Murphy NJ, Cleaver AE, et al. Zinc supplementation during pregnancy: zinc concentration of serum and hair from low-income women of Mexican descent. *Am J Clin Nutr* 1983;37:572–82.Google ScholarCrossrefPubMed
- [9]. Jameson S. Effect of zinc deficiency in human reproduction. *Acta Med Scand Suppl* 1976;593:1–89.
- [10]. Google ScholarPubMed
- [11]. 10.Hambidge KM, Krebs NF, Jacobs MA, Favier A, Guyette L, Ikle DN. Zinc nutritional status during pregnancy: a longitudinal study. *Am J Clin Nutr* 1983;37:429–42.Google ScholarCrossrefPubMed
- [12]. 11.Weiss M, Eisenstein Z, Ramot Y, Piptz S, Shulman A, Frenkel Y. Renal reabsorption of inorganic phosphorus in pregnancy in relation to the calciotropic hormones. *Br J Obstet Gynaecol* 1998;105:195–9.Google ScholarCrossrefPubMed
- [13]. Tuttle S. Trace element requirements during pregnancy. In: Campbell DM, Gillmer

- MDG., eds. Nutrition in pregnancy. London: Royal College of Gynaecologists, 1983:47–54. Google Scholar
- [14]. Pitkin RM. Calcium metabolism in pregnancy and the perinatal period: a review. *Am J Obstet Gynecol* 1985;151:99–109. Google Scholar CrossRef PubMed
- [15]. National Research Council. Recommended dietary allowances. 10th ed. Washington, DC: National Academy Press, 1989. Google Scholar.
- [16]. Lawn JE, Blencowe H, Oza S, et al. Every New born: progress, priorities, and potential beyond survival. *Lancet*. 2014;384(9938):189–205. [PubMed][Google Scholar]
- [17]. UNICEF, WHO, World Bank et al. Levels and trends in child mortality 2015. 2015:1–36. [Google Scholar]
- [18]. Barros FC, Bhutta Za, Batra M, et al. Global report on preterm birth and stillbirth (3 of 7): evidence for effectiveness of interventions. *BMC Pregnancy Childbirth*. 2010;10(Suppl 1):S3. [PMC free article][PubMed][Google Scholar]
- [19]. Allen LH. Vitamin B12 metabolism and status during pregnancy, lactation and infancy. *Adv Exp Med Biol*. 1994;352:173–186. [PubMed][Google Scholar]
- [20]. Allen RH, Stabler SP, Savage DG, et al. Metabolic abnormalities in cobalamin (vitamin B12) and folate deficiency. *FASEB J*. 1993;7(14):1344–1353. [PubMed][Google Scholar]
- [21]. Chiang PK, Gordon RK, Tal J, et al. S-Adenosylmethionine and methylation. *FASEB J*. 1996;10(4):471–480. [PubMed][Google Scholar]
- [22]. Halarnkar PP, Blomquist GJ. Comparative aspects of propionate metabolism. *Comp Biochem Physiol B*. 1989;92(2):227–231. [PubMed][Google Scholar]
- [23]. Muthayya S, Kurpad A, Duggan C, et al. Low maternal vitamin B12 status is associated with intrauterine growth retardation in urban South Indians. *Eur J Clin Nutr*. 2006;60(6):791–801. [PubMed][Google Scholar]
- [24]. Sukumar N, Rafnsson S, Kandala N, et al. Prevalence of vitamin B-12 insufficiency during pregnancy and its effect on offspring birth weight: a systematic review and meta-analysis. *Am J Clin Nutr*. 2016;103(5):1232–1251. [PubMed][Google Scholar]
- [25]. Haider BA, Bhutta ZA. Multiple-micronutrient supplementation for women during pregnancy. *Cochrane database Syst Rev*. 2015;11:CD004905. [PMC free article][PubMed][Google Scholar]
- [26]. Allen LH. Causes of vitamin B12 and folate deficiency. *Food Nutr Bull* 2008;29:S20–S34. discussion S35–27 10.1177/15648265080292S105 [PubMed] [CrossRef] [Google Scholar]
- [27]. Samuel TM, Duggan C, Thomas T, et al. . Vitamin B(12) intake and status in early pregnancy among urban South Indian women. *Ann Nutr Metab* 2013;62:113–22. 10.1159/000345589 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- [28]. Taneja S, Bhandari N, Strand TA, et al. . Cobalamin and folate status in infants and young children in a low-to-middle income community in India. *Am J Clin Nutr* 2007;86:1302–9. [PubMed] [Google Scholar]
- [29]. Chandyo RK, Ulak M, Sommerfelt H, et al. . Nutritional intake and status of cobalamin and Folate among non-pregnant women of reproductive age in Bhaktapur, Nepal. *Nutrients* 2016;8:375 10.3390/nu8060375 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- [30]. Kaushansky K, et al. Iron deficiency and overload. In: *Williams Hematology*. 9th ed. New York, N.Y.: The McGraw-Hill Companies; 2016. <http://accessmedicine.mhmedical.com/content.aspx?sectionid=94304160&bookid=1581&jumpsectionID=94304237&ResultClick=2#1121092571>. Accessed Oct. 16, 2016.
- [31]. Schrier SL, et al. Treatment of iron deficiency anemia in adults. <http://www.uptodate.com/home>. Accessed Oct. 16, 2016.
- [32]. Iron-deficiency anemia. American Society of Hematology. <http://www.hematology.org/Patients/Anemia/Iron-Deficiency.aspx>. Accessed Oct. 16, 2016.
- [33]. What is iron-deficiency anemia? National Heart, Lung, and Blood Institute. <http://www.nhlbi.nih.gov/health/health-topics/topics/ida/>. Accessed Oct. 16, 2016

- [35]. FAQs. Nutrition during pregnancy. American College of Obstetricians and Gynaecologists. <https://www.acog.org/womens-health/faqs/nutrition-duringpregnancy>. Accessed Jan. 12, 2022
- [36]. . Au K.S., Ashley-Koch A., Northrup H. Epidemiologic and genetic aspects of spina bifida and other neural tube defects. *Dev. Disabil. Res. Rev.* 2010;16:6–15.doi: 10.1002/ddrr.93. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- [37]. Northrup H., Volcik K.A. Spina bifida and other neural tube defects. *Curr. Probl. Pediatr.* 2000;30:313–332. [PubMed] [Google Scholar]
- [38]. Centers for Disease Control and Prevention. CDC grand rounds: additional opportunities to prevent neural tube defects with folic acid fortification. *MMWR – Morbidity & Mortality Weekly Report.* 2010;59(31):980-4.
- [39]. Czeizel AE, Dudas I. Prevention of the first occurrence of neural-tube defects by periconceptional vitamin supplementation. *N Engl J Med.* 1992 Dec 24;327(26):1832-5
- [40]. Prevention of neural tube defects: results of the Medical Research Council Vitamin Study. MRC Vita Study Research Group. *Lancet.* 1991 Jul 20;338(8760):131-7.min
- [41]. 20;338(8760):131-7.min
- [42]. Darmstadt GL, Osendarp SJM, Ahmed S, Feldman C, Van JMA, Baqui AH, et al. Effect of antenatal zinc supplementation on impetigo in infants in Bangladesh. *Pediatric Infectious Disease Journal* 2012;31(4):407- 9. [PubMed] [Google Scholar]
- [43]. [Hamadani JD, Fuchs GJ, Osendarp SJM, Huda SN, Grantham- McGregor SM. Zinc supplementation during pregnancy and effects on mental development and behaviour of infants: a follow- up study. *Lancet* 2002;360(9329):290- 4. [PubMed] [Google Scholar]
- [44]. Osendarp S. Zinc supplementation in Bangladeshi women and infants: effects on pregnancy outcome, infant growth, morbidity and immune response [thesis]. Wageningen: Wageningen University, 2001. [Google Scholar].
- [45]. Cambridge M: Zinc and Health: Current status and future directions. *J Nutr.* 2000, 130 (Suppl): 1344-1349
- [46]. Hotz C, Brown KH: International Zinc Nutrition Consultative Group (IZiNCG) technical document: Assessment of the risk of zinc deficiency in populations and options for its control. *Food Nutr Bull.* 2004, 25 (Suppl 1): 94-203.Google Scholar
- [47]. Nriagu J: Zinc deficiency in human health.
- [48]. [http://www.extranet.elsevier.com/homepage_about/mrwd/nvrn/Zinc%20Deficiency%20in%20Humans.pdf]
- [49]. Rambolt A, Duley L, Crowther CA, Haslam RR. Antioxidants for preventing preeclampsia. Hoboken, NJ: The Cochrane Library.
- [50]. Balogun OO, da Silva Lopes K, Ota E, Takemoto Y, Rumbold A, Takegata M, et al. Vitamin supplementation for preventing miscarriage. Hoboken, NJ: The Cochrane Library; 2016
- [51]. Rumbold A, Ota E, Nagata C, Shahrook S, Crowther CA. Vitamin C supplementation in pregnancy. Hoboken, NJ: The Cochrane Library; 2015.
- [52]. Xu H, Perez-Cuevas R, Xiong X, Reyes H, Roy C, Julien P, et al. An international trial of antioxidants in the prevention of preeclampsia (INTAPP). *Am J Obstet Gynecol* 2010; 202: 239.e1–e10.
- [53]. Mastroiacovo PA, Mazzone T, Addis A, Elephant E, Carlier P, Vial T, et al. High vitamin A intake in early pregnancy and major malformations: a multicenter prospective controlled study. *Teratology* 1999;; 7– 11.
- [54]. Wiley Online LibraryCASPubMedWeb of Science@Google Scholar
- [55]. Duerbeck NB, Dowling DD. Vitamin A: too much of a good thing? *Obstet Gynecol Surv* 2012; : 122– 8.